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SCHOOL READINESS AND GROWTH IN ACADEMIC ABILITIES FROM SCHOOL ENTRY TO 5TH GRADE WITHIN A DISADVANTAGED SAMPLE

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ABSTRACT

School readiness is a continuous, malleable, multi-faceted process that develops during early childhood and results in how ready a child is to learn as they enter school. Components of school readiness include children's academic readiness, cognitive readiness, and social, emotional, and behavioral readiness. Based on studies assessing the relation between school readiness and academic achievement, specific aspects of children's academic readiness, including vocabulary, reading, and math abilities and components of cognitive readiness, such as attention, are consistent predictors of later academic success. The findings for the social, emotional, and behavioral aspects of school readiness have been mixed, with some studies finding a relation to later academic outcomes, while others do not.

The current study uses multiple analytical approaches to examine the relation between demographic characteristics, academic readiness, and school readiness, and children's vocabulary, reading, and math achievement in elementary school within a predominantly Black, urban, low-income sample. The sample consisted of 306 children who attended an enhanced preschool program and were followed from preschool to 5th grade. Children experienced a considerable amount of growth in reading and math skills relative to national norms from Kindergarten to 5th grade. Results revealed that predictors of children's vocabulary skills in Kindergarten and 5th grade included preschool vocabulary and reading abilities, and emotion knowledge; emotion knowledge also predicted growth in elementary vocabulary skills. Preschool reading and math were significantly related to Kindergarten and 5th grade reading; emotion recognition was related to 5th grade reading ability. Preschool pre-reading skills were associated with growth in elementary reading, with a narrowing of the gap by 5th grade between those with lower and higher abilities in preschool. Kindergarten and 5th grade math skills were predicted by preschool math and reading; sustained attention predicted Kindergarten math. Preschool pre-math abilities predicted growth in math, with the gap between lower and higher achieving students narrowing during elementary school. Even within a disadvantaged population, variations in maternal education predicted Kindergarten academic abilities. After accounting for preschool academic abilities, demographic factors did not predict growth in academic achievement during elementary school.

Despite previous studies which have not found a relation between the social, emotional, and behavioral aspects of school readiness on children's later academic achievement, the current study found that children's with higher emotion knowledge in preschool had higher scores in vocabulary and math in elementary school. Significant associations were found with direct child assessments of emotion knowledge, but not with teacher-rated measures of social competence or behavior problems.

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Chapter 1:

Introduction

The development of cognitive and academic abilities is a developmental process that begins before children enter formal schooling. As a result it is important for researchers to study the changes and growth that characterize cognitive and academic development from a longitudinal perspective. Models of individual growth trajectories of children's academic abilities have allowed researchers to explore how certain characteristics, such as children's readiness for school in various domains predict later academic achievement (Collins, 2006; Singer & Willet, 2003). Using this method, researchers can assess whether these predictor variables are significantly related to the mean level (intercept) as well as the growth or stagnation (slope) in academic abilities. Research using individual growth models (Grimm, Steele, Burchinal, Mashburn, & Pianta, 2010) and less complex models involving only two time points (Duncan, Claessens, Huston, Pagani, Engel, Sexton, et al., 2007) have shown that children's academic and cognitive abilities at school entry, specifically their pre-math, pre-reading abilities, and attention are strong predictors of later achievement. In contrast, the association between children's early social-emotional and behavioral competence and later academic achievement has been inconsistent, with some studies finding weak or non-significant effects (Duncan et al., 2007), while others identify a small to moderate association (Grimm et al., 2010; Zins, Bloodworth, Weissberg, & Walberg, 2004). In addition to examining children's early skills as predictors, other research has examined the influence of poverty on children's academic success. Findings indicate that not only is there is an achievement gap between lower-income children and their higher-income peers at school entrance, but in addition, children from lower-income families develop at a slower rate, resulting in a widening of the achievement gap over the elementary years (Ferguson, 2007).

Much of this research has utilized individual growth trajectories models which assume that all individuals have the same pattern of growth over time. In contrast, Latent Growth Curve Analysis (LGCA) is an alternative method that assumes there are latent subgroups of individuals who have similar patterns of growth. Using this method, it is possible to identify groups of individuals with similar growth trajectories and compare the patterns of growth across groups. Although numerous studies have replicated the finding that children from lower-income families enter school with lower rates of achievement and remain below their higher-income peers through elementary school (Jordan, Kaplan, Locuniak, & Ramineni, 2007; Jordan, Kaplan, Olah, & Locuniak, 2006), it is unlikely that all children from low-income families show the same trajectory of poor performance. Further, as preschool programs, such as Head Start and public preschool become increasingly available to children from low-income families, quality programming is likely to influence their trajectories of school readiness and later achievement (*Promise of Pre-K*, 2009). Yet all children who are exposed to high quality preschool programs are not likely to be equally impacted by these programs (e.g. US Department of Health & Human Services, 2010). Therefore, research is needed to determine the differential patterns of growth experienced by low-income children who attend a preschool program. Further, it is important to understand what factors may predicts these different trajectories of growth. In particular, if some children experience more rapid growth in academic abilities, understanding how these children differ from those whose abilities do not increase as quickly could assist researchers to develop early interventions and preschool curricula that address the needs of low-income children. Possible predictors of the differences in children's patterns of achievement include demographic and family characteristics, as well as children's readiness for school across multiple domains including academic, cognitive, social-emotional, and behavioral development.

The goal of this dissertation is to use multiple analytic methods to examine how demographic characteristics, preschool academic abilities, and components of school readiness predict academic abilities and growth in academic abilities for a low-income sample of children who attended a comprehensive public preschool program. There are three research aims. The first aim involves determining how well three groups of variables (1) demographic characteristics, 2) academic abilities, and 3) assessments of children's social-emotional, behavioral, and attentional (SEBA) school readiness) predict 5th grade assessments of children's vocabulary, reading and math skills. The second aim will examine the pattern of growth in academic abilities from Kindergarten through 5th grade on measures of verbal ability, reading, and math. Then demographic characteristics, academic readiness, and SEBA school readiness variables will be used to predict growth in academic abilities for each of the outcome measures. The third aim is to identify differential patterns of growth (model latent growth trajectories for subgroups) with this population using Latent Class Growth Analysis (LCGA). Then I will determine whether demographic, academic, and SEBA school readiness variables predict membership to these latent subgroups of growth.

Development of Academic Abilities

One of the purposes of schooling is to develop children's abilities, particularly in the domains of vocabulary, reading, and math. However due to child characteristics, as well as other factors, there are substantial individual differences in both the entering skills (school readiness) and growth of academic achievement across the elementary years (West, Denton, & Germino-Hausken, 2000). Here I review factors that may influence these developmental processes.

Socio-Economic Status (SES)

SES, as measured by parent income and education, is a consistent predictor of differences in children's school readiness and academic achievement throughout elementary and high school (McLoyd, Aikens & Burton, 2006). SES not only predicts math, language/vocabulary, and cognitive abilities, but also predicts social-emotional skills, prosocial behavior, peer relationships, teacher-child relationships, participation, motor development and health (Currie, 2005; Janus & Duku, 2007; Jordan et al., 2006; Ladd, Birch, & Buhs, 1999; NICHD Early Child Care Research Network, 2005).

Research on the academic trajectories of lower SES and higher SES children indicate that several patterns of achievement may occur. One possibility is that the differences in children's abilities at school entry continue to diverge over time resulting in a widening achievement gap (McClelland, Acock, Morrison, 2006; Curby, Rimm-Kaufman, & Ponitz, 2009). Evidence for this widening achievement gap has been repeatedly documented, particularly in the language and literacy field, where it has been called the "Matthew effect", whereby more skilled readers are exposed to more print and get better vocabulary skills, which in turn leads them to be better readers than their peers who were less proficient readers at the outset (Juel, 1988). A second possibility is that the differences in children's abilities remain stable over time, resulting in parallel patterns of growth (McCoach, O'Connel, Reis, & Levitt, 2006). In this case, the academic advantages that children possess at school entry remain through elementary school. A third alternative is that the achievement gap present at school entry closes over time, with lower achieving students catching up to their peers (Curby et al., 2009; Hamre & Pianta, 2005; Wright, Horn & Sanders, 1997). There is also research documenting a "fourth-grade slump", which is characterized by a performance dip in reading scores starting in 4^{th} grade, among low-SES children (Chall, Jacobs, & Baldwin, 1990). Word meaning, a component of reading displays the first and strongest drop (Chall & Jacobs, 2003). Several explanations have been proposed, including: shifting from "learning to read" to "reading to learn", issues around fluency and automaticity, difficulty decoding word meaning as more difficult words become less familiar, resulting in comprehension difficulties, and the increased influence of peer behaviors and attitudes as children get older (Chall & Jacobs, 2003;Hirsch, 2003). Many of these explanations may be related to children's motivation to learn and to try to succeed, with school becoming more difficult and children from low-SES households not having the same amount of academic support at home (Sanacore & Palumbo, 2009).

Although there is evidence for each of these patterns, most research has found that differences in achievement by SES increase over time. It is likely that the achievement gap associated with SES is mediated by both the early experiences of children from low-SES families as well as differences in the stimulation and opportunities afforded across childhood. Children's early experiences and the social contexts in which children grow up may affect development either through accumulated exposure or biological embedding, in which early experiences affect biological processes which in turn have a long-term impact on development (Hertzman & Boyce, 2010; Shonkoff et al., 2009).

Although SES is related to children's school readiness, when researchers examine the relation between the components of SES (income and parental or maternal education) and school readiness, maternal education is a more robust predictor of language, math, motor development, and social skills than is income (Fantuzzo, Rouse, McDermott, Sekino, Childs, & Weiss, 2005), and parental education, specifically graduating from college is a stronger predictor than income-to-need ratio (Crosnoe, Leventhal, Wirth, Pierce, Pianta, & NICHD Early Child Care Research Network, 2010). Crosnoe and colleagues found that once the home and childcare environments were included in the model, income-to-needs ratio was not longer a significant predictor of reading or math, although parental education remained significant. The effects of income diminished once the home environment was included as a covariate, indicating that early experiences in the home may mediate the relation between SES and school readiness.

Parent Characteristics and the Home Environment. Parent characteristics and the home environment a child experiences during the first five years of life substantially impact children's school readiness. There is evidence that the home environment mediates the relation between income and school readiness (Linver, Brooks-Gunn, & Kohen, 2002), and that exposure to reading mediates the relation between SES and children's expressive vocabulary (Forget-Dubois, Dionne, Lemelin, Perusse, Tremblay, & Boivin, 2009). The parenting context including both the physical and social resources available to children is a stronger predictor of language and social skills in Kindergarten than maternal education and the child-care context (NICHD Early Child Care Research Network, 2004). Additionally family structure has been associated with children's school readiness and achievement; children who live in two-parent families outperform those who live in single parent households on measures of school readiness (Janus & Duku, 2007).

Characteristics of the home environment, such as language stimulation, literacy promoting behavior, access to literacy and math materials (books, games, toys and computer software) influence children's development and subsequent school success. Children from low-

SES families are less likely to have math and literacy activities in the home (Jordan et al., 2006) and children in low-SES families use the educational materials they own less frequently than children from middle income families (Starkey & Klein, 2000). Exposure to educational materials and parent interactions when using these materials predicts children's early math and reading abilities (Senechal & LeFevre, 2002; Starkey, Klein, & Wakeley, 2004). Not only is reading to children predictive of school readiness, but the way that parents read can affect children's language skills. Britto and colleagues found that parents who were story tellers (which involved adding commentary throughout the story) rather than story readers and who supported and taught to their children as they read, by encouraging children to problem-solve through guided assistance had children with better language skills than those who were story readers and did not support or teach while reading, controlling for the amount of reading that took place (Britto, Brooks-Gunn, & Griffin, 2006).

Not only is having materials in the home and using these materials related to children's development, but a parent's involvement and interactions with their child impact later outcomes. Maternal involvement in school predicts teacher reports of academics and school readiness (Janus & Duku, 2007; Pettit, Bates, & Dodge, 1997) and the quality of parent-child interactions predicts children's social skills and communication, but not cognitive abilities (Connell & Prinz, 2002). Therefore, while parental involvement may impact school readiness it does not appear to be the driving force behind the effect of the home environment on children's school readiness.

Parental factors such as depression, stress, health status and quality of parenting also affect child competence. Parents who live in low-SES households are more likely to experience stress and depression, and as a result may be less sensitive to their children's need which may account for part of the relation between SES and child achievement (Campbell & von

Stauffenberg, 2008). The emotional distress that can accrue as a result of living in poverty may mediate the relation between income and behavior problems (Linver et al., 2002). Further, harsh parenting is negatively related to children's social skills and academics in Kindergarten (Pettit et al., 1997). Finally, living in poverty increases the likelihood of experiencing health problems (Currie, 2005) which is associated with children's school readiness (Janus & Duku, 2007).

In summary, measures of SES are consistent significant predictors of school readiness and later achievement, with parental education being the strongest predictor. Additionally, the home environment including family status, parenting practices, parent characteristics and materials and activities in the home predict children's abilities at school entry and throughout elementary school; there is some evidence that these characteristics mediate the relation between SES and school success.

Variability in Academic Trajectories within Low-SES Families. The achievement gap involves the academic performance disparities found between children from different racial groups (most research has been conducted comparing Black and White children, although research on Latino and Asian students is emerging) and from families with different SES levels (Ferguson, 1998; Jencks & Phillips, 1998). These disparities are evident in children's test scores and in teachers and parents perceptions and expectations of children's abilities (Ferguson, 2003; Ferguson, 2007; McKown & Weinstein, 2008). These differing patterns of achievement are of concern as academic achievement is related to multiple functional and health outcomes (Adler, Boyce, Chesney, & Cohen, 1994; Ferguson, 2007).

Most of the research examining children's different achievement trajectories has grouped all children from lower-SES families and all Black children into the low achieving category; yet there is variability in children's school readiness and achievement within low-SES families (Attar, Guerra, & Tolan, 1994; Elias & Haynes, 2008). Therefore grouping all low-SES and Black children as the lower achieving students misrepresents the diversity that exists within this group. Research is needed to explore differences between children within a low-SES sample to determine whether there are achievement differences at school entry and whether the patterns of achievement widen, narrow or remain stable over time. Once differences in the patterns of growth are assessed, it is important to determine what predicts these patterns of growth within a low-SES sample. One possibility is that differences in children's readiness for school are predictive of patterns of growth in academic abilities in elementary school within a low-SES sample.

School Readiness and Academic Achievement

School readiness is a continuous, malleable, multi-faceted process that develops during early childhood and results in how ready a child is to learn as they enter school. At the most general level it involves children's readiness to do well in school; yet specific definitions of school readiness differ as school readiness encompasses multiple aspects of child development. Conceptualization of the domains and measures of school readiness vary across studies (Bierman, Domitrovich, Nix, Gest, Welsh, Greenberg et al., 2008; Graue, 2006). However, there is general agreement that three broad constructs are central to a comprehensive model of child readiness: academic readiness, cognitive readiness, and social-emotional / behavioral readiness.

Academic readiness. The most researched area of school readiness is academic readiness, which incorporates several academic skills, including language, pre-literacy, and math skills. More research has been devoted to understanding the development of language/pre-literacy than pre-math skills, yet both domains are strong predictors of later academic abilities (Duncan, et al., 2007). Emergent literacy skills are the building blocks of learning to read (Whitehurst & Lonigan, 1998). As so much attention has been devoted to language/pre-literacy, including language knowledge and skills (oral language and listening comprehension), and pre-reading knowledge and skills (phonological awareness, print skills and alphabet knowledge, most definitions include language/pre-literacy as a core component of school readiness (*School Readiness Act of 2005*, 2005). Compared to language/pre-literacy skills, pre-math skills have been underemphasized despite evidence that early math skills (classification, seriation, number, spatial reasoning and time) are a better predictor than language/pre-literacy skills are of later math and reading (Duncan, et al., 2007; Pagani, Fitzpatrick, Archambault, & Janosz, 2010).

Studies have repeatedly documented that children with better language and emergent literacy abilities in preschool and at Kindergarten entry are more likely to outperform their peers throughout elementary school language and emergent literacy predict later academics (Juel, 1988; LaParo & Pianta, 2000; Lonigan, 2006; NICHD Early Child Care Research Network, 2005; Whitehurst & Lonigan, 1998). Early language and literacy skills have been found to be the strongest predictor of later reading abilities (LaParo & Pianta, 2000), and better pre-reading skills have been associated with faster rates of growth in reading through 1st grade compared to children with lower pre-reading abilities at school entry (Curby et al., 2009). These findings are not surprising as early reading skills are the foundation for later academic abilities.

In addition to predicting later reading abilities, language and emergent literacy skills at school entry are related to math skills throughout elementary school (Duncan et al., 2007; Curby et al., 2009; LaParo & Pianta, 2000). There are several possible explanations for why early language and literacy are related to math abilities. Math assessments often require children to read and to understand instructions. Children who have difficulties reading may have difficulty decoding sentences or may not comprehend the questions (Martiniello, 2008; Martiniello, 2009). A second reason that children may perform better in math if they have better early language and literacy skills is that math skills may be stored verbally (Geary, 1993). Support for this hypothesis comes from a study which found that reading was a significant predictor of the growth curves in children's math abilities in elementary school (Grimm, 2008).

Early math skills are predictive of later math and reading abilities (LaParo & Pianta, 2000). Duncan and colleagues used five longitudinal datasets to examine which elements of school readiness were most predictive of later academic abilities and found that overall early math skills were the strongest predictor of later abilities (Duncan et al., 2007). Math abilities are quite stable with early math skills predicting patterns of growth in math abilities (Aunola, Leskinen, & Lerkkanen, 2004); children with lower math abilities at school entry have slower rates of growth compared to children who enter with higher math abilities (Jordan et al., 2006; 2007). In other words, there is a fanning effect with children who enter school with better math abilities improving at a faster rate than lower achieving students. Some studies have found a different pattern, with better pre-math skills associated with slower rates of growth, indicating narrowing trajectories by 1^{st} grade (Curby et al., 2009), although this study had a smaller sample size with less income variability which might explain the inconsistencies in the findings.

Early math skills are also predictive of later reading abilities (Duncan et al., 2007). One study evaluating a preschool math curriculum found effects not only on math skills but also showed improved reading comprehension abilities than comparison students (Lange, Sarama, & Clements, 2009). One explanation for this cross-domain association is that assessments of math abilities may not only evaluate children's abilities specifically in math, but may tap into higher order processes, such as executive functioning and intelligence (Blair, 2002). Alternatively, children's abilities to solve problems may help them in understanding patterns in learning to read.

