USING PRE-KINDERGARTEN DATA TO PREDICT STUDENTS' KINDERGARTEN PERFORMANCE

by

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ABSTRACT

JACQUELINE M. TYNAN. Using pre-kindergarten data to predict students' kindergarten performance (Under the direction of DR. JAMES R. COOK)

As support mounts for the use of pre-kindergarten (pre-k) to promote academic achievement, there is increased need to understand the nature of pre-k's effects and the key elements of effective pre-k programming. The present study used a short-term longitudinal design to examine the effects of a pre-k program for at-risk four-year-olds. Using data collected from classroom observations, teacher-rated measures of students' social-emotional functioning, and standardized measures of academic functioning, associations between classroom quality and students' social-emotional and academic development were assessed. Indicators of classroom quality reflected teachers' use of Warmth, Positive Discipline, and Logic and Reasoning, based on ratings of teacher-child interactions during classroom observations. Each measure of pre-k classroom quality was examined in relation to student's pre-k social-emotional functioning (as measured by the Devereux Early Childhood Assessment), pre-k receptive vocabulary skills, and kindergarten literacy and math skills (as assessed via multiple standardized measures). Results indicate children from pre-k classrooms in which teachers were more warm and supportive in their interactions with children received better ratings of prosocial skills (Attachment, $p<.05$; Initiative. $p<.10$) and fewer Behavior Concerns ($p<.05$). Measures of classroom quality were not directly related to students' kindergarten academic functioning; however results suggest an indirect relationship via students' social-emotional functioning. That is, students with higher teacher ratings in Initiative and fewer behavior concerns in spring of their pre-k year performed better on fall and spring kindergarten assessments of math and reading than their peers with less positive

ratings of social-emotional skills . Additionally, students with higher teacher ratings of Attachment in pre-k performed worse (p<.05) on kindergarten measures of academic functioning. The Attachment-functioning relationship was not in the expected direction and warrants further examination. The present study supports the need for quality pre-k to promote children's social-emotional development and academic achievement, particularly for at-risk children.

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CHAPTER 1: INTRODUCTION

Public support for pre-kindergarten (pre-k) has grown during the past several decades as research has continued to demonstrate its effectiveness in preparing children for school (e.g., Burchinal et al., 2008; Camilli, Vargas, Ryan, & Barnett, 2010; Campbell & Ramey, 1995; Howes et al., 2008). Pre-k not only garners support from the general public, but economists and politicians support pre-k because it has proven to be a cost-effective intervention with positive outcomes lasting well into adulthood (Schweinhart et al., 2005; Weiland & Yoshikawa, 2013). The broad support and positive perceptions of pre-k have led to increases in access to and enrollment in pre-k. For instance, Georgia was the first state to offer access to universal pre-k in 1995 and, as of January 2015, forty states and the District of Columbia provide publicly-funded pre-k to four-year-olds (Barnett, 2015). The increase in access to pre-k programs between 1990 and 2013 yielded a rise in enrollment from 35% to 51% among three- and four-year-olds (National Center for Education Statistics, 2015), comprising approximately 1.5 million children (U.S. Census Bureau, 2015). That said, despite the clear increase in access to pre-k, children with greater risks (i.e., those from low-income households and with poorly educated parents) are less likely to enroll in pre-k and even less likely than their peers to be enrolled in quality pre-k (Barnett & Yarosz, 2004; Brown & Bogard, 2007; Pianta et al., 2005). The advent of widespread, publicly-funded pre-k (e.g., Head Start) was intended to close gaps in access to pre-k and increase school readiness for children

from low-income households and from minority groups; however, the gap remains, reflecting an artifact of a long history of lack of access and quality for children from representing these backgrounds (Haberman, 1991; Pianta, Belsky, Houts, & Morrison, 2007). Increasing low-income and minority families' access to quality pre-k is a logical step for efforts to address the education gap that persists through high school. The earlier the achievement gap is addressed, the greater chances of closing it.

The present study explored the impact of a publicly funded pre-k program that was designed to help close the achievement gap by targeting (via the enrollment process) children deemed at-risk of school failure and focusing on social-emotional (SE) development and pre-literacy skills. Using pre-k and kindergarten data, this study investigated how implementation of the program's evidence-based curriculum related to children's academic and social-emotional (SE) functioning in a largely African American and Latino population. Based on the extant literature and the program's emphasis on SE development, the relationship between SE functioning and academic achievement within this population was also of interest. The following sections provide a framework for the study with a review of theory and research supporting pre-k as an intervention, highlighting the importance of early childhood interventions for children identified as at-risk.

A brief overview of the known relationship between pre-k and academic and SE functioning is followed by discussion of the importance of quality programming. This paper provides a review of requirements for quality programming, such as the incorporation of early math, pre-literacy, and SE lessons, the use of an evidence-based curriculum, and fidelity of implementation to the selected curriculum. While multiple

aspects of quality have been identified in the literature and are incorporated into evidence-based curricula, the present study focused on quality of teacher-child interactions. Background information about key components of the curriculum (e.g., informal learning) that contribute to quality teacher-child interactions are discussed. Among the components discussed, emphasis is placed on SE development and the need for quality informal interactions in the classroom. Questions of interest and hypotheses are presented followed by discussion of results and implications of the findings.

1.1 Relevant Theory and Research

The theory of *life cycle skill formation*, in which "skills beget skills," suggests that skills build on one another