Cognitive Readiness. Attention skills are a core dimension of cognitive readiness. Executive functioning (EF), a broad domain within cognitive abilities is a higher-order cognitive ability which is activated as an individual attempts to resolve a cognitive conflict (for example a rule-based task) that requires the inhibition of a dominant response in favor of a sub-dominant response (Zelazo, Muller, Frye & Marcovitch, 2003). Sustained attention a fundamental component associated with attention (Razza, Martin, & Brooks-Gunn, 2010), is considered an aspect of EF, which is characterized by the ability to continuously focus and direct cognitive resources on a particular stimulus (Posner & Peterson, 1990). In real world contexts, sustained attention allows children to maintain focus on important characteristics in the environment and ignore distractions (Derryberry & Rothbart, 1997). As children age from infancy through childhood, they are better able to sustain their attention for longer periods of time (Betts, Mckay, Maruff, & Anderson, 2006; Kannass & Oakes, 2008).

Given the demands of learning in the classroom (e.g., maintaining attention on repetitive tasks), it is not surprising that children's ability to pay attention and sustain attention is predictive of children's academic abilities in preschool (Friedman-Weieneth et al, 2007) and elementary school (Muris, 2006). Sustained attention appears to be a key mechanism underlying the relation between the family environment and children's school readiness (Belsky, Fearon & Bell., 2007; NICHD ECCRN, 2003; Razza, Martin, & Brooks-Gunn, 2010). Better sustained attention is associated with higher levels of cognitive competence (Choudhury & Gorman, 2000), inhibitory control (Reck & Hund, 2011), social competence (Murphy, Laurie-Rose, Brinkman &

McNamara, 2007; Perez-Edgar, McDermott, Koreltiz, Degnan, Curby, Pine, & Fox, 2010), and behavioral regulation (NICHD ECCRN, 2003); meanwhile, children who have difficulties sustaining attention are more likely to have language, reading, and math deficits (Faraone, Biederman, Webster, & Russell, 1998; Marshall, Hynd, Handwrk, & Hall, 1997). Some researchers have explored how the more general construct of attention at school entry is related to the growth in academic abilities; attention was found to be the only non-academic predictor of later academic achievement (Duncan et al., 2007). Yet no research has examined how sustained attention is related to growth in academic abilities in elementary school.

Social-emotional and behavioral readiness. Social-emotional competence is a construct used to describe the process of acquiring skills to develop emotion recognition and management, compassion for others, positive social relationships, and responsible and effective decision making (Denham & Weissberg, 2003; Greenberg, Weissberg, O'Brien, Zins, Fredericks, Resnik, et al., 2003). The research on the relation between social-emotional competence and later academic abilities is inconsistent. Some studies have documented associations between children's social-emotional competence and later measures of academic achievement and cognitive ability (Zins, et al., 2004), other researchers have found that such a relation does not exist (Duncan, et al., 2007). More recent evidence indicates that such a relation does exist, although the size of the effect is small (Grimm et al., 2010; Romano, Babchishin, Pagani, & Kohen, 2010). A child's school readiness is shaped by their emotion knowledge, social competence and behavior problems.

Emotion knowledge. Emotion knowledge is a domain of social-emotional competence, which includes emotion recognition and emotion expression (Garner & Waajid, 2008). Emotion recognition is the ability to understand one's own emotions and the emotions of others based on facial expressions, behavioral cues and social contexts, which require an individual to recognize display rules and to appreciate the potential causes and consequences of an emotional expression (Denham, 1998; Garner & Waajid, 2008; Trentacosta & Fine, 2010). Emotion expression is the ability to correctly identify and label emotions based on a facial expression (Denham & Burton, 1996). As children enter Kindergarten it is developmentally appropriate for children to be able to label basic emotions (e.g. happy, mad, sad, and scared) and to recognize the presence of these emotions on others (Denham, Blair, DeMulder, Levitas, Sawyer, Auerbach-Major, et al., 2003).

Preschool emotion knowledge and self regulatory abilities are predictors of academic competence in Kindergarten (Campbell & von Stauffenberg, 2008), and emotion knowledge is a significant predictor of language (Garner & Waajid, 2008). Emotion control (e.g. reactivity and regulation) and emotion understanding (e.g. recognizing and labeling emotions) are better predictors of academic abilities than cognitive control (e.g. executive function) and cognitive understanding (e.g. theory of mind) (Leerkes, Paradise, O'Brien, Calkins, & Lange, 2008). A possible mechanism for this relation is through attention, as emotion knowledge and expression are related to children’s attention skills in elementary school (Trentacosta, Izard, Mostow, & Fine, 2006), which are predictive of later academic abilities (Trentacosta & Izard, 2007).

Social competence. While emotion knowledge is about a child’s understanding of emotions, social competence centers on how children interact with others, which in the school context includes peers and teachers. As children enter school, they must simultaneously learn to navigate new peer relationships (Ladd et al., 1999) and to work independently (Campbell & von Stauffenberg, 2008). Children should be able to follow directions, take turns, ask for help when needed, and develop new friendships. As children spend much of their time interacting with classmates, children’s ability to develop peer relationships can influence their learning experience. As children navigate this new environment, teachers want their students to be curious and eager to try new experiences, while respecting adult/teacher authority and following the rules (Rimm-Kaufman & Pianta, 2000). Not only is social competence helpful in making friends with peers, but positive social interactions with peers are related to better student-teacher relationships (Griggs, Gagnon, Huelsman, Kidder-Ashley, & Ballard, 2009).

Young children who are able to sustain positive peer engagement and who are better regulators of their emotions have better outcomes across multiple academic domains (Denham, 2006). Socially competent behaviors, such as helping, sharing and cooperation in Kindergarten have been associated with 3rd grade literacy (Miles & Stipek, 2006) and academic achievement in 8th grade after accounting for prior academic abilities (Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo, 2000). Possible explanations for how SEL affects academics is through work-related skills, such as engagement and participation, with better social competence related to higher levels of engagement and participation, which are in turn related to academic achievement (Ladd et al., 1999). Some studies have found that socially competent behaviors predict academic achievement and success on standardized tests better than behavior problems (Malecki & Elliott, 2002), yet further work is required to understand how these more positive behaviors relate to later academics.

Behavior Problems. In addition to children's emotion knowledge and social competence, behavior problems contribute to children's social-emotional and behavioral readiness for school. Behavior problems are often categorized as either externalizing (for example overactive or aggressive) or internalizing (for example underactive or withdrawn; Fantuzzo, Bulotsky, McDermott, Mosca, & Lutz, 2003; Trentacosta & Fine, 2010). Generally, externalizing problems are associated with more negative teacher-child relationships (Hamre, Pianta, Downer, & Mashburn, 2007), peer rejection and difficulty maintaining friendships (Hanish, Martin, Fabes, & Barcelo, 2008), which are related to poor school adjustment (Ladd, Kochenderfer, & Coleman, 1997). However it should be noted that, exhibiting a certain level of aggressive behavior can also be associated with being socially effective; for example, aggression may be used to assert dominance and gain resource control (Vaughn, Vollenweider, Bost, Azria-Evans, & Snider, 2003). Internalizing behaviors may not be noticed as quickly as externalizing behaviors as children with internalizing problems may experience anxiety or depression. As a result these children may appear well behaved, in contrast to children with externalizing behaviors who act out.

Exhibiting behavior problems, such as aggressive or disruptive behavior is associated with poor academic achievement and later school dropout (Ladd, Buhs, & Seid, 2000; McLoyd, 1998; Vitaro, Brendgen, Larose, & Tremblay, 2005). Classroom behaviors problems significantly predict math achievement (Dobbs, Doctoroff, Fisher, & Arnold, 2006), and there is evidence that internalizing and externalizing behaviors are both related to growth in academic abilities in elementary school after controlling for prior academic abilities (Grimm et al., 2010). There are several reasons that a relation between behavior problems and academic abilities is not always significant. Konold and Pianta (2005) found that ratings of children's behavior were influenced by the informant (parents versus teachers), which is an indication that behavior ratings may better reflect the informant than the child. Further, reports of behavior problems are not normally distributed and many children display no problems at all; therefore, including a categorical variable may better characterize behavior problems than a continuous variable (Grimm et al., 2010).

Evaluating the predictive abilities of multiple components of school readiness simultaneously. Few studies have simultaneously examined multiple aspects of school readiness and few have controlled for prior academic abilities. Duncan and colleagues attempted to overcome these limitations when analyzing six longitudinal data sets to examine the consistency in the relation between school readiness and academic abilities (from 3rd to 8th grade; Duncan et al., 2007). Findings indicated a consistent pattern whereby children's early math, reading and attention were consistently related to later academic abilities, and math was a more stronger predictor than reading. Measures of social-emotional competence and behavior problems were not consistently related to later academic abilities and when these measures were significant, the effect sizes were quite small. This study used a variety of control variables, creating a situation where multiple highly correlated variables were entered as simultaneous predictors. Forget-Dubois and colleagues (2007) found that when multiple aspects of social-emotional competence where entered simultaneously as predictors, there was a high level of collinearity, resulting in non-significance for all social-emotional variables. When only one variable was entered into the model, the measure became significant indicating that one reason for non-significant findings might be a high level of collinearity between measures. Therefore, the predictive power of social-emotional and behavioral variables to later academic abilities is unclear.

The Duncan and colleagues article spurred great debate regarding the importance of social-emotional and behavioral skills at school entry. In response a series of reports have re-evaluated the same datasets and other large longitudinal datasets to determine the consistency of these findings (Foster, 2010). Overall, these studies found a weak relation between social-emotional and behavioral skills and later achievement (Grimm et al., 2010; Romano et al., 2010).

Grimm and colleagues used growth curves rather than simply predicting later academic abilities at one time point, and found that although some measures of internalizing, externalizing and social skills were related to growth in academic abilities, but the effect were small. Romano and colleagues (2010) used a Canadian dataset and found that most social-emotional and behavioral variables did not predict academic abilities, yet prosocial behavior showed a small significant effect.

The Role of Preschool Education

Early childhood educational experiences influence both children's readiness for school and academic abilities in elementary school; this is particularly true for children from disadvantaged families. Since all children in the current sample were exposed to a district-run preschool program that was enhanced with evidence-based curricula, it is important to understand the potential influence preschool has on children's school readiness and academic skills.

As nearly one in every five children in the United States currently lives in poverty (Children's Defense Fund, 2005), a variety of early childhood programs have been designed and evaluated to determine whether they can help at-risk children succeed in school. Several classic evaluations of preschool programs that have found that attending preschool had positive effects on both academic and non-academic outcomes, including: High/Scope Perry Preschool, Abecedarian, the Chicago Child-Parent Centers and Head Start (Ramey & Campbell, 1984; Reynolds & Ou, 2010; US Department of Health & Human Services, 2010; Weikart & Schweinhart, 1997). Based on evaluations of the High/Scope Perry Preschool program, Abecedarian and the Chicago Child-Parent Centers, children who attended these comprehensive early education programs improved on a variety of outcomes across the lifespan. Attending preschool was related to better scores on IQ tests, on tests of reading and math ability (Campbell & Ramey, 1995; Reynolds & Temple, 1995). Children who attended these programs were less likely to be retained, placed in special education (Schweinhart & Weikart, 1985; Campbell, Pungello, Miller-Johnson, & Burchinal, 2001). As adults, they were more likely to complete high school, attend college or vocational training, were more likely to have a skilled job, had higher incomes, and were less likely to be arrested, to be on welfare, or to have a child out-of-wedlock (Campbell, Wasik, Pungello, Burchinal, Barbarin, Kainz, et al., 2008; Reynolds, Temple, Robertson, & Mann, 2001; Schweinhart, Berrueta-Clement, Barnett, Epstein, & Weikart, 1985).

The Head Start preschool model was designed to boost the school readiness of low-income children (US Department of Health & Human Services, 2010). Head Start is a comprehensive program, providing education, medical, dental and mental health care, nutrition services and involves parents. In a randomized control trial of Head Start, attending Head Start was found to have a positive impact on children's language, literacy, pre-writing skills and math skills at the end of preschool, but these effects faded over time, and had almost disappeared by 1st grade. There were very few program effects on children's social-emotional development (US Department of Health & Human Services, 2010).

Curricular Enhancements. With the growing evidence that preschool programs can positively influence children's school readiness and later school success, the focus has shifted from determining whether preschool is beneficial, to assessing which specific curricula are most effective at improving children's school readiness in particular domains. To enhance children's pre-reading and math abilities numerous curricula have been developed and evaluated including Dialogic Reading (Whitehurst & Lonigan, 1998), Sound Foundations (Byrne & Fielding-

Barnsley, 1991), Literacy Express (Lonigan, Menchettie, Phillips, McDowell, & Farver, 2005), and PreK Mathematics (Klein, Starkey, & Ramirez, 2002). Each program focuses on specific areas of development; for example, the pre-reading programs often concentrate on oral language skills, phonemic awareness, alphabet knowledge, print knowledge, word identification, and spelling. Similarly, programs have been developed to enhance children's social and emotional skills in preschool (Zins, Bloodworth, Weissberg, & Walberg, 2004). Evidence-based preschool social-emotional programs include: Preschool PATHS (Domitrovich, Cortes, & Greenberg, 2007), the Incredible Years Dinosaur School (Webster-Stratton, Reid, & Stoolmiller, 2008), Emotions Course (Izard, Trentacosta, King, & Mostow, 2004) and Al's Pals (Lynch, Geller, & Schmidt, 2004). These programs teach children to recognize and label emotions, develop social problem-solving skills, emotion and behavior regulation and enhance social competence.

Methodological Approaches

Two different methodological approaches – individual growth and a latent subgroups approach – will be used to examine the relation between school readiness and children's academic abilities in elementary school. Although previous research has found that these methods often lead to similar conclusions, it is important to explore the consistency in the findings and to determine whether one of the approaches is able to detect a different pattern of growth in academic abilities, or a different type of association between the school readiness variables and the outcomes.

Individual growth. An important advance in understanding the development of academic and cognitive growth has come from new models for longitudinal data analysis. One way to assess data longitudinally is to use multi-level modeling to determine individual growth trajectories (Collins, 2006; Singer & Willet, 2003) which permits more precise characterizations of the patterns of growth over time, including those that are both linear and non-linear. With a sufficient number of time points, it is possible to examine multiple patterns including stable, increasing and decreasing growth as well as inconsistent patterns with peaks and valleys. By modeling growth in academic abilities and using demographic and school readiness variables to predict these patterns of growth, we are better able to understand what factors influence patterns of academic development (Bates, 2000).

Latent Subgroups Approach. An alternative approach is latent subgroups analysis which identifies subgroups within the population who share a similar pattern of characteristics (Laursen & Hoff, 2006). This approach permits the discovery of different patterns of growth among subgroups in a population (Bergman & Magnusson, 1997). While such models have been regularly applied to the development of substance use and delinquency pattens (Bates, 2000; Coffman, Patrick, Palen, Rhoades, & Ventura, 2007, Nagin, 2005) this approach has rarely been used in understanding early patterns of academic growth.

The Current Study

The current study includes three research aims. The first aim is to use a series of hierarchical regression models to assess whether demographic characteristics, preschool academic variables, and measures of school readiness predict children's 5th grade vocabulary, reading, and math skills among a disadvantaged sample of children who attended a preschool program. The second aim is to determine which demographic characteristics and aspects of children's school readiness predict the individual *growth curve*s of children's academic abilities from Kindergarten to 5th grade. The third aim is to assess whether there are *latent subgroups of growth* in academic abilities from preschool to 5th grade and to use demographic, academic, and school readiness variables to predict membership to each of the classes. In the current study, predictors will be grouped into three categories: 1) covariates and demographic characteristics, 2) preschool academic abilities, and 3) social, emotional, behavioral, and attentional (SEBA) school readiness variables assessed in preschool.

Aim 1

The first aim is to use a series of hierarchical regression models to assess to what extent different groups of variables predict children's academic abilities in 5^{th} grade. Assessing how well school readiness variables predict academic abilities at one time point is common practice, and the analyses are similar to those conducted by Duncan and colleagues (2007). Table 1 illustrates the variables included in each of the four models. I hypothesize that in Model 1, parental education will be the strongest predictor of 5^{th} grade academic abilities, but that many of the demographic variables will not be significant. Research has consistently found that children's pre-math, pre-reading and attention skills are strong predictors of later academic abilities; therefore, in Model 2, I hypothesize that within this sample, measures of children's vocabulary, pre-reading, and pre-math will also predict the outcomes. As measures of social-emotional competence and behavior problems have been inconsistently related to academic abilities, I hypothesize (Model 3) that some of these measures will be significantly related, but that they will only account for a small percentage of the explained variance. I hypothesize sustained attention will be significantly related to the outcomes more often than the other school readiness measures, given previous research that has found a similar pattern (Duncan et al., 2007). Finally, in Model 4 which combines all predictors, I hypothesize that the number of significant SEBA variables will decrease and that the strength of the association between SEBA variables and the outcomes will diminish with the addition of the preschool academic variables.

Aim 2

The second aim involves modeling individual growth curves of academic abilities and using demographic and school readiness variables to predict growth in academics. First, I will determine the pattern of growth in children's academic abilities from Kindergarten to 5th grade. Given previous findings through 2nd grade from the present sample which indicated that children experienced considerable growth in academic abilities (Moore, Greenberg & Domitrovich, 2010), I expect a linear trend upward, with the average level of children's abilities increasing over time compared to national norms. Two areas of research lend support to the idea that over time the rate of increase in abilities will slow or decrease relative to national norms: research evaluating preschool programs has found that the effects of preschool fade in elementary school and research on the 4th grade slump has found that low-income children's abilities declined relative to peers starting in 4th grade. Therefore, I expect a quadratic effect, with growth in academic abilities being faster immediately following the preschool program, but slowing over time. Four sets of models will be run using the individual growth curves; the predictors in each of the models are presented in Table 1. For each of the models, predictors will be assessed to see if they predict the *intercept* and *growth* in the outcome. My hypotheses for the each of the growth curve models are similar to those for the regression models in terms of predicting the *intercept*. Based on previous work by Moore and colleagues (2011) and by Shah and colleagues (2011) with the previous sample I believe that there will be variables that predict convergent patterns of growth from Kindergarten to 5th grade.

Aim 3

The third aim is to examine a multiple trajectory model of latent classes of growth in academic abilities. I will employ Latent Class Growth Analysis (LGCA) to determine whether there are different patterns of growth in each of the academic abilities from Kindergarten to 5th grade. Multiple models will be run for each outcome, gradually increasing the number of classes. Previous work with this sample assessing latent classes of growth from preschool to 2nd grade found three classes of growth in math skills and five classes of growth in reading (Moore et al., 2010); therefore, I expect at least three classes for each of the domains. Despite work from researchers indicating that the gap between low-achieving and high-achieving children increases over time, the previous work with this sample found parallel trajectories of growth. Therefore, I hypothesize that the achievement gap will not widen over time. Furthermore, for reading abilities, previous work indicated that there were groups of individuals who started with low abilities, but increased at a faster rate than other children, essentially catching up to moderately achieving children by 2nd grade. Therefore, I hypothesize that there will also be groups of children who have very different patterns of growth.

Next I will assess whether demographic characteristics predict group membership. In a prior study with this sample that used demographic characteristics to predict latent trajectories of growth, the measures of SES were not strong predictors of group membership. Therefore I hypothesize that demographic characteristics will not be consistent predictors of trajectories of academic abilities. Finally, I will determine which aspects of school readiness predict latent trajectories of academic abilities. As research has found that pre-math, pre-reading and attention were significant predictor of academic abilities, I hypothesize that the same variables will also be significant predictors of class membership. SEBA measures have not been consistently related to academic achievement, but some studies that used latent class analysis to create classes of school readiness found that social-emotional skills were important for children with lower academic abilities (Konold & Pianta, 2005). If there is a group of children with lower abilities who increase at a faster rate than other classes, I hypothesize membership to this class will be related to better social-emotional competence and fewer behavior problems.

Chapter 2:

Methods

Participants

The sample was collected in the evaluation of the REACH preschool program in Harrisburg, PA. The sample includes 355 children who entered the preschool program during 2002-2003 (12 classrooms) and 2003-2004 (26 classrooms). In the first year, 168 students were recruited; in the second year an additional 187 children participated. One hundred and fifty nine of the children attend preschool for two years, beginning at age three; the other 196 received the program for only one year beginning when they were four years old.

The sample's demographic characteristics are available in Table 1. In total, 55% are female, 69% are Black, 20% are Hispanic or of mixed race including being Hispanic, 90% have English as a primary language. Since there majority of the sample was Black and the portion of the sample that was not Black was diverse (Hispanic, mixed race, white…), there was little power to detect differences between ethnicities. Being black was never significantly related to the outcomes in any of the models; therefore it was not included in the tables, but was included in the analyses. The majority of the sample is disadvantaged, over 90% of students in the school district are eligible for free or reduced lunch, 77% of the children were below the poverty line at entry to school, 60% were receiving WIC and 72% were eligible for free or reduced lunch. The primary caregivers' level of education was quite varied: 30% did not complete high school, 38% completed high school and 32% completed some post-secondary education. Fourteen percent of the sample was born with a low birth weight (under 5.5 lbs.), 21% live in two-parent families and the average household had 1.3 adults and 2.5 children.

Procedure

Child interviews were conducted annually from entry to preschool through 3rd grade. No child interviews were conducted in 4th grade, but due to new funding, interviews were administered again in 5th grade. During preschool interviews were done between October and December during two 30-45 minute sessions. Starting in Kindergarten, interviews were conducted between February and April and were normally completed in one session lasting generally 45-75 minutes. The interviews were held in a quiet room outside of the class. Interviewers were college graduates with experience working with children. Interviewers were trained for 20 hours and then completed practice interviews to assess their reliability in administering the interview.

In addition to child interviews, teachers completed ratings of behavior and academic abilities from preschool through 3rd grade and again in 5th grade. During preschool, teachers rated children in the fall and spring. Starting in Kindergarten, teachers completed the ratings annually between April and May.

Enhanced Preschool Program Model

The preschool program was administered by the school district in partnership with a local Head Start grantee. As a result of this collaboration, the program adhered to national Head Start standards, but went beyond these requirements by staffing each classroom with two teachers, one of which was required to have bachelor’s degrees and teaching certificate, the other teacher was only required to have a high school education. Teachers varied in their educational experiences, but as a group they exceeded qualifications for Head Start education levels set by Federal guidelines. In the first year of the program, 15% of the district teachers had Master’s degrees.

Eighty five percent of the district teachers and 42% of the Head Start teachers had a bachelor's degree compared to 28% of Head Start teachers in the FACES 2000 sample (FACES, 2006). There was very little turnover in staff between the first and second year of the program.

The student teacher ratio within the preschool program was low (8:1) with a maximum of 16 students per classroom. The program was comprehensive in that it provided 5 hours a day (8 am to 1 pm) during the academic year as well as an optional 6-week summer program. Consistent with the Head Start model, the program included three home visits in addition to the two parent-teacher conferences. As an additional service to support working parents, wrap around childcare was offered before and after school.

Program Core Components. The preschool program was enhanced with evidence-based curricula including the High Scope curriculum (Weikart & Schweinhart, 1997), which served as the basis for the classroom program and the preschool PATHS curriculum (Promoting Alternative Thinking Strategies; Domitrovich, et al., 2007), a universal, teacher-taught curriculum designed to promote social and emotional competence. Additionally, the program was enhanced with best practices including a balanced literacy framework and coaching (International Reading Association & National Association for the Education of Young Children, 1998). The balanced literacy framework emphasized the importance of active learning and high-quality teacher-child interactions, classroom environments rich in language and print, and a variety of formats including the use of individual, large and small group instruction. Prior to beginning the program, teachers participated in a week of in-service training that focused on the key curriculum components and Head Start standards. During the school year, teachers also received in-class coaching support from literacy specialists that included observation, modeling, and in vivo support. The intensity of coaching varied depending on teacher's skill level and the percentage of students in the classroom with delays.

Measures: Academic Achievement Variables

In order to characterize academic achievement across the elementary years, measures of receptive vocabulary, reading achievement, and math achievement were assessed on a yearly basis. The following measures will be used to create the growth trajectories from Kindergarten to 5th grade. All three measures were administered annually from Kindergarten through 3rd grade and then again in 5th grade.

Vocabulary. The Peabody Picture Vocabulary Test III (PPVT-III; Dunn & Dunn, 1981) is a 175 item measure of children's receptive vocabulary. Children are presented four pictures on a page and asked to identify the picture that best illustrates the word presented orally by the examiner. A total score of correct responses is calculated and converted into an age-standardized score (*M* = 100, *SD* = 15).

Reading. The Woodcock-Johnson Psycho-Educational Battery Revised – Letter-Word Identification (WJ-Letter Word) subtest was used to assess reading skills (Woodcock & Johnson, 1990). The test is designed to measure intellectual and academic abilities for individuals from preschool through adulthood. The WJ-Letter Word subtest consists of 57 items that measure the child's ability to match a rebus (pictographic representation of a word) with the actual picture of that object and the ability to identify letters and words in large type in the test booklet. The WJ has high reliability and good predictive and concurrent validity (Woodcock & Johnson, 1990); the reliability of the WJ-Letter Word was .94 for children aged 8 to 12.

Math. The Woodcock-Johnson Psycho-Educational Battery Revised – Applied Problem (WJ-Applied Problems) subtest is a measure of mathematical ability with a total of 60 items. The items are graded in difficulty (empirically determined by the Rasch item analyses). Easier items include content addressing ordinal counting, counting relevant objects in an assortment of objects, and simple addition and subtraction, while more complex items include multiplication, division and problem solving questions. For children aged 8 to 12, the WJ-Applied Problems has a reliability of .92.

Measures: School Readiness Variables

Demographic Characteristics. Parents completed enrollment forms in the summer in order to register their children in the preschool program. Similar questions on family structure, family demographics, and health history were completed by parents of Kindergarten children. A list of the demographic characteristics is presented in Table 1.

Academic Readiness. The same three measures that will be used to assess growth will also be used to assess cognitive readiness in preschool: the PPVT-III, a measure of receptive vocabulary, and two subtests of the WJ, WJ-Letter Word and WJ-Applied problems. The PPVT-III has a reliability of .71 for children aged 48 to 53 months. Using a stratified probability sample of 2479 children in Head Start classrooms, the reliability was .84 for Letter-Word Identification and .90 for Applied Problems.

Attention Skills. The Leiter-Revised Attention Sustained Subtest (Leiter-R AS; Roid & Miller, 1997) was used to assess children's ability to sustain attention to detail while completing a repetitive task. Children were shown a target figure (e.g., flower) located at the top of the array and were instructed mark each of the target figures, but none of the other figures on the array as quickly as they can. This process was repeated 4 times, with an increasingly complex array of figures; they are given a total of 30 seconds per array. The adjusted total correct score was calculated by subtracting the total number of errors from the total number of correct and was then converted to an adjusted total scaled score (M=10, SD=3). The internal consistency of the Leiter-R AS has a Cronbach alpha coefficient of .83 for the 4-5 year old version and test-retest reliability of .85. This measure was administered in the spring of Kindergarten.

Emotion Knowledge. Three measures were used to assess emotion knowledge: the Assessment of Children's Emotions, the Kusche Emotional Inventory, and the Emotion Recognition Questionnaire. The Assessment of Children's Emotions (ACES) is a measure assesses children's emotion expression knowledge. Children are presented with 12 photographs of children posing facial expressions (Schultz & Izard, 1998). Of the 12 photos, eight of the faces were of children expressing the four basic feelings (happy, sad, scared, and mad) and four were of expressionless faces. Children are asked to identify whether the child in the photo was happy, sad, mad or scared; children receive one point for the correct identification of the facial expression depicted in the photograph.

The Kusché Emotional Inventory (KEI) assesses children's ability to recognize various emotional expressions accurately (Kusché, 1984). The original measure presented children with 32 trials of four drawings of emotion expressions (one target; three distracters) and asked to identify the cartoon picture best matching a given feeling label; examples of the emotions include: being scared, being ashamed, feeling surprised, and being disappointed. This measure is similar to the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981), but focuses on emotions rather than more general vocabulary. Each item was scored as follows: two points for the correct emotion, one point for the correct valence, and zero points for an incorrect response. Children in the comparison group for the current study only completed the first 18 items; therefore the summary score was based on 18 items. The summary score was created by taking the mean score across all items.

The Emotion Recognition Questionnaire (ERQ) assesses children's developing knowledge of the normative reactions to emotion-eliciting situations (Ribordy, Camras, Stafani, & Spaccarelli, 1988). Children were presented 16 vignettes. For example one vignette describes a child whose little brother broke their favorite toy on purpose. Children are then shown four facial expressions (happy, sad, mad, and scared) and asked to identify the face that showed how the story character felt. Children were given two points for the correct emotion, one point for the correct valence, and zero points for an incorrect response. All three emotion knowledge measures were administered in the spring of Kindergarten.

Social Competence. Two measures were used to assess social competence, the Head Start Competence Scale and Cooperative Classroom Behaviors. The Head Start Competence Scale assesses child's social (i.e. listens to other points of view, shares things with others, gives suggestions) and emotional competence (i.e. identifies feelings appropriately, copes with sadness, understands others' feelings; Domitrovich, Cortes, & Greenberg, 2001). The 12 items reflect two conceptual constructs: interpersonal relationships and emotion regulation. Respondents are asked to rate each item on a four-point scale (e.g., where 1 = not at all well and 4 = very well). A total score was created by averaging all of the items on the measure.

Cooperative Classroom Behaviors was developed for the Head Start FACES (FACES, 2006) and assesses how often a child engages in cooperative classroom behavior. The 12 items reflect cooperative classroom behaviors such as following teacher's directions, helping put things away, and complimenting classmates and are rated on a three-point scale (1 = never, 2 = sometimes, and 3 = very often). The total score ranges from zero to 24 and is calculated by summing the responses for all 12 items. Teachers completed both measures in the spring in Kindergarten.

Behavior Problems. To assess behavior problems, the 14-item Behavior Problems Scale was administered; the measure was developed for the Head Start FACES (FACES, 2006) and assesses the frequency of aggressive, hyperactive / inattentive, and withdrawn behavior. Each item is rated on a three-point scale (0 = not true, 1 = somewhat or sometimes true, and 2 = very true or often true). The scale provides both at Total Problem Score (alpha = .85), as well as three subscales: Aggressive, Hyperactive / Inattentive and Withdrawn. Teachers completed this measure in the spring in Kindergarten.

Chapter 3:

Results

Descriptive Statistics

The means and standard deviations at each time point from Kindergarten to 5th grade for the three outcome measures (Peabody Picture Vocabulary Test, WJ-Letter Word and WJ-Applied Problem) are presented in Table 3. The PPVT, the WJ-Letter Word, and the WJ-Applied Problems are normed measures with a mean of 100 and a standard deviation of 15. Means and standard deviations for the predictor variables in preschool are also presented. There was attrition over time resulting in a decreasing sample size from preschool to 5th grade. In preschool, 306 children completed the assessment, the sample decreased to 283 in Kindergarten, 250 in 1st grade, 237 in 2nd grade, 208 in 3rd grade, and 185 in 5th grade. The majority of the attrition was due to children leaving the district. Other reasons for missing data include: children moved to private or charter schools, children were in Learning Support, and children were placed in Special Education; children who were able to be tested in Learning Support and Special Education completed the assessments and were included in the analyses.

Attrition analyses were run comparing those who dropped out of the sample by 5th grade to those with complete data. Children who attrited were less likely to be Black (62% and 74%; $p = .034$) and were more likely to come from two-parent families (25% and 13%; $p = .010$). No other demographic differences were found between the groups. No differences were found between the two groups on preschool measures including: the PPVT, the WJ-Letter Word, the WJ-Applied Problem, the KEI, the ACES, the ERQ Expressive or Receptive, the SAT, or any of the teacher-report measures (CCB, HSCS, and BP).

The PPVT scores were almost one standard deviation below the mean at preschool with slight improvement through 5th grade. In preschool, the WJ-Letter Word scores were approximately half a standard deviation below the normative mean. In 1st through 5th grade the sample was near the normative mean, although scores dropped relative to the normative mean across elementary school. For the WJ-Applied Problems the mean in preschool and Kindergarten was approximately one standard deviation below the normative mean. In elementary school, scores increased relative to the mean and were at approximately the mean of 100 by 2nd grade, and remained at a similar level through 5th grade.

The preschool social, emotional, behavioral, and attention (SEBA) readiness variables were not standardized, and therefore comparisons to the overall population cannot be made. In preschool, children scored relatively high on the ERQ Receptive and Expressive subscales with means of 1.70 and 1.82 respectively, with possible scores ranged from 0 to 2. Scores were closer to the mid-range for the KEI, the ACES, and the SAT. Children tended to score higher than the mid-point on both teacher-reported social competence measures (CCB and HSCS), and the distribution for the Behavior Problems measure was skewed, with a mean of 5.24 and a range from 0 to 24; teachers reported that a high proportion of children displayed very few behavior problems.

Table 4 presents the correlations between the PPVT at each of the time points (Kindergarten to 5th grade). All correlations were significant at $p < .001$. There was very high stability between adjacent years all correlations were .65 or greater, and all correlations were greater than .49 indicating a high level of stability in the PPVT scores over time. For the WJ-Letter Word, correlations over time are presented in Table 5. Similar to the PPVT, all correlations were significantly related ($p < .001$) and were consistently above .40. There is remarkable stability from grade 1 onwards. Correlations for the WJ-Applied Problems are presented in Table 6. Again all correlations were significant ($p < .001$), and ranged from .31 to .81.

Table 7 presents correlations between the demographic characteristics and the outcomes variables. Due to the large number of variables, only the outcome variables in Kindergarten and 5th grade are presented. Higher parent education was significantly related to all three outcomes at both Kindergarten and 5th grade (correlations ranged from .25 to .29 with Kindergarten abilities, and .16 to .22 with 5th grade scores). Living in a two-parent family was related to higher PPVT (Kindergarten: $r = .17$; 5th grade: $r = .25$) and WJ-Letter Word scores ($r = .15$ at Kindergarten and 5th grade), but not to WJ-Applied Problems. Higher family income was related to all three Kindergarten outcomes (PPVT: $r = .23$; WJ-Letter Word: $r = .20$; WJ-Applied Problems: $r = .14$), but only to the PPVT at 5th grade ($r = .17$). Gender was only related to the Kindergarten WJ-Letter Word with girls outperforming boys in Kindergarten pre-reading.

Table 8 presents the correlations among the SEBA school readiness variables. All preschool variables were significantly related, with the exception of the teacher-rated behavior problems measure, which was not significantly related to the ACES or the ERQ Receptive; both measures assess children's emotion understanding. The strongest correlations were found between the teacher reports (Cooperative Classroom Behaviors, Head Start Competence, and Behavior Problems), all of which had correlations of a magnitude greater than .70; the BP measure was negatively correlated with other assessments because a high score represents more behavior problems.

Table 9 presents the correlations between the preschool SEBA school readiness variables and the outcome variables (PPVT, WJ-Letter Word, and WJ-Applied Problems) in Kindergarten and 5th grade. All of the SEBA school readiness variables were significantly related to the Kindergarten PPVT, although the strongest correlations were with the KEI (r = .56), the ERQ Expressive Scale (r = .46), and the ACES (r = .43); the weakest correlations were with the Head Start Competence Scale (r = .16) and Behavior Problems (r = -.20). Similarly, all school readiness variables except the Head Start Competence Scale and Behavior Problems were correlated with the 5th grade PPVT. All of the SEBA school readiness variables were significantly correlated with the WJ-Letter Word in Kindergarten, except the Head Start Competence Scale. The strongest correlations were found with the ERQ Expressive (r = .31) and the SAT (r = .30). All SEBA variables except the KEI were related to the 5th grade WJ-Letter Word. All SEBA variables were correlated with the Kindergarten WJ-Applied Problems; the strongest correlations were with the Sustained Attention Task (r = .36), the KEI (r = .28), and the ACES (r = .28). Most, but not all school readiness variables remained significantly related to the 5th grade WJ-Applied Problems.

Demographics and Preschool Academic and Non-Academic School Readiness Variables Predicting 5th Grade Achievement

To achieve the first aim, multiple hierarchical stepwise regressions were run for each of the three 5th grade outcomes (PPVT, WJ-Letter Word, and WJ-Applied Problems) to determine whether the demographic characteristics, the preschool academic or SEBA measures significantly predicted academic abilities in 5th grade. Four sets of models were run for each of the three outcomes to determine the added variance accounted for by different groups of variables (see Table 1 for the groups of variables included in each model). Model 1 included the covariates (cohort and years in program) and the demographic characteristics (gender, race, parent education, family type, and income). Model 2 included the covariates, the demographic characteristics, and the preschool academic variables (PPVT, WJ-Letter Word, WJ-Applied Problems). Preschool academic variables that were not significant were removed from the model and from all subsequent models, leaving only significant academic variables. In Model 3, the covariates, demographic characteristics, and the SEBA variables were included (the KEI, ACES, ERQE, ERQR, CCB, HSCS, and BP). Due to the large number of school readiness variables, non-significant variables will be removed from the model one at a time, starting with the least significant predictor. Model 4 included all variables and was run multiple times, removing non-significant SEBA variables, until only the significant ones remained in the model. Comparing R^2 change scores allows us to determine how much variance was explained by different groups of variables. The R^2 change from Model 1 to Model 2, provides the additional contribution of the preschool academic variables, and the R^2 change from Model 1 to 3 calculates the percent of variance explained by the SEBA school readiness variables.

Table 10 provides the results from the final four regression models predicting the PPVT in 5th grade including the R^2 for each model. In Model 1, children with more educated parents (p = .020) and those from two parent families (p = .006) had higher PPVT scores in 5th grade. In Model 2, preschool vocabulary (p < .001) and pre-reading skills (p = .005) significantly predicted 5th grade vocabulary. After accounting for pre-academic functioning, parent education and family type did not remain significant. Gender, which had not been a significant predictor in Model 1 emerged as a significant predictor in Model 2 (p = .010), with boys outperforming girls. The R^2 for Model 2 was .436, an increase of .304 from Model 1. In Model 3, none of the demographic variables were significant, but four SEBA variables were, including: the KEI (p = .009), the ACES (p = .008), the ERQE (p = .035), and the SAT (p = .017). In all cases children with higher scores in preschool had higher 5th grade vocabulary scores. Model 3 had an R^2 of .391, an increase of .259 from Model 1. Model 4 tested for the significance of the SEBA school readiness variables after accounting for the covariates, demographics, and preschool academic abilities. Only one school readiness variable was significant: children's emotion recognition skills as assessed by the ACES (p = .001), which was positively related to 5th grade vocabulary. Preschool vocabulary (p < .001), pre-reading (p = .007), and gender (p = .009) were also significant; boys scored higher than girls in 5th grade vocabulary. The addition of the ACES into the model increased the R^2 from Model 2 by .045, resulting in an R^2 of .481 in the final model.

Table 11 presents the four hierarchical regression models when using the WJ-Letter Word as the outcome. In Model 1, the only significant demographic characteristic was parent education (p = .007); those with more educated parents had higher reading achievement in 5th grade. After accounting for pre-academic skills, none of the demographic characteristics were significantly related to 5th grade reading, but preschool pre-reading and pre-math predicted 5th grade reading. The addition of the preschool academic variables increased the R^2 by .146. When the SEBA variables were added to the covariates and demographic characteristics in Model 3, ERQ Receptive (p = .007) significantly predicted the 5th grade WJ-Letter Word. The R^2 change from Model 1 to 3 was .062. In Model 4, children's preschool receptive emotion knowledge skills measured by the ERQ Receptive (p = .028) emerged as a significant predictor over and above demographic characteristics and preschool pre-reading and pre-math, with an increase in the R^2 from Model 2 to 4 was .025, resulting in an R^2 of .256.

The results for the hierarchical regression models for the WJ-Applied Problems are presented in Table 12. Parent education (p = .017) was the only significant demographic characteristic in Model 1, with a higher level of parent education associated with higher 5th grade math scores. In Model 2, preschool pre-reading (*p* = .008) and pre-math (*p* = .009) were significant, gender emerged as a significant predictor (*p* = .022), but parent education did not remain significant. Higher, 5th grade mathematics scores were found for boys, and children with higher preschool pre-reading and pre-math scores. From Model 1 to 2, the R^2 increased by .119. In Model 3, there was only one significant SEBA variable: the SAT (*p* = .002). Children who were better able to sustain their attention in preschool had higher 5th grade math scores. Sustained attention did not remain significant in Model 4 after accounting for preschool academic abilities; therefore, Model 4 was identical to Model 2 was an R^2 of .199.

Growth Curve Models

The second aim examined the pattern of growth in academic abilities from Kindergarten to 5th grade and used demographic and school readiness variables as predictors of the growth in academic abilities. Multilevel modeling (MLM) was used to model change in academic abilities over time (Singer, 1998). The MLM model included within-person (Level 1) and between-person change (Level 2). Data was analyzed using SAS PROC MIXED with full maximum likelihood estimation. With the current study, the data collection schedules varied (e.g. no data was collected in 4th grade); MLM is able to handle unbalanced data, such as unstable data collection schedules and differing number of data collection occasions. By using full information maximum likelihood, MLM is able to estimate models for all participants, regardless of the number of data points available for each participant, using the assumption that data is missing at random (Raudenbush & Bryk, 2002; Schafer, 1997). As there are multiple outcomes, a series of models was run for each outcome to determine the error structure and the fixed and random effects. All models included within-person and between-person variance at Levels 1 and 2 respectively. Models were selected based on the AIC, BIC and significant parameters.

A series of four hierarchical models were run to assess how well different groups of variables predict the intercept and the slope of each of the outcomes, the groups of variables included in each model is presented in Table 1. All continuous variables were standardized with a mean of 0 and a standard deviation of 1. For all variables included in the model, main effects and interactions with time were tested. Main effects assess the ability of a variable to predict the *intercept* (Kindergarten score); interactions with time assess whether the predictor variable is significantly related to the *slope or growth* in the outcome. In order to predict the slope, an interaction between the predictor and time must be included in the model. For each predictor, the interaction with time was tested, and non-significant interactions were removed. Demographic characteristics and covariates were included in all models even if they were not significant.

PPVT. The pattern of growth for the PPVT from Kindergarten to 5th grade included a fixed linear effect, and random linear effect. The outcome models are presented in Table 13. In Model 1, parent education ($p < .001$) significantly predicted the PPVT at Kindergarten; children with more educated parents had higher PPVT scores. None of the demographic characteristics significantly interacted with time, indicating that none predicted *growth* in the PPVT. Model 2 included the addition of the preschool academic variables; the preschool PPVT ($p < .001$) and the preschool WJ-Letter Word ($p = .001$) significantly predicted the *intercept* of the PPVT, but did not predict *growth* in the PPVT. In Model 3, several SEBA variables significantly predicted the intercept of the PPVT, specifically the KEI ($p < .001$), the ERQ Expressive ($p = .008$), and the SAT ($p < .001$). Children with higher scores on the emotion knowledge and sustained attention measures had higher PPVT scores in Kindergarten. Additionally, the interaction between the ACES and time was significant indicating an association between the ACES and *growth* in the

PPVT. Finally, Model 4 included the preschool academic and the SEBA variables. In this model, the KEI (p = .018) remained significantly related to the intercept of the PPVT, but the ERQE and the SAT did not remain significant. The ACES was significantly related to the *growth* in the PPVT, as evidenced by the significant interaction between the ACES and time (p = .026). Figure 1 illustrates the interaction of the ACES by time. Children who had a higher ACES score in preschool had PPVT scores that dropped slightly from Kindergarten to 2nd grade, but that rose from 2nd to 5th grade. In contrast children with a lower score on the ACES maintained a relatively stable PPVT score from Kindergarten to 5th grade, with a mean around 89, except for a small dip in 2nd and 5th grade.

WJ-Letter Word. The WJ-Letter Word included fixed linear, quadratic, and cubic effects, and a random linear effect. Table 14 presents the growth models for the WJ-Letter Word. In Model 1, gender (p <.001) and parent education (p = .004) were significant, with girls outperforming boys and children with more educated parents scoring higher on the WJ-Letter Word in Kindergarten. In Model 2, two academic variables were significant predictors: preschool WJ-Letter Word (p < .001), which also had a significant interaction with quadratic time (p = .044), and preschool WJ-Applied Problems (p < .001). Children with higher preschool pre-math abilities had higher Kindergarten reading scores. The interaction between preschool WJ-Letter Word and Time^2 is illustrated in Figure 2. The difference between children with higher and lower WJ-Letter Word in preschool diminished over time. With the addition of the preschool academic variables, the significance of all demographic characteristics disappeared. In Model 3, two SEBA variables were significantly related to the WJ-Letter Word, the ERQE (p = .009) and the SAT (p < .001); in both cases higher scores in preschool were related to higher reading scores in Kindergarten. In Model 4, which combined the preschool academic and SEBA variables, none of the preschool school readiness variables remained significant; therefore, the final version of Model 4 was identical to Model 2.

WJ-Applied Problems. The pattern of growth for the WJ-Applied Problems included linear and quadratic fixed effects, and random linear effect. The growth models for the WJ-Applied Problems are presented in Table 15. In Model 1, parent education predicted Kindergarten WJ-Applied Problems ($p < .001$). Children with more educated parents had higher scores. Since the interaction between gender and time was significant, gender was significantly related to *growth* in the WJ-Applied Problems ($p = .001$). In Model 2, the WJ-Letter Word ($p < .001$) and the PPVT ($p = .004$) significantly predicted Kindergarten WJ-Applied Problems, with higher scores in preschool related to higher Kindergarten math scores. The WJ-Applied Problems predicted *growth* in the WJ-Applied Problems from Kindergarten to 5th grade, as evidenced by the significant interaction with Time and Time^2. When SEBA variables were included (Model 3), the ACES ($p = .002$) and the SAT ($p < .001$) were positively significantly related to Kindergarten math scores. In Model 4, the SAT ($p = .001$) remained significantly related to children's Kindergarten math skills: children with higher sustained attention performed higher in math at Kindergarten. The ACES did not remain significant. Figure 3 presents the significant interaction between the preschool WJ-Applied Problems by Time ($p = .003$) and by Time^2 ($p < .001$). Children's math scores became increasingly similar from Kindergarten to 5th grade regardless of how they scored on the preschool WJ-Applied Problems. This appears to be a combination of fade-out by those with higher preschool math abilities and catch-up by those with lower preschool scores. Additionally, gender significantly predicted *growth* in math ($p = .022$), as illustrated in Figure 4. Over time the gap between girls and boys in math skills increased, with boys outperforming girls.

Alternative Growth Models. In the models presented above, a prior time point for the outcome of interest was used as a predictor in the models (for example, the PPVT assessed in preschool was used as predictor of the growth in the PPVT from Kindergarten to 5^{th} grade). To make sure that this variable was not accounting for all of the variance in the model, all models were also run without using the same covariate to predict the outcome. When the preschool assessment of the outcome was not included, the significance of the other predictors rarely changed. As there was also a concern that the standardization of the measures would lead to difficulty in modeling growth, the models were also run using raw scores. Although the error structures of the models were more complex and age was included as a covariate, the significant predictors were almost identical. Given the similarity of the results, for the purpose of this study, the most conservative models are interpreted: those models include the outcome variable in preschool as a predictor and use the standardized scores.

Latent Class Growth Curve Modeling

In addition to utilizing growth curves, latent class growth analyses (LCGA) were conducted to assess whether subgroups within the sample had different patterns of growth, and whether demographic and school readiness variables predicted these patterns of growth. Using LGCA allows for the latent class modeling of longitudinal data (Nagin, 1999, 2005). Variable-centered growth models assume that the pattern of growth is consistent across the entire population; in contrast, LGCA uses a person-centered approach which allows for different growth parameters for unobserved subpopulations. Therefore, when using LGCA unobserved subpopulations are identified and the patterns of growth for each of these subpopulations are assessed. After the unique growth parameters of the subpopulations are determined, LCGA has the ability to link observed covariates to the latent class trajectories. Trajectory models will be estimated using SAS Proc Traj (Jones, Nagin, & Roder, 2001). This procedure handles missing data using full information maximum likelihood (FIML). FIML uses all available observed data to estimate the model parameters and standard errors of the missing data.

LCGA models were run in SAS using Proc Traj (Jones, Nagin, Roeder, 2001). The first step involved determining the number of trajectories for each of the outcomes. To determine the number of trajectories, the models were run two ways: assuming only linear growth (the most parsimonious models) and assuming quartic growth (the least parsimonious models). In both cases a one-trajectory model was fit and each subsequent model added a trajectory until the best fitting model was identified. Models were compared using multiple indices of relative fit including: the Bayesian Information Criterion (BIC) and the Akaike Information Criterion (AIC); smaller values indicate a better model fit. Additionally, models were examined for interpretability and size of the latent classes in order to determine the best model fit. For all three outcomes the number of classes identified was similar for the least and most parsimonious models. Once the number of trajectories was determined, the shape of each trajectory was assessed by determining the highest order that was significant. As there were five time points, linear, quadratic, cubic, and quartic trends were evaluated. Significant linear growth indicates an increase or decrease in scores over time. Quardatic growth reflects “U” shaped growth: an increase followed by a decrease, or a decrease followed by an increase. Cubic and quartic growth indicate fluctuations in growth at one time point. To assess whether covariates and demographic characteristics predict trajectories of growth in academic abilities, both groups of predictors were entered as time-invariant covariates to predict class membership to each of the latent trajectories of academic abilities. Finally, preschool academic abilities and SEBA school readiness variables were entered as predictors of trajectories of academic abilities to determine if particular components of school readiness predict differences in the trajectories of academic abilities.

PPVT. Table 16 presents the BIC and AIC for the LCGA models for the PPVT. The top panel presents the BIC and AIC assuming linear growth, and the bottom panel assumes quartic growth. Although the model with five classes was the best fitting model (based on the BIC), the rate of decrease from the four-class model to the five-class model was small compared to the previous drops in the AIC and BIC. When the four-class model was run, one class only included 6.9% of the sample, and when covariates were included, the model would not iterate. Therefore, a three-class solution was selected. The three-class model was run first assuming quartic growth for all classes; for classes that did not have a significant quartic effect, the quartic effect was dropped, and the models were re-run assuming cubic growth. If the cubic growth effect was not significant, it was dropped from the model. This process was repeated until the highest order growth effect was significant for all classes.

The final model included three classes (Figure 5). The first class was labeled the Low Vocabulary class, which was characterized by a significant quartic effect and comprised 31.4% of the sample; this class entered Kindergarten with a mean of approximately 80 which remained relatively stable through 5th grade, despite a dip in 2nd grade. The second class was the largest class with 50.3% of the sample, and was named the Moderate Vocabulary class, which included linear growth; this class' mean remained above a score of 90 from Kindergarten through 5th grade. The third class was considered the High Vocabulary class, and only had a significant linear effect and included 18.4% of the sample; the mean level for the class increased slightly, from below 105 in Kindergarten to almost 110 by 5th grade.

Table 17 presents the association between the covariates, predictor variables and trajectory membership. The Low Vocabulary class (Class 1) is used as the reference class. Compared to the Low Vocabulary class, children in the Moderate Vocabulary class were more likely to be boys (p = .002), had higher pre-reading (p = .011), and vocabulary (p < .001) scores in preschool, and scored higher on the KEI (p = .034), a measure of emotion recognition. Children in the High Vocabulary class were also more likely to be boys (p = .012), had higher pre-reading (p = .025), and vocabulary (p < .001) scores in preschool, and scored higher on a measure of sustained attention (SAT; p = .021).

WJ-Letter Word. Multiple models were run to determine the best fitting model for the WJ-Letter Word. Table 18 presents the BIC and AIC for the models; the top panel assumes linear growth, and the bottom panel assumes quartic growth for each class. The five-class model had the smallest BIC and AIC for the models assuming quartic growth, and the six-class solution had the smallest BIC and AIC when assuming linear growth, although the rate of decrease was very small. The five-class model included a class with 6.5% of the sample; therefore a four-class model was selected.

A graphical representation of the four-class model is presented in Figure 6. The first class had a significant cubic effect and made up 11.2% of the sample and is considered the Very Low Reading class. This class maintained a reading level between 70 and 80 from Kindergarten through 5th grade, peaking in 1st grade at around 80. The second class was named the Low Reading class, included significant quartic growth, and had a mean level of around 90 from Kindergarten to 5th grade, again peaking in 1st grade; this class included 32.2% of the sample. The third class, with 33.5% of the sample was characterized by Moderate Reading abilities hovering around 100 from Kindergarten to 5th grade, and had a significant cubic effect. The fourth class, consisting of 23.2% of the sample and described as High Reading began with a reading level of approximately 105 in Kindergarten, which increased until 2^{nd} grade to above 120, and then dropped to the low 110s by 5^{th} grade.

The association between trajectory class membership and the predictors for the WJ-Letter Word are presented in Table 19. Class 1, the Very Low Reading class is used as the reference class. No significant differences were found between the classes on any of the demographic characteristics. Compared to the children in the Very Low Reading Class, children in the Low Reading class had higher pre-reading abilities in preschool (p = .033). Compared to children in the Very Low Reading class, children in the Moderate Reading class and the High Reading class had higher pre-reading (p < .001 for both classes) and pre-math skills (Moderate Reading: p = .009; High Reading: p = .001) in preschool. No other school readiness predictors were significant.

WJ-Applied Problems. The same set of models was run to determine the best fitting model for the WJ-Applied Problems. Table 20 provides the BIC and AIC for each of the models. The four-class solution had the smallest BIC; the smallest AIC for both sets of models was the five-class solution. The four-class solution included a class with only 2.3% of the sample; therefore a three-class solution was chosen. The highest order effect was then identified for each class; all classes had significant quadratic effects.

The final model is presented in Figure 7. The Low Math class was the largest with 51.3% of the sample. This class began with a mean of 80 in Kindergarten, which rose to almost 90 by 5^{th} grade. The second class, characterized as the Moderate Math class included 36.8% of the sample, with the mean level rising from slightly above 90 to above 100 from Kindergarten to

5th grade, peaking at 110 in 3rd grade. The third class, the High Math class included 11.9% of the sample; the mean at Kindergarten was approximately 105, and rose to 125 in 2nd grade, before decreasing to 115 in 5th grade.

Table 21 presents the association between trajectory class membership and the predictors for the WJ-Applied Problems. Class 1, the Low Math class is the reference class. Compared to the Low Math class, the Moderate Math class had higher pre-math skills in preschool ($p < .001$) and higher emotion expression knowledge as assessed by the ACES ($p = .030$). The High Math class had children who had higher pre-math ($p < .001$) and sustained attention ($p = .006$) in preschool than the Low Math class.

Chapter 4:

Discussion

Considerable attention has focused on whether school readiness variables such as academic readiness, emotion knowledge, social competence, behavior problems, and attention predict academic abilities in elementary school (Bodovski & Youn, 2011; Duncan et al., 2007; Ladd et al., 1999; Malecki & Elliott, 2002). Yet, at present, the relation between school readiness variables, particularly social and emotional competencies and elementary academic abilities remains unclear. Additionally, few studies have: (1) used *direct* child assessments of emotion knowledge, (2) assessed how school readiness predicts *growth* in academic abilities across the elementary years, and (3) used *subgroup* analyses. The purpose of the current study is to extend previous studies by employing regression models, growth curves, and latent class growth analyses (LCGA) to examine how assessments of school readiness predict children's academic abilities from Kindergarten to 5th grade.

Academic Abilities Over Time

By using a longitudinal design the current study assessed the patterns of growth in children's vocabulary, reading, and math skills from school entry to 5th grade for a sample of predominantly Black children from low-income families who attended an enhanced district-run preschool program. It is interesting to note the degree to which the sample "catches up" to the norm, particularly in reading and math from Kindergarten to 5th grade. Children entered Kindergarten with mean levels half to one standard deviation below the norm in both measures of reading (X = 94) and math (X = 95). During early elementary school, the sample achieved mean levels of 104 in reading and 102 in math, indicating that these children were "catching up" to their less disadvantaged peers. Some researchers have found that the achievement gap between children from higher and lower income families tends to widen over time (McClelland et al., 2006; Curby et al., 2009), which is inconsistent with the findings from the current study. However, the sample from the current study is quite homogeneous and more similar demographically and in terms of preschool experiences to the sample from the Head Start FACES study, which is a longitudinal, nationally representative random sample of children in Head Start programs. Across several cohorts, FACES studies have found that children who attended Head Start made gains relative to national norms from preschool to Kindergarten; therefore resulting in a narrowing of the achievement gap, similar to the findings from the current study (West, Denton, & GErmino-Hausken, 2000; West, Malone, Hulsey, Aikens, & Tarullo,. 2010; Zill, Resnick, Kim, McKey, Clark, … & D'Elio, 2001; Zill, Resnick, Kim, O'Donnell, & Sorongon, 2003). Although these findings are promising, it should be noted that there is some debate regarding the norming of the Woodcock-Johnson, and whether normed scores may be inflated (McCabe, Margolis, & Barenbaum, 2001).

Although, children's reading and math skills improved relative to national norms during the early elementary years, there was a slight decline as children got older. Children's reading abilities peaked in 1st grade at 104, and declined gradually relative to norms to 98 by 5th grade; children's math abilities increased until 3rd grade, when they reached almost 102, but then dropped in 5th grade relative to norms to 98. Unfortunately data was not collected on children in 4th grade, so comparisons can only be made from 3rd to 5th grade. Compared to reading abilities, children's math skills increased more gradually and only showed a decline compared to norms in 5th grade. Mean scores increased from 85 in Kindergarten to 96 in 1st grade, 100 in 2nd, 102 in 3rd, and then declined slightly to 98 in 5th grade. Research on the "fourth grade slump" finds that children from low-SES families experience a decline in their reading abilities compared to norms beginning in 4th grade, and the gap between children from different SES levels is likely to increase over time (Chall, Jacobs, & Baldwin, 1990). Reading appears to be the first affected domain, although other academic domains also decline relative to norms in the later elementary years (Hirsch, 2003). In the current study, reading abilities were the first to decline relative to norms, but that decrease began much earlier than 4th grade, and the decline was very gradual, rather than a more pronounced dip as described by the "fourth grade slump".

Predictors of Academic Abilities

Three 5th grade outcome measures were included in the current study: the PPVT, the WJ-Letter Word, and the WJ-Applied Problems. The PPVT is a measure of children's vocabulary. The final regression model predicted the residualized change between preschool and 5th grade vocabulary. Boys and those with higher scores in preschool pre-reading (WJ-Letter Word) and emotional understanding (ACES) had higher 5th grade vocabulary scores. Based on raw means, in Kindergarten girls had higher scores than boys, but the boys caught up to the girls during elementary school, and at 5th grade boys outscored girls, although the difference in raw means was not significant. Although only one SEBA variable was significant in the regression model, which included preschool academic abilities, four SEBA variables were significant predictors when preschool academics were not included: three measures of emotion understanding (the KEI, the ERQE, and the ACES), and sustained attention (the SAT). In the growth curve models that included preschool academic abilities, boys and children with higher preschool vocabulary, pre-reading (WJ-Letter Word), and emotion knowledge (KEI) had higher vocabulary scores in Kindergarten, but they did not predict the slope of the PPVT. Additionally, children with more emotion knowledge (as evidenced by higher scores on the ACES in preschool) experienced faster *growth* in vocabulary from Kindergarten through 5th grade. Two additional SEBA variables were significant in predicting Kindergarten abilities in the models without academic abilities: the ERQE and the SAT. Therefore very similar patterns emerged for the regression models predicting 5th grade vocabulary and the growth curve models predicting the Kindergarten intercept, and the same four SEBA variables were significant in predicting Kindergarten and 5th grade vocabulary when preschool academic variables were not in the model.

The WJ-Letter Word assesses children's reading ability. In the regression models predicting the residualized change in reading between preschool and 5th grade, higher scores on preschool measures of pre-math, and receptive emotion knowledge (ERQ Receptive) were associated with higher reading scores in 5th grade. No additional SEBA variables were significant when preschool academics were not included in the models. In the growth models, none of the SEBA variables were significant in predicting Kindergarten reading when the preschool academic variables were included in the model. Pre-reading and pre-math were significant predictors; preschool children who scored higher in pre-reading and pre-math had higher Kindergarten reading scores. In addition, preschool pre-reading scores were significantly associated with *growth* in reading; children with lower preschool pre-reading scores caught up to those with higher scores by 5th grade. This finding is in contrast to previous work by Curby and colleagues (2009) who found that early reading skills predicted divergent reading trajectories. Although none of the SEBA variables were significant in the final model, the ERQE and the SAT were significant in the model without preschool academics. Considering the moderate collinearity between preschool pre-math and ERQE (r = .34) and SAT (r = .41), and between preschool pre-reading and ERQE (r = .36) and the SAT (r = .29), it is not surprising that these variables were not able to account for additional variance in the outcome.

For the WJ-Applied Problems, regression models indicated that boys and those with higher pre-reading had higher 5th grade math scores. Sustained attention significantly predicted Kindergarten math until preschool academics were included in the model. In the growth models, all three academic measures were significant predictors: children with higher vocabulary, pre-reading, and pre-math scores had higher math scores in Kindergarten. Children's sustained attention (SAT) was also significantly positively related to Kindergarten WJ-Applied Problems, which is consistent with other research (Blair & Razza, 2007). There was a significant interaction between the preschool WJ-Applied Problems and Time showing a convergence in math score for children with lower and higher scores in preschool. This finding contradicts the fanning effect in math identified by Jordan and colleagues (2007), but supports the research by Curby and colleagues (2009) who found that math abilities converged over time. Additionally, gender was related to *growth* in math, with boys improving their math skills at a faster rate than girls. Emotion knowledge (the ACES) was also a significant predictor in the model without preschool academic abilities.

In the regression models, the amount of variance explained by the demographic characteristics and the preschool academic variables was 44% for vocabulary, 23% for reading, and 20% for math. Despite the fact that the PPVT outcomes had the most variance explained of the three models, the addition of the SEBA variables significantly increased the amount of explained variance in 5th grade PPVT scores; emotion understanding (the ACES) accounted for an additional 5% of the outcome, resulting in almost 50% of the variance explained. As a result, it not surprising that the KEI, ERQE, and SAT were not significant, as there was limited variance left to explain. Furthermore, there is a high degree of collinearity between several of the SEBA and preschool academic variables in the model. For example, pre-math and the SAT (r = .41), vocabulary and the ERQE (*r* =.50), the ACES and the ERQE (*r* =.44), and the ACES and the KEI (*r* = .44) all had relatively high correlations. For 5th grade math skills, demographic characteristics and preschool academic abilities only accounted for 20% of the variance, but none of the SEBA variables remained significant when the preschool academic variables (pre-math and pre-reading) were included in the model. Specifically, the SAT had been significant in the previous model. The SAT and preschool pre-math had a correlation of *r* = .44, and the correlation between the SAT and preschool pre-reading was *r* = .36. Considering the relatively high inter-correlations at preschool it is not surprising that the SAT did not remain significant when preschool pre-math and pre-reading were included in the model.

In both regression models and growth models, there was crossover from pre-math to later reading abilities and from pre-reading to later math skills. Extensive research has documented a relation between early reading and later math abilities (Duncan et al., 2007; Curby et al., 2009; LaParo & Pianta, 2000). Given that solving math problems often requires children to read and understand instructions, the association between early reading and later math is not surprising (Martiniello, 2008; Martiniello, 2009). The opposite finding, that early math is related to later reading is also consistent with previous research which has found that despite the lack of emphasis on the importance of early math skills, they are a strong predictor of later math and reading (Duncan, et al., 2007; Pagani, Fitzpatrick, Archambault, & Janosz, 2010). It is possible that assessments of math abilities may not only evaluate children's abilities specifically in math, but may tap into higher order processes, such as executive functioning and intelligence, which have been related to reading abilities (Blair, 2002). Alternatively, children's abilities to solve problems may help them in understanding patterns in learning to read.

Predicting Growth in Outcomes

It is notable that although there appeared to be some improvement relative to national norms in reading and math, few variables significantly predicted *growth* in these abilities once the preschool ability in that specific skill was accounted for. One explanation for this finding is that although there was growth in abilities, there was little change in rank order. The correlations between adjacent years for each of the outcomes ranged from .51 to .95, with most correlation between .64 and .80. Without larger changes in rank order, there is little variance to be explained, which may result in few variables significantly predicting *growth or change* in the outcomes. By including preschool abilities as a predictor in the regression and growth models a large amount of the variance was already explained by prior preschool abilities, leaving little room for other factors to explain growth or changes over time. As noted earlier, in the regression models predicting 5th grade academic abilities, demographic characteristics and preschool academic abilities accounted for substantial variance in the outcomes. Additionally, the LCGA models did not identify subgroups with unique patterns of growth, again indicating a high degree of stability. These findings are consistent with work by Alexander and Entwisle (1998) who reported that academic abilities begin to stabilize in early elementary, resulting in few changes in rank order.

Given the high level of stability in the outcomes, it is not surprising that few variables predicted *growth* in vocabulary, reading, and math skills in elementary school. In fact, in the growth models, for each of the outcomes there were one or two significant interactions by time, which indicates that the predictor was significantly associated with *growth* in the outcome between Kindergarten and 5th grade. In contrast, some studies have found multiple predictors of growth in academic abilities. For example, using the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K), Li-Grining and colleagues (2010) found that several socioeconomic and school readiness variables were related to growth in academic abilities; however, the ECLS-K sample is substantially larger and more diverse than the sample in the current study. Yet using the same dataset, Morgan and colleagues (2011) found that many of their predictors were significantly related to the intercept of the growth curves of reading and math from 1st to 5th grade, but few predicted the slope. Another study which used data from the National Institute of Child Health and Human Development (NICHD) Study of Early Childcare and Youth Development found that although several variables predicted the intercept of the academic growth curves from 1st to 5th grade, a limited number of variables were related to the slope (El Nokali et al., 2010).

It could be argued that given the number of interactions tested, some interactions by time would be significant by chance; however since the interactions that were significant were theoretically meaningful, they will be interpreted. For reading abilities, children who began with higher reading skills showed some "fade out", as indicated by not maintaining their advantage through 5th grade. The preschool children with lower scores experienced a faster rate of growth than their higher achieving peers, and from 1st grade on appeared to maintain a relatively stable reading level compared to national norms. In regard to math abilities, the convergence in 5th grade of those with higher and lower preschool pre-math skills appears to be a combination of both "fade out" and "catch up". Children with higher scores in preschool experienced some decline on the standardized assessments over time, providing evidence of a "fade out" effect. Additionally, those preschoolers with lower scores increased at a faster rate than those with initially higher scores, particularly from 2nd to 5th grade, which is indicative of "catch up". In both cases (for the WJ-Letter Word and the WJ-Applied Problems), the interaction by Time or Time^2 followed a similar pattern to that identified by Shah et al. (2011) who used the same dataset to examine the effects of preschool on 3rd grade academic outcomes. Using the NICHD dataset, El Nokali and colleagues (2010) also found a similar pattern with a narrowing of the gap in reading, math, and vocabulary between those with lower and higher early achievement scores.

In the current study, a different pattern emerged for the PPVT, with children who had higher emotion knowledge scores in preschool showed greater improvement in their vocabulary skills than those with lower scores. Although they used a different analytic method, this finding is similar to that of Konold and Pianta (2005). Additionally, there was an interaction between gender and time for math; over time boys improved their math skills faster than did girls.

The Role of SES, Parent Characteristics, and Home Environment on Academic Abilities

Some of the strongest and most consistent predictors of children's academic abilities are measures of SES, specifically parent education and income (Crosnoe et al., 2010; Fantuzzo et al., 2005; Forget-Dubois et al., 2009; Linver et al., 2002; McLoyd et al., 2006); children from low-income families, with less educated parents do not perform as well as their more affluent peers. Most studies examining the role of SES that have found differences were based on large diverse samples. Yet even within low-SES samples, parental education predicts academic achievement (Attar, Guerra, & Tolan, 1994; Elias & Haynes, 2008). The current sample was relatively homogeneous (predominantly Black, low-income, single-parent families) and less research has examined how measures of SES are related to academic abilities *within* a disadvantaged sample.

In the current study, for *all* outcomes at both Kindergarten and 5th grade, parent education was a significant predictor of ability; it was the only demographic characteristic related to all outcomes at both time points. This finding is consistent with previous research that has found that parent education is a stronger predictor of academic abilities than income and other demographic characteristics (Crosnoe et al., 2011; Fantuzzo et al., 2005). Thus, even in a low SES population, variation in parent education predicts vocabulary, reading, and math skills at Kindergarten and 5th grade. It is hypothesized that possible mechanisms linking parent education to academic outcomes involve characteristics of the home environment, including access to literacy and math materials (Jordan et al., 2006), reading to children (Senechal & LeFevre, 2002), the quality of the parent-child interactions (Connell & Prinz, 2002), and parental involvement (Janus & Duku, 2007). These findings are supported by the FACES study, which followed a nationally representative random sample of children who attended Head Start (West et al., 2010). Within this low-income sample, the number of family risk factors was related to *change* in language and math from preschool to Kindergarten, with fewer risk factors associated with greater improvements towards national norms from preschool to Kindergarten. In the current study, although parental education was significantly related to Kindergarten and 5th grade vocabulary, reading, and math, it was not significant in any of the models once the preschool academic variables were included. This is likely due to the high degree of collinearity between parent education and preschool academic abilities. Parent education likely influenced children's academic abilities at preschool entry, which was in turn related to academic abilities throughout elementary school, but parent education did not have an additional affect on abilities.

The current study included assessments from preschool until 5th grade, and did *not* find that any measures of SES were related to *growth* in academic abilities from Kindergarten and 5th grade. In contrast to the FACES study, found that family risk was related to *change* in academic abilities, but only followed children until Kindergarten. This finding indicates that for the current sample the academic disadvantage associated with growing up in a low-SES household is not amplified during elementary school. Given the research on the 4th grade slump, which finds a decline in abilities among children from low-SES families, it is promising the effect of SES only influenced abilities in Kindergarten, not the trajectories of achievement during elementary school. However, more research is needed to better understand how SES is related to academic abilities within low-SES samples, and to assess whether SES may have an additional effect on development in later elementary.

In addition to the research documenting the low achievement of minority children, there is some evidence that Black boys, in particular, fail to achieve their full potential; in particular, Black boys who live in urban settings tend to fall behind their peers in academic achievement early on and continue to fall further and further behind over time, ultimately resulting in higher rates of delinquency, school failure, and incarceration compared to girls and children from other races (Barbarin, 2010; Ogbu, 1997; Osborne, 1999). As this sample is predominantly Black, we could not compare ethnicity differences, but we were able to examine whether boys experienced more academic difficulties compared to girls. Based on raw means, although not significant, girls had slightly higher vocabulary scores in preschool and Kindergarten; during elementary school boys caught up to girls, and scored higher (although not significantly) in 3^{rd} and 5^{th} grade. In the regression models, gender was a significant predictor of 5^{th} grade vocabulary, favoring boys. In the growth curve models, boys outperformed girls in Kindergarten vocabulary after accounting for academic and school readiness variables, but gender did not predict *growth*. Gender was not a significant predictor of Kindergarten of 5^{th} grade reading based on the growth curves and regression models, but based on raw means, girls scored higher than boys from preschool to 5^{th} grade, and significant differences were found in preschool, Kindergarten, 1^{st} grade, and 3^{rd} grade. For math, analyses comparing raw means found that girls outperformed boys through 1^{st} grade and in 3^{rd} grade (although the differences were not significant after preschool); boys scored higher in 2nd and 5th grade (although not significantly). In the regression models, gender significantly predicted 5th grade math skills; boys outperformed girls. After accounting for prior abilities, gender significantly predicted *growth* in elementary math with boys growing at a faster rate than girls. Therefore, boys did not fall further behind girls; in fact they seemed responsive to elementary education and performed at the same level or higher than girls. Consistent with the findings from the current study, using ECLS-K data, Morgan and colleagues (2011) found that gender significantly predicted growth in math skills from 1st to 5th grade, with boys scoring *higher* than girls. As with the current study, gender was not related to reading. However, other research using the ECLS-K sample found that when children were grouped by gender *and* race, African American boys lagged behind their peers, although the gap between boys and girls did not increase over time (Matthews et al., 2010).

Importance of Social, Emotional, Behavioral and Attention School Readiness Variables

There has been substantial debate among researchers regarding the importance of children's social-emotional skills in predicting academic abilities, yet there are relatively few studies that have examined this question. One of the most cited studies (Duncan et al, 2007) uses six datasets to examine how preschool measures of school readiness predict change in academic achievement in elementary school. The authors concluded that of the non-academic school readiness variables, only attention predicted improvement in academic abilities in elementary school (2nd to 5th grade depending on the study); social-emotional variables were not significant predictors. Yet other studies have found significant prediction from social-emotional variables (Campbell & von Stauffenberg, 2008; Garner & Waajid, 2008). In a special issue of *Developmental Psychology* which focused on follow-up analyses to the Duncan paper, the majority of articles reported consistent, small significant effects of social-emotional variables

(Foster, 2010; Grimm et al., 2010; Romano et al., 2010). Some of the criticisms of the Duncan article were: the study only included two time points rather than accounting for growth in academic abilities, it did not assess subgroups of children, there was a lack of variance in the SEL measures, the predictive ability of prosocial skills and behavior problems was not examined, and by including so many covariates, a large amount of the variance in the outcomes may have been explained by the covariates, and issues of collinearity may have resulted in non-significant findings.

The current study addresses many of these criticisms by using growth curves modeling, and by using a diversity of academic, cognitive, and social, emotional, and behavioral school readiness measures including teacher-assessments and direct child assessments, which were not used in the Duncan study. The current study both replicated similar models to the Duncan study and ran more complex models. After accounting for preschool academic abilities, emotion knowledge predicted children's vocabulary (PPVT) in Kindergarten and 5th grade, sustained attention was related to Kindergarten math (WJ-Applied Problems) abilities, and emotion knowledge predicted 5th grade reading (WJ-Letter Word). Without accounting for preschool academic abilities, additional emotion knowledge measures and sustained attention predicted Kindergarten and 5th grade vocabulary, sustained attention predicted 5th grade math, and emotion knowledge and sustained attention were related to Kindergarten reading. The consistency of these findings across analytic methods lends strong support to the argument that emotion knowledge and sustained attention contribute to the development of children's vocabulary, reading, and math. Each of the significant SEBA measures was assessed through direct assessments with children, rather than as teacher ratings of children's skills. This is noteworthy as typically children's emotion knowledge and attention are assessed through teacher reports, rather than direct assessments.

There is growing evidence to suggest that there may be pathways to school success, other than having strong cognitive abilities (Konold & Pianta, 2005; McClelland, Morrison, & Holmes, 2000). For example, as would be expected, Konold and Pianta found that children with high cognitive functioning in preschool had high test performance concurrently and in 1st grade, regardless of their social competence. Children with average cognitive abilities, but high social competence performed higher in vocabulary and math in preschool and 1st first grade compared to children with average cognitive abilities and low to average social competence. Findings from the current study, which suggest that emotion knowledge and attention are important predictors of children's vocabulary, reading, and math in Kindergarten and 5th grade above early academic abilities support the notion that there may be pathways to school success other than having strong cognitive abilities.

Other studies have also found that measures of emotion knowledge are significant predictors of academic abilities (Leerkes et al., 2008). Although, the current study cannot determine the *mechanism* that links emotion understanding to academics, there are several possible explanations for the mechanism that predicts this link. Children who are more skilled at recognizing emotions in others, may respond more appropriately in interactions with peers and teachers, and therefore may illicit more communicative interactions, which may increase their vocabulary (Denham, 1986; Miller et al., 2006). Secondly, children who are better able to recognize emotions are also more likely to be better at regulating their own emotions, which leads to richer social interactions with peers and adults; which may again create more frequent and richer communicative interactions that may result in an enhanced vocabulary. Alternatively, the skills needed to identify vocabulary for different emotions may be similar to the process used to identify other words which may implicate a third variable of an unspecified cognitive skill. Less research has explored the relation between emotion knowledge and math. However, there is some evidence suggesting that "prevention strategies that directly target one […] problem area tend to have indirect, positive effects on […] other target areas" (Walker & Shinn, 2002, p.3). For example, children who received a social-emotion learning and conflict resolution curriculum experienced improvements in standardized tests of math achievement from 1st to 6th grade (Brown, Roderick, Lantieri & Aber, 2004). Similar cross-over effects have been replicated in other studies (Durlak et al., 2011). Based on research with children in preschool to 1st grade, the pathway between emotion knowledge and academic abilities may also be mediated by attentional abilities (Rhoades et al., 2011). Based on differential emotions theory, children with higher emotion knowledge may be able to utilize their positive emotions in situations that require attention, focus, and concentration (Izard, 2009). The ability to shift between emotional and cognitive tasks may then mediate by children's attention skills. There is evidence that attention mediates the relation between emotion regulation and academic abilities (Trentacosta & Izard, 2007) and between emotion knowledge and academic abilities (Rhoades et al., 2011).

Sustained attention is characterized by the ability to continuously focus and direct cognitive resources on a particular stimulus (Posner & Peterson, 1990) and is considered a core element of school readiness (Blair, 2002). An example of sustained attention in the classroom would be when children are able to maintain focus on important characteristics in the environment and ignore distractions (Derryberry & Rothbart, 1997). Sustained attention has previously been associated with children's academic abilities in preschool (Friedman-Weieneth et al, 2007), Kindergarten (Welsh, Nix, Blair, Bierman, & Nelson, 2010), elementary school

(Muris, 2006), and growth in emergent literacy and numeracy from preschool to Kindergarten (Welsh et al., 2010). Furthermore, Duncan and colleagues (2007) found that attention was the only non-academic predictor of achievement in elementary school. Given the possible meditational role of attention between emotion knowledge, emotion regulation, and academic abilities, and research on the role of sustained attention, it is not surprising that sustained attention was significantly associated with math in the growth and LCGA models, and with vocabulary and reading, when not accounting for preschool academic abilities.

A possible mechanism linking children's ability to sustain their attention and academic abilities relates to their ability to remain on task in the classroom. In school, children often are required to focus and attend to repetitive and tedious tasks. Children who are better able to stay on task may be more likely to learn more and as a result develop better skills in that area; in contrast children who have difficulty sustaining attention have more difficulty staying on task and as a result are more likely to experience delays in academic domains (Faraone, Biederman, Weber, & Russell, 1998; Marshall, Hynd, Handwrk, & Hall, 1997). Sustained attention and behavior and emotion regulation are also related (Blair, 2002). Children who are better able to sustain their attention have improved behavior regulation (Eisenberg et al., 2005; NICHD ECCRN, 2003) and are less likely to experience attention-behavior disorders, such as attention-deficit/hyperactivity disorder (Rothbart, Posner, & Hershey, 1995).

Teacher-Reports of Social Competence and Behavior Problems. In the current study, teacher ratings of social competence and behavior problems were significantly correlated with better outcome in both Kindergarten and 5th grade. However, after controlling for earlier levels of academic skill, neither teacher measures of social competence or behavior problems were significant in predicting growth in vocabulary, reading, or math, while direct assessments of children's attention and emotion knowledge still showed predictive power to Kindergarten and 5th grade abilities. There are several explanations for this pattern of findings. Teachers may not be highly skilled in differentiating socially competent children and behaviors. Teachers may only be distinguishing children who are outliers (who lack social competence or exhibit many problem behaviors). The skewed distributions for each of the three teacher measures, particularly for Behavior Problems and Cooperative Classroom Behaviors lend support to this hypothesis. It is also possible that properties of the measures themselves could affect teachers' ratings; for example if there was a scale with more response options or if the responses options had more specific criteria, teachers may be better able to differentiate children's social competence and behavior problems. Alternatively, teachers may not be able to distinguish behavioral difficulties from different aspects of social competence. The high level of collinearity between the three measures (correlations ranged from .76 to .78), indicates that teachers may not be tapping into the nuanced differences between the constructs these measures are attempting to assess.

The finding that teacher reports of children's social competence and behavior problems were not significant predictors of Kindergarten or 5th grade vocabulary, reading, or math is important since teacher reports are a commonly used method of assessing children's abilities, particularly in non-academic domains. This is in large part due to cost and ease of data collection. Some studies have drawn strong conclusions based on the non-significance of teacher reports of behavioral readiness variables, implying that social-emotional abilities are not predictive of later achievement (Duncan et al., 2007). Given the current findings, caution should be exercised when drawing those conclusions, as the non-significance may be the result of the method of assessment rather than the constructs themselves. Yet in some previous studies, teacher-reports of children's social competence and behavior problems have been predictive of children's academic abilities (e.g., Dobbs et al., 2006; Grimm et al., 2010; Malecki & Elliott, 2002), indicating that it is possible for teacher measures to predict academic abilities.

Convergence Across Analytic Methods

Multiple analytic methods were used to assess the relation between school readiness and academic abilities including regressions using two time points controlling for preschool abilities in the same domain (preschool predicting 5th grade outcomes), growth curves using standardized scores where the outcome measure assessed in preschool was used as a predictor, and latent class growth analyses. Using multiple methods, there was a high level of convergence across methods. For example, for the PPVT as the outcome, in all analyses (regression models, growth curves, and LCGA), gender, preschool vocabulary (PPVT), and preschool pre-reading (WJ-Letter Word) were significant predictors of children's vocabulary (assessed using the PPVT). In two of the three models, the KEI and the ACES, both measures of emotion understanding was also significant in predicting vocabulary skills. A measure of sustained attention (SAT) was significant in only one of the models. The consistency in the predictive ability of the ACES and the KEI indicates that these results are unlikely to have been spurious. To be concise the pattern of results across methods for the other outcomes are not presented, but similar patterns emerged.

Given the high percentage of explained variance in the regression models (demographic characteristics and preschool academic abilities accounted for 44%, 23%, and 20% of the variance of vocabulary, reading, and math, respectively), models were run both including the outcome variable in preschool as a predictor and without this variable as a predictor. Both sets of models yielded similar results. Correlations between the preschool assessments and

Kindergarten abilities ranged from .51 to .66. The inclusion of the preschool assessment and considering the fact that the predictors and the outcomes include some measurement error, a large percentage of the variance in the outcomes is already accounted for, leaving little room for other predictors. Additionally, the similarity in findings may be the result of the relatively high correlations among the preschool academic variables (ranging from .30 to .53). It is possible that even when the specific outcome variable assessed in preschool is dropped from the model, the other preschool academic assessments continue to explain a large amount of the variance in the outcome.

Growth Curve Models. Since using standard scores can reduce the size of the standard errors, there is the possibility that growth curves will not effectively capture the patterns of growth. For the current sample this was not the case; the growth curves using raw scores yielded very similar findings, but had more complex error structures to account for the growth in abilities, which have mostly been accounted for through standardization when using standard scores. Using standard scores may result in growth curves which make it appear as though children's abilities are decreasing, when in fact they are only improving at a slower rate than the norm. In the current study, despite a small trend downward in elementary school, children's abilities generally increased over time relative to the norm. Finally, using the outcome variable measured at a previous time point as a predictor has the potential to account for such a large amount of variance that other variables lose significance.

LCGA. The purpose of using LCGA is to assess whether there are subgroups of the population for whom the patterns of growth are different. If subgroups are identified that have different trajectories, it is important to understand what predicts different patterns of growth. For example, if two classes have similar mean levels at the first time points, but one class has an increasing slope and another has a decreasing slope, it would be valuable to understand why children experience such different patterns of growth. Furthermore, regression models or growth curves may not capture the diverse patterns and may therefore not be able to accurately predict these patterns. Sometimes the only difference between the patterns of growth is changing mean levels, in other words, the subgroups are parallel. In this case the LCGA models provide little additional information from what can be deduced from the growth curve models. In the current study, for each of the three outcomes, the patterns of growth were similar across subgroups. None of the subgroups had practically different trajectories; in other words, the growth trajectories of one subgroup never intersected the growth trajectories of the other subgroups. This finding was consistent across all three outcomes: the PPVT, the WJ-Letter Word, and the WJ-Applied Problems. Therefore, for each of the outcomes, the LCGA approach did not provide additional information compared to the growth curve models. Person-oriented approaches have recently undergone criticism, in particular for the distinction (or lack of distinction) between person-oriented theory and person-oriented methods, and the inability to test certain assumptions of the models (Sterba & Bauer, 2010). The LCGA analyses in the current study did not lead to distinguishing subgroups that appeared qualitatively different.

Strengths and Limitations

This study led to several important improvements over previous research examining the relation between measures of school readiness and academic abilities. The current study uses a longitudinal data set that assesses the growth of children's academic abilities from Kindergarten to 5th grade. Using this longitudinal data set, multiple analytic methods were used to assess the relation between school readiness and the growth of academic abilities in elementary school, including regression models, growth curves, and longitudinal subgroup growth analysis.

Furthermore, longitudinal analyses were conducted using both raw and standard scores. Based on the results of multiple methods, the current study was able to assess the convergence across methods, which provides stronger evidence of the strength of the results. Additionally, the current study employed both teacher reports and direct child assessments of children's cognitive and social-emotional skills and demonstrated the importance of multiple modes of assessment.

Despite the strengths of the current study, it also includes several limitations. First, the sample in the current study is relatively homogeneous, comprised predominantly of Black children from low-income families. Therefore the sample is not nationally representative, and caution should be exercised when generalizing these findings to populations with less disadvantage and non-urban populations. Second, all children in the current study participated in one or two years of the district-run enhanced preschool program. It is unclear whether the association between non-academic school readiness variables and academic abilities in elementary school was influenced by children's exposure to this unique preschool program, and therefore whether these findings are generalizable to children who did not attend a similar preschool program. Third, the current analyses only determined that there is a relation between preschool academic, cognitive and social-emotional readiness abilities and academic growth across the elementary school years, but we did not ascertain how this association occurs. Fourth, due to the transient nature of the sample in the current study and the longitudinal design, there is attrition in the sample, which may have affected the results.

Conclusions & Future Directions

The current study found that children's preschool academic abilities were quite predictive of Kindergarten and 5th grade academic achievement. After accounting for early academic abilities, emotion knowledge predicted Kindergarten vocabulary and growth in vocabulary skills across elementary school, emotion knowledge predicted 5th grade reading, and sustained attention predicted Kindergarten math skills. Therefore, academic, cognitive, and social-emotional measures of school readiness were related to vocabulary, reading, and math abilities. For vocabulary, emotion knowledge was related to a narrowing of the gap between those with higher and lower emotion knowledge skills in preschool. There was also a narrowing of the reading gap between children with higher and lower preschool pre-reading abilities, and the math trajectories of children with lower and higher preschool pre-math abilities converged over time.

The results of the current study lead to several future research directions. First, given the homogeneity of the sample in current study (predominantly African-American children from low-income families), future research should explore whether these findings are replicated with more heterogeneous samples, including children from diverse ethnic backgrounds and from a variety of socio-economic classes. Second, it is unclear whether children's preschool experiences affected the relation between their social-emotional, behavioral, and attentional skills and their elementary academic abilities. Future research should examine whether these findings are replicated with children who have had a range of experiences during the preschool years. Third, it is important to understand how different types and quality of preschool and early elementary programs may differentially affect both the trajectories of learning and well as factors that might predict these trajectories.

Fourth, the majority of previous research examining how early social-emotional competence and behavior predict academic abilities rely on teacher ratings of social-emotional competence and behavior problems. In the current study, teacher-reported measures were not significantly related to academic abilities when other variables were included in the models; this finding was consistent across the regression, growth, and LCGA models. However, direct assessments of children's preschool abilities were predictive of Kindergarten and 5^{th} grade academic achievement. Research is needed to determine if this pattern of findings is replicated with other samples and using other measures, and future studies examining how social-emotional competence and behavior problems relate to academic abilities should employ direct child assessments of children's social-emotional competence in addition to teacher reports.

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APPENDIX

Table 1

Regression and growth curve models

Predictors	Model 1	Model 2	Model 3	Model 4
Covariates & Demographics	X	X	X	X
Preschool Academic		X		X
SEBA			X	X

X indicates that this group of variables will be included in the model; Covariates and Demographics include cohort, years in program, gender, ethnicity, parent education, family type, and income; Preschool Academic variables include vocabulary, pre-reading, and pre-math; SEBA variables include the KEI, ACES, ERQE, ERQR, CCB, HSCS, BP, and SAT.

Table 2

Sample Characteristics

	Percentage or Mean	Standard Deviation
Gender		
Female	55%	0.50
Ethnicity		
Black	69%	0.47
Hispanic and mixed with Hispanic	20%	0.40
Primary Caregiver Education		
Less than High School	30%	0.46
High School	38%	0.49
More than High School	32%	0.47
Language		
English	91%	0.29
Family Type		
Two-Parent	19%	0.39
Below Poverty Line	77%	0.42
Receives WIC	60%	0.49
Eligible for Head Start	72%	0.45

Table 3

Achievement scores and predictor variables

	Percentage or Mean	Standard Deviation
PPVT		
Preschool	86.81	13.50
Kindergarten	89.53	12.73
1st Grade	89.30	11.45
2nd Grade	88.51	12.12
3rd Grade	90.81	12.88
5th Grade	90.93	12.29
WJ-Letter Word		
Preschool	94.52	10.97
Kindergarten	93.67	13.36
1st Grade	104.06	14.99
2nd Grade	102.94	15.98
3rd Grade	100.66	14.44
5th Grade	98.25	13.22
WJ-Applied Problems		
Preschool	87.76	13.77
Kindergarten	85.05	14.46
1st Grade	95.64	14.96
2nd Grade	99.50	16.21
3rd Grade	101.86	15.45
5th Grade	98.08	13.30
Preschool Measures		
KEI	1.34	0.27
ACES	6.30	2.31
ERQE	1.70	0.38
ERQR	1.82	0.33
SAT	10.23	3.17
CCB	17.69	4.28
HSCS	20.28	8.84
BP	5.24	5.06

KEI – Kusché Emotional Inventory; ACES – Assessment of Children's Emotions; ERQE – Emotion Recognition Questionnaire Expressive Subtest; ERQR – Emotion Recognition Questionnaire Receptive Subtest; SAT – Leiter's Sustained Attention; CCB – Cooperative Classroom Behavior; HSCS – Head Start Competence Scale; BP – Behavior Problems.

Table 4

Correlations between PPVT over time

	Preschool	Kindergarten	1^{st} grade	2^{nd} grade	3^{rd} grade	5^{th} grade
Preschool	-	-	-	-	-	-
Kindergarten	0.66***	-	-	-	-	-
1^{st} grade	0.62***	0.65***	-	-	-	-
2^{nd} grade	0.61***	0.70***	0.74***	-	-	-
3^{rd} grade	0.49***	0.58***	0.64***	0.68***	-	-
5^{th} grade	0.58***	0.62***	0.68***	0.75***	0.74***	-

*** $p < .001$

Table 5

Correlations between WJ-Letter Word over time

	Preschool	Kindergarten	1st grade	2nd grade	3rd grade	5th grade
Preschool	-	-	-	-	-	-
Kindergarten	0.60***	-	-	-	-	-
1st grade	0.55***	0.71***	-	-	-	-
2nd grade	0.51***	0.67***	0.88***	-	-	-
3rd grade	0.44***	0.58***	0.89***	0.88***	-	-
5th grade	0.40***	0.56***	0.69***	0.80***	0.95***	-

*** $p < .001$

Table 6

Correlations between WJ-Applied Problems over time

	Preschool	Kindergarten	1st grade	2nd grade	3rd grade	5th grade
Preschool	-	-	-	-	-	-
Kindergarten	0.51***	-	-	-	-	-
1st grade	0.47***	0.52***	-	-	-	-
2nd grade	0.53***	0.61***	0.70***	-	-	-
3rd grade	0.46***	0.55***	0.63***	0.81***	-	-
5th grade	0.31***	0.40***	0.54***	0.58***	0.64***	-

*** $p < .001$

Table 7

Correlations between demographic characteristics and outcomes in Kindergarten and 5th grade

	1	2	3	4	5
1. Gender	-	-	-	-	-
2. Black	-.09	-	-	-	-
3. Parent Ed.	.02	.04	-	-	-
4. Two-parent	.06	-.12*	.15**	-	-
5. Income	.01	-.08	.33***	.32***	-
6. K. PPVT	.05	.08	.29***	.17**	.23**
7. K. WJ-Letter Word	.18**	.08	.25***	.15*	.20**
8. K. WJ-Applied Problems	.11	-.04	.27**	.05	.14*
9. 5th PPVT	-.03	-.02	.22**	.25**	.17*
10. 5th WJ-Letter Word	.08	-.03	.16*	.15*	.13
11. 5th WJ-Applied Problems	-.07	-.12	.20**	.12	.11

p < .05; ** *p* <.01; *** *p* < .001; Parent. Ed. = Parents Education; Two-parent = Two-parent family; K = Kindergarten; 5th = 5th grade.

Table 8

Correlations between preschool school readiness variables

	1	2	3	4	5	6	7
1. KEI	-	-	-	-	-	-	-
2. ACES	0.44***	-	-	-	-	-	-
3. ERQE	0.47***	0.44***	-	-	-	-	-
4. ERQR	0.39***	0.33***	0.55***	-	-	-	-
5. SAT	0.35***	0.30***	0.23***	0.25***	-	-	-
6. CCB	0.20**	0.18**	0.22**	0.13*	0.24***	-	-
7. HSCS	0.18**	0.12*	0.19**	0.14*	0.24***	0.76***	-
8. BP	-0.15**	-0.11	-0.15**	-0.11	-0.26***	-0.78***	-0.76***

* $p < .05$; ** $p < .01$; *** $p < .001$; KEI – Kusché Emotional Inventory; ACES – Assessment of Children's Emotions; ERQE – Emotion Recognition Questionnaire Expressive Subtest; ERQR – Emotion Recognition Questionnaire Receptive Subtest; SAT – Leiter's Sustained Attention Task; CCB – Cooperative Classroom Behavior; HSCS – Head Start Competence Scale; BP – Behavior Problems.

Table 9

Correlations between preschool variables and outcomes in Kindergarten and 5th grade

	K. PPVT	K. Letter Word	K. Applied Problems	5th PPVT	5th Letter Word	5th Applied Problems
Pre. KEI	.56***	.21**	.28***	.45***	.15	.16*
Pre. ACES	.43***	.20**	.28***	.45***	.24**	.19*
Pre. ERQE	.46***	.31***	.20**	.40***	.26**	.10
Pre. ERQR	.28***	.15*	.14*	.30***	.27**	.19*
Pre. SAT	.36***	.30***	.36***	.38***	.27**	.27**
Pre. CCB	.23***	.14*	.20**	.17*	.21**	.15
Pre. HSCS	.16*	.09	.16*	.13	.15*	.18*
Pre. BP	-.20**	-.19**	-.18**	-.15	-.19*	-.14

* $p < .05$; ** $p < .01$; *** $p < .001$; K – Kindergarten; 5th – 5th grade; KEI – Kusché Emotional Inventory; ACES – Assessment of Children's Emotions; ERQE – Emotion Recognition Questionnaire Expressive Subtest; ERQR – Emotion Recognition Questionnaire Receptive Subtest; SAT – Leiter's Sustained Attention Task; CCB – Cooperative Classroom Behavior; HSCS – Head Start Competence Scale; BP – Behavior Problems.

Table 10

Results from regression models predicting 5th grade PPVT

		Model 1	Model 2	Model 3	Model 4
R^2		.132	.436	.391	.481
Cohort	STB	0.11	0.04	0.13	0.07
	SE	2.04	1.64	1.78	1.61
Years in Program	STB	0.04	-0.08	0.01	-0.09
	SE	2.02	1.72	1.76	1.65
Gender	STB	-0.08	-0.06*	-0.12	-0.18**
	SE	1.96	1.61	1.76	1.55
Parent Education	STB	0.19*	0.02	0.12	0.03
	SE	0.46	0.39	3.66	0.37
Family Type: Two Parent	STB	0.23**	0.09	0.08	0.04
	SE	2.98	2.48	2.64	2.44
Income	STB	0.02	-0.02	-0.10	-0.06
	SE	0.66	0.54	0.58	0.52
PPVT	STB	-	0.53***	-	0.44***
	SE		0.07		0.08
Preschool WJ – Letter Word	STB	-	0.24**	-	0.22**
	SE		0.08		0.08
Preschool KEI	STB	-	-	0.21**	-
	SE			3.68	
Preschool ACES	STB	-	-	0.23**	0.25***
	SE			0.46	0.39
Preschool ERQE	STB	-	-	0.17*	-
	SE			2.83	
Preschool SAT	STB	-	-	0.19*	-
	SE			0.30	

* $p < .05$; ** $p < .01$; *** $p < .001$; KEI – Kusché Emotional Inventory; ACES – Assessment of Children's Emotions; ERQE – Emotion Recognition Questionnaire Expressive Subtest; SAT – Leiter's Sustained Attention Task; - indicates that this variable was not included in the model.

Table 11

Results from regression models predicting 5th grade WJ-Letter Word

		Model 1	Model 2	Model 3	Model 4
R^2		.085	.231	.147	.256
Cohort	STB	0.07	0.05	0.09	0.06
	SE	2.11	1.97	2.05	1.95
Years in Program	STB	-0.01	-0.12	-0.01	-0.11
	SE	2.13	2.07	2.08	2.04
Gender	STB	0.01	-0.08	0.04	-0.05
	SE	2.06	1.98	2.00	1.97
Parent Education	STB	0.23**	0.15	0.20**	0.14
	SE	0.49	0.46	0.48	0.45
Family Type: Two Parent	STB	0.09	0.04	0.05	0.02
	SE	3.15	2.94	3.04	2.92
Income	STB	0.06	0.02	0.04	0.01
	SE	0.70	0.65	0.69	0.64
Preschool WJ – Letter Word	STB	-	0.29**	-	0.26**
	SE		0.10		0.10
Preschool WJ – Applied Problems	STB	-	0.22*	-	0.18*
	SE		0.08		0.08
Preschool ERQR	STB	-	-	0.26**	0.18*
	SE			2.78	3.76

* p < .05; ** p < .01; *** p < .001; ERQR – Emotion Recognition Questionnaire Receptive Subtest; - indicates that this variable was not included in the model.

Table 12

Results from regression models predicting 5th grade WJ-Applied Problems

		Model 1	Model 2	Model 3	Model 4
R^2		.080	.199	.134	.199
Cohort	STB	0.09	0.07	0.03	0.07
	SE	2.16	2.06	2.09	2.06
Years in Program	STB	0.05	-0.04	0.06	-0.04
	SE	2.18	2.15	2.11	2.15
Gender	STB	-0.09	-0.18*	-0.14	-0.18*
	SE	2.11	2.05	2.10	2.05
Parent Education	STB	0.21*	0.14	0.18*	0.14
	SE	0.49	0.47	0.47	0.47
Family Type: Two Parent	STB	0.08	0.04	0.03	0.04
	SE	3.18	3.01	3.05	3.01
Income	STB	0.01	-0.04	-0.03	-0.04
	SE	0.71	0.67	0.69	0.67
Preschool WJ – Letter Word	STB	-	0.23**	-	0.23**
	SE		0.10		0.10
Preschool WJ – Applied Problems	STB	-	0.23**	-	0.23**
	SE		0.09		0.09
Preschool SAT	STB	-	-	0.27**	-
	SE			0.32	

* p < .05; ** p < .01; *** p < .001; SAT – Leiter's Sustained Attention Task; - indicates that this variable was included in the model.

Table 13

Results from growth curve models for the PPVT

		Model 1	Model 2	Model 3	Model 4
Intercept	STB	-0.41**	0.04	-0.44**	-0.19*
	SE	0.13	0.10	0.16	0.10
Time	STB	0.04**	0.03*	0.03*	0.03**
	SE	0.01	0.01	0.01	0.01
Cohort	STB	0.14	0.03	0.16	0.10
	SE	0.10	0.08	0.09	0.08
Years in Program	STB	0.33***	-0.01	0.12	-0.03
	SE	0.09	0.08	0.09	0.08
Gender	STB	-0.02	-0.18*	-0.17*	0.20**
	SE	0.09	0.07	0.08	0.07
Parent Education	STB	0.18***	0.07	0.11*	0.06
	SE	0.05	0.04	0.04	0.04
Family Type: Two Parent	STB	0.20	0.03	0.38	-0.02
	SE	0.13	0.11	0.17	0.11
Income	STB	0.07	0.03	0.01	0.01
	SE	0.05	0.04	0.05	0.04
Preschool PPVT	STB	-	0.56***	-	0.42***
	SE		0.04		0.05
Preschool WJ – Letter Word	STB	-	0.16***	-	0.15***
	SE		0.04		0.04
Preschool KEI	STB	-	-	0.25***	0.12*
	SE			0.05	0.05
Preschool ERQE	STB	-	-	0.14**	-
	SE			0.05	
Preschool SAT	STB	-	-	0.16***	-
	SE			0.05	
Preschool ACES	STB	-	-	0.09	0.08
	SE			0.06	0.05
Preschool ACES by Time	STB	-	-	0.02*	0.02*
	SE			0.01	0.01

* $p < .05$; ** $p < .01$; *** $p < .001$; KEI – Kusché Emotional Inventory; ACES – Assessment of Children's Emotions; ERQE – Emotion Recognition Questionnaire Expressive Subtest; SAT – Leiter's Sustained Attention Task; - indicates that this variable was not included in the model.

Table 14

Results from growth curve models for the WJ-Letter Word

		Model 1	Model 2	Model 3	Model 4
Intercept	STB	-2.65***	-2.30***	-2.52***	-2.30***
	SE	0.18	0.17	0.19	0.17
Time	STB	2.25***	2.20***	2.27***	2.20***
	SE	0.15	0.16	0.17	0.16
$Time^2$	STB	-0.65***	-0.65***	-0.66***	-0.65***
	SE	0.05	0.05	0.06	0.05
$Time^3$	STB	0.06***	0.06***	0.06***	0.06***
	SE	0.00	0.01	0.01	0.01
Cohort	STB	0.29**	0.27**	0.26*	0.27**
	SE	0.10	0.09	0.10	0.09
Years in Program	STB	0.31**	0.02	0.27*	0.02
	SE	0.11	0.10	0.11	0.10
Years in Program by Time	STB	-0.05*	-0.06*	-0.07**	-0.06*
	SE	0.02	0.02	0.02	0.02
Gender	STB	0.38***	0.09	0.15	0.09
	SE	0.11	0.08	0.10	0.08
Parent Education	STB	0.15**	0.01	0.13*	0.01
	SE	0.05	0.04	0.05	0.04
Family Type: Two Parent	STB	0.24	0.15	0.13	0.15
	SE	0.13	0.12	0.14	0.12
Income	STB	0.03	0.00	0.00	0.00
	SE	0.05	0.05	0.06	0.05
Preschool WJ – Letter Word	STB	-	0.42***	-	0.42***
	SE		0.46		0.46
Preschool WJ – Applied Problems	STB	-	0.23***	-	0.23***
	SE		0.05		0.05
Preschool WJ – Letter Word by $Time^2$	STB	-	-0.01*	-	-0.01*
	SE		0.00		0.00
Preschool ERQE	STB	-	-	0.14**	-
	SE			0.05	
Preschool SAT	STB	-	-	0.17**	-
	SE			0.05	

* p < .05; ** p < .01; *** p < .001; ERQE – Emotion Recognition Questionnaire Expressive Subtest; SAT – Leiter's Sustained Attention Task; - indicates that this variable was not included in the model.

Table 15

Results from growth curve models for the WJ-Applied Problems

		Model 1	Model 2	Model 3	Model 4
Intercept	STB	-1.60***	-1.21***	-1.42***	-1.20***
	SE	0.15	0.14	0.14	0.14
Time	STB	0.90***	0.86***	0.89***	0.88***
	SE	0.05	0.05	0.05	0.05
$Time^2$	STB	-0.10***	-0.10***	-0.10***	-0.10***
	SE	0.01	0.01	0.01	0.01
Cohort	STB	0.08	0.09	0.09	0.05
	SE	0.09	0.08	0.09	0.08
Years in Program	STB	0.19*	-0.10	0.07	-0.08
	SE	0.09	0.08	0.09	0.08
Gender	STB	0.23*	-0.04	0.07	-0.04
	SE	0.11	0.10	0.11	0.10
Parent Education	STB	0.16***	0.02	0.09*	0.02
	SE	0.05	0.04	0.04	0.04
Family Type: Two	STB	0.04	-0.07	-0.12	-0.11
Parent	SE	0.12	0.11	0.12	0.11
Income	STB	0.06	0.01	0.02	0.02
	SE	0.05	0.04	0.05	0.04
Gender by Time	STB	-0.08*	-0.06*	-0.07*	-0.06*
	SE	0.03	0.03	0.03	0.03
Preschool WJ – Letter	STB	-	0.20***	-	0.17***
Word	SE		0.04		0.04
Preschool PPVT	STB	-	0.14**	-	0.08**
	SE		0.05		0.04
Preschool WJ –	STB	-	0.18*	-	0.11
Applied Problems	SE		0.08		0.08
Preschool WJ –	STB	-	0.12*	-	0.14**
Applied Problems by	SE		0.05		0.05
Time					
Preschool WJ-Applied	STB	-	-0.02**	-	-0.02***
Problems by $Time^2$	SE		0.01		0.01
Preschool ACES	STB		-	0.14**	-
	SE			0.05	
Preschool SAT	STB	-	-	0.28***	0.15***
	SE			0.05	0.04

* p < .05; ** p < .01; *** p < .001; ACES – Assessment of Children's Emotions; SAT – Leiter's Sustained Attention Task; - indicates that this variable was not included in the model.

Table 16

Fit indices for LCGA models for the PPVT

Number of Classes	BIC	AIC
Assuming Linear Growth		
1	4578.75	4571.17
2	4377.54	4362.36
3	4303.27	4280.50
4	4286.48	4256.13
5	4283.74	4245.80
6	4291.22	4245.69
Assuming Quartic Growth		
1	4587.56	4572.39
2	4395.17	4364.82
3	4326.94	4281.41
4	4313.68	4252.97
5	4312.85	4236.97
6	4326.35	4235.29

Table 17

The association between trajectory class membership and predictors for the PPVT

	Moderate Vocabulary		High Vocabulary	
Variable	Estimate	SE	Estimate	SE
Cohort	0.83	0.52	0.07	0.84
Years in Program	-0.94	0.55	-0.85	0.81
Gender	-1.97**	0.62	-2.19*	0.88
Parent Education	0.02	0.12	0.31	0.17
Family Type – Two Parent	0.84	0.85	0.60	1.08
Income (categorical)	-0.01	0.16	0.16	0.23
Preschool PPVT	0.11***	0.03	0.29***	0.06
Preschool WJ-Letter Word	0.08**	0.03	0.09*	0.04
Preschool KEI	2.40*	1.16	3.13	1.97
Preschool SAT	0.10	0.10	0.39*	0.17

Estimates refer to multinomial logistic regression predicting group membership; Class 1 is the reference group; * $p < .05$; ** $p < .01$; ***$p < .001$

Table 18

Fit indices for LCGA models for the WJ-Letter Word

Number of Classes	BIC	AIC
Assuming Linear Growth		
1	4790.07	4784.44
2	4607.25	4595.99
3	4525.66	4508.77
4	4500.28	4477.77
5	4487.98	4459.84
6	4487.61	4453.83
Assuming Quartic Growth		
1	4758.84	4747.58
2	4538.39	4515.88
3	4431.01	4397.23
4	4402.49	4357.46
5	4368.67	4312.38
6	4381.96	4314.41

Table 19

The association between trajectory class membership and predictors for the WJ-Letter Word

	Low Reading		Moderate Reading		High Reading	
Variable	Est.	SE	Est.	SE	Est.	SE
Cohort	0.33	0.71	1.18	0.71	1.50	0.80
Years in Program	-0.39	0.83	-0.64	0.78	-0.73	0.785
Gender	-0.47	0.66	0.10	0.68	-0.08	0.75
Parent Education	-0.03	0.13	0.06	0.14	0.19	0.16
Family Type – Two Parent	0.56	1.01	-0.04	1.03	0.96	1.10
Income (categorical)	0.13	0.27	0.12	0.26	0.04	0.28
Preschool WJ-Letter Word	0.11*	0.05	0.20***	0.05	0.26***	0.05
Preschool WJ-Applied Problems	0.02	0.03	0.07**	0.03	0.10**	0.03

Estimates refer to multinomial logistic regression predicting group membership; Class 1 is the reference group; * $p < .05$; ** $p < .01$; ***$p < .001$

Table 20

Fit indices for LCGA models for the WJ-Applied Problems

Number of Classes	BIC	AIC
Assuming Linear Growth		
1	4818.71	4813.09
2	4684.32	4673.07
3	4649.72	4632.85
4	4642.74	4608.24
5	4649.41	4606.29
Assuming Quartic Growth		
1	4767.98	4756.73
2	4587.19	4564.69
3	4532.51	4498.76
4	4515.36	4470.36
5	4523.88	4467.64

Table 21

The association between trajectory class membership and predictors for the WJ-Applied Problems

	Moderate Math		High Math	
Variable	Estimate	SE	Estimate	SE
Cohort	0.26	0.43	1.34	0.91
Years in Program	-0.21	0.43	0.47	0.81
Gender	-0.06	0.43	-1.55	0.93
Parent Education	-0.01	0.10	0.19	0.19
Family Type – Two Parent	-1.21	0.61	0.00	0.92
Preschool WJ-Applied Problems	0.11***	0.03	0.21***	0.05
Preschool ACES	0.22*	0.10	0.18	0.23
Preschool SAT	0.08	0.08	0.51**	0.18

Estimates refer to multinomial logistic regression predicting group membership; Class 1 is the reference group; * $p < .05$; ** $p < .01$; *** $p < .001$

Figure 1

PPVT: Interaction of preschool ACES by time

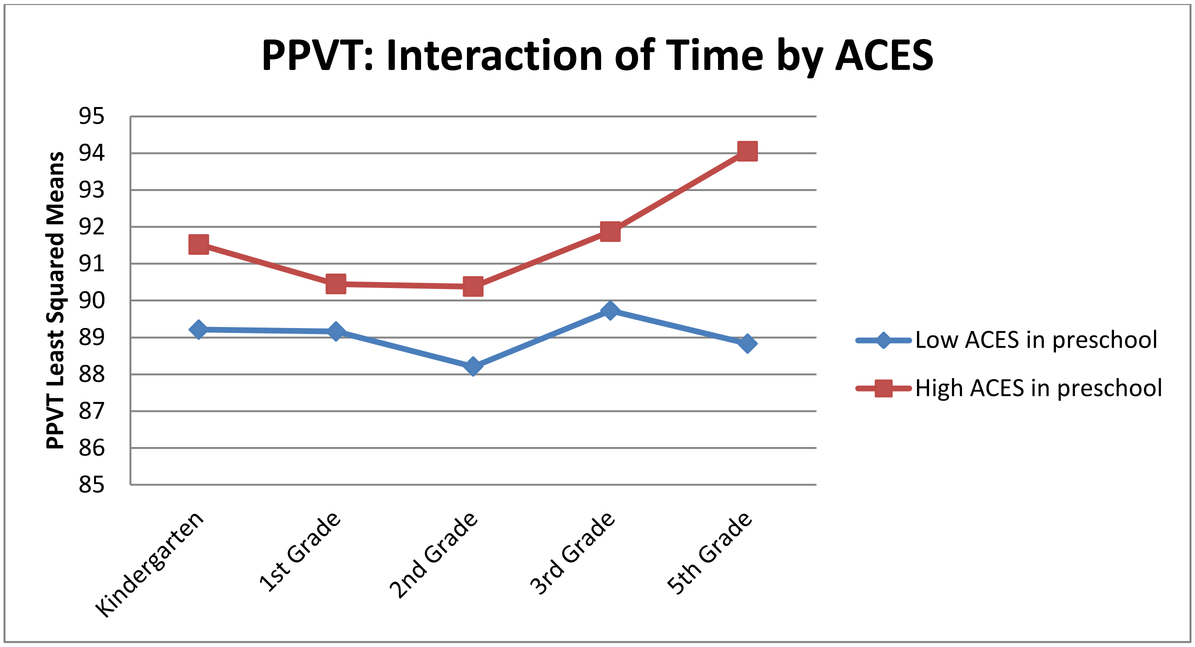


Figure 2

WJ-Letter Word: Interaction of preschool WJ-Letter Word by time

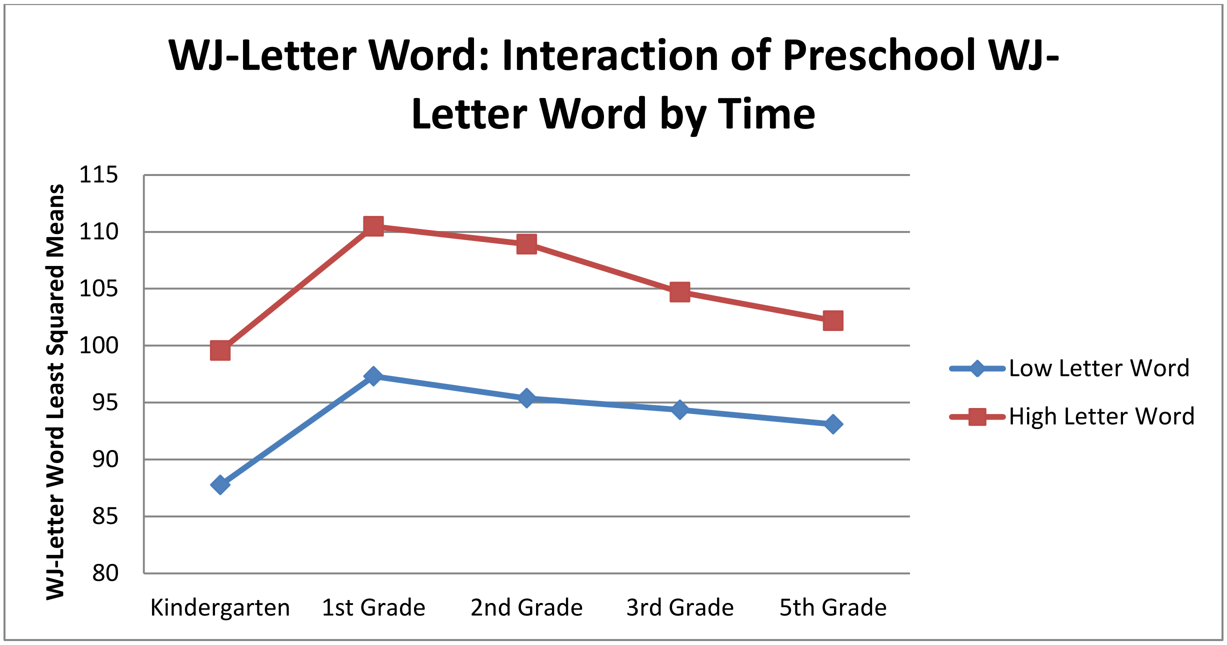


Figure 3

WJ-Applied Problems: Interaction of preschool WJ-Applied Problems by time

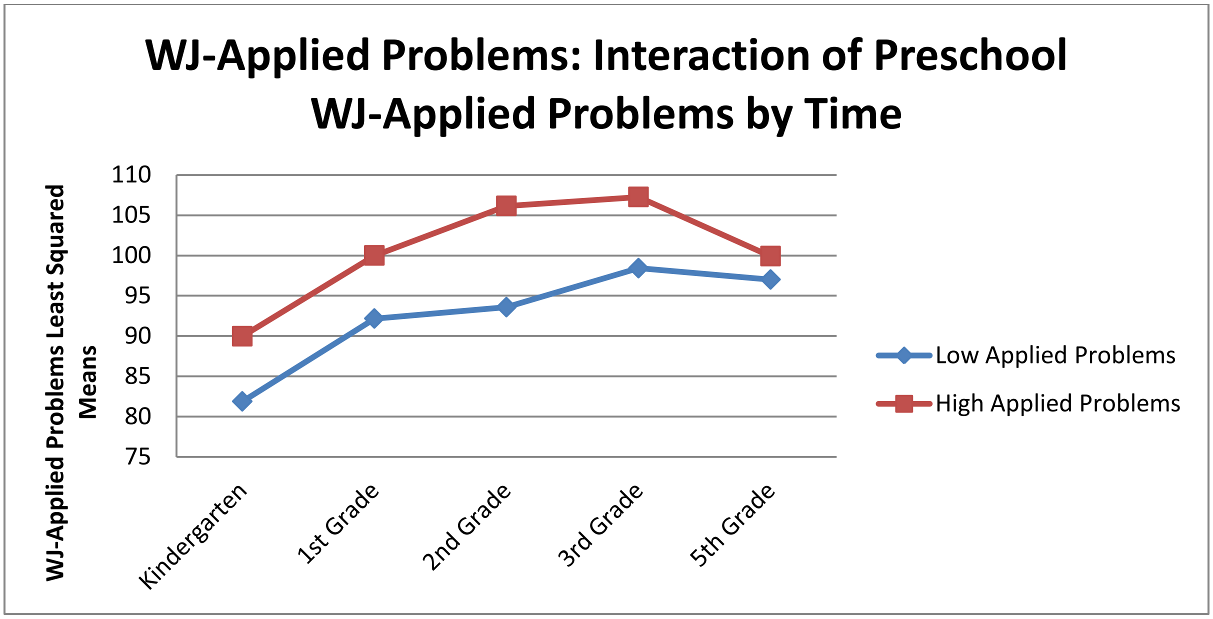


Figure 4

WJ-Applied Problems: Interaction of gender by time

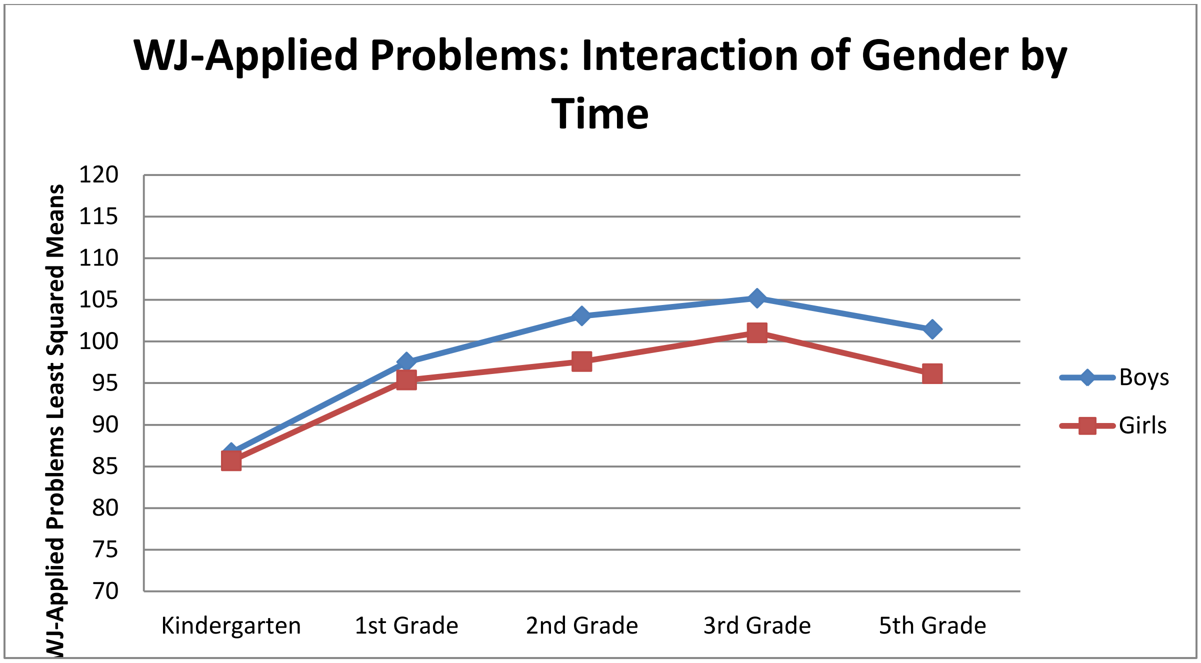


Figure 5

Latent trajectories for the PPVT.

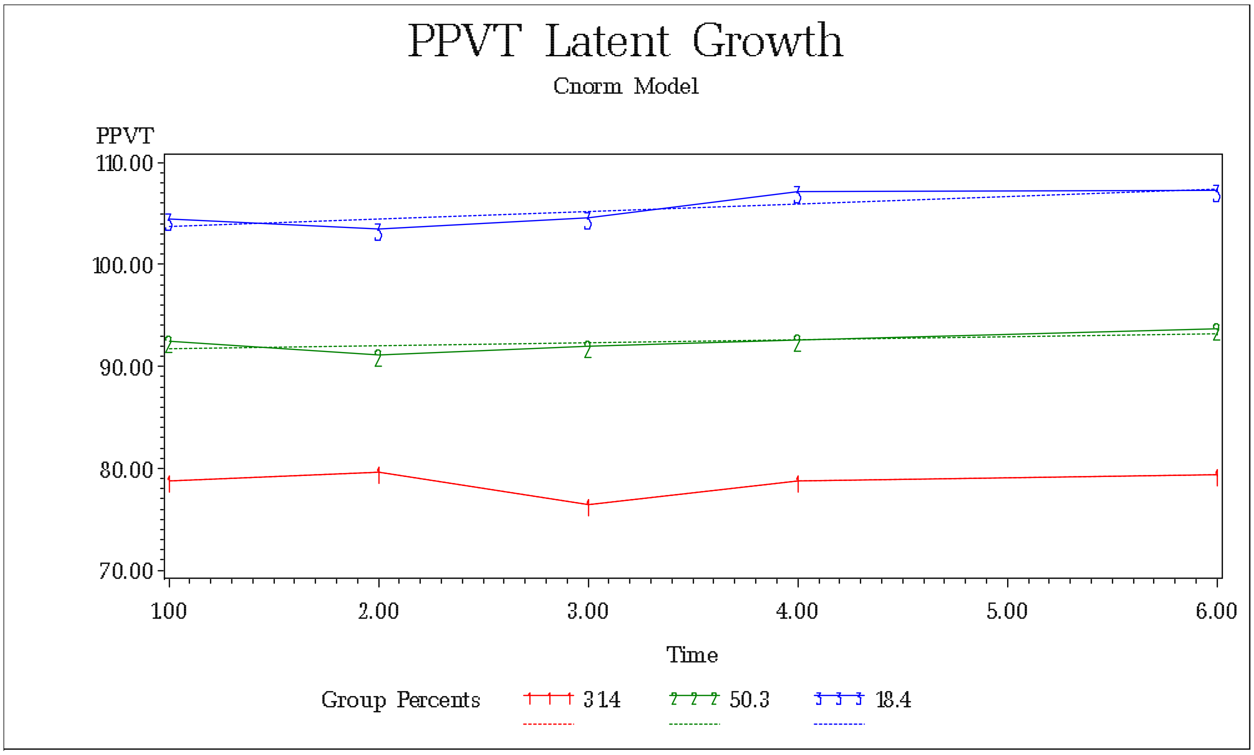


Figure 6

Latent trajectories for the WJ-Letter Word.

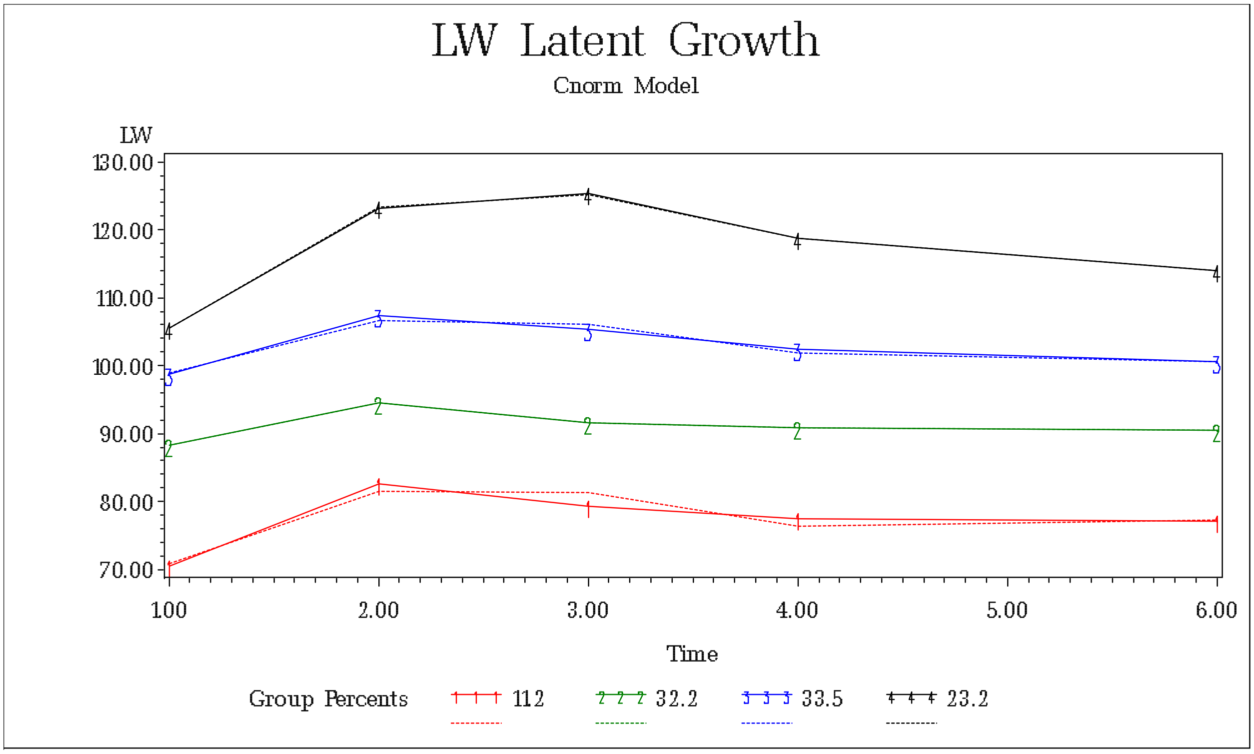
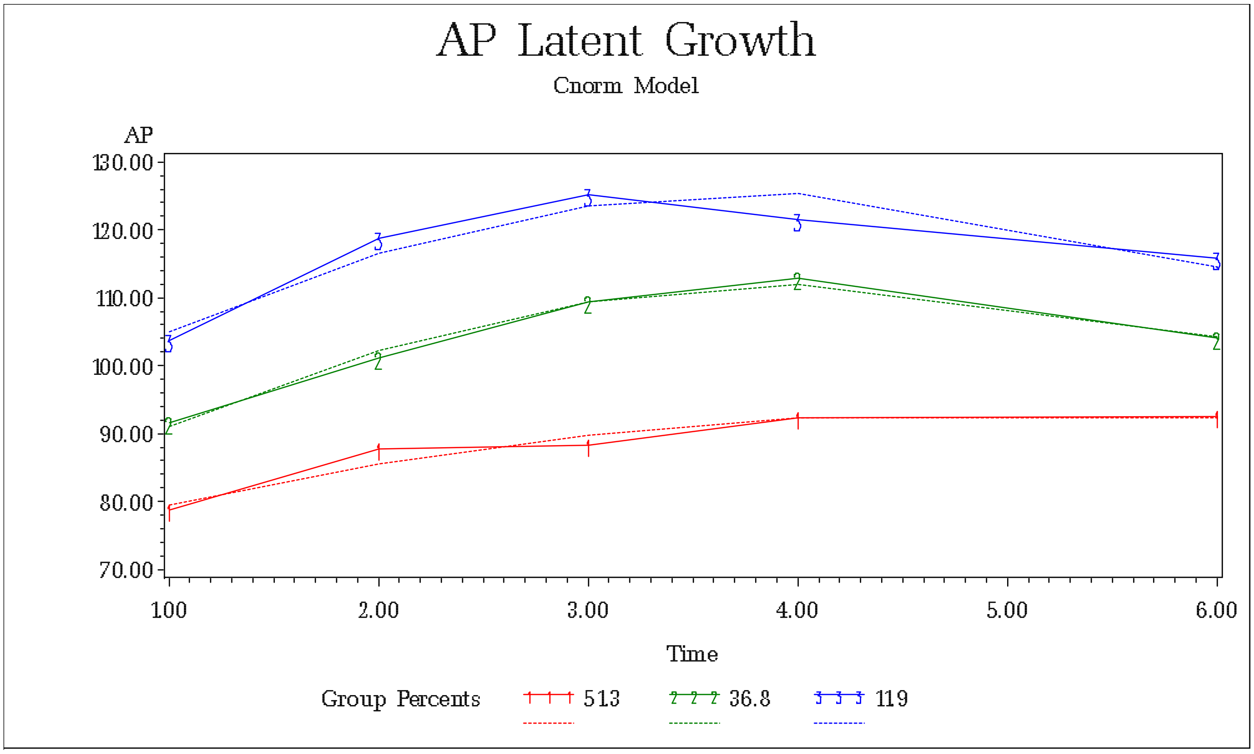


Figure 7

Latent trajectories for the WJ-Applied Problems.



JULIA E. MOORE

Curriculum Vitae

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***Graduate Research Assistant,* Prevention Research Center,**
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PUBLICATIONS

1. Domitrovich, C.E., **Moore, J.E.**, Thompson, R., & Collaborative for the Advancement of Social, Emotional, and Academic Learning. (2012). *Interventions that promote social-emotional learning in young children*. Handbook of Early Education. (Eds. R. Pianta, L. Justice, S. Barnett, & S. Sheridan)
2. Domitrovich, C.E, **Moore, J.E.,** & Greenberg, M.T. (In Press). *Maximizing the effectiveness of social-emotional interventions for young children through high quality implementation.* A Handbook of Implementation Science for Psychology in Education: How to Promote Evidence-Based Programmes and Practices. (Eds. B. Kelly & D. Perkins).
3. Rhoades, B. L, Bumbarger, B.K., & **Moore, J.E.** (In Press). The Role of a State-Level Prevention Support System in Promoting High Quality Implementation and Sustainability of Evidence-based Programs. *American Journal of Community Psychology.*
4. Barwick, M. A., Bennett, L. M., Johnson, S. N., McGowan, J., & **Moore, J. E.** (In Press). Training health and mental health professionals in motivational interviewing: A systematic review. *Journal of Consulting and Clinical Psychology.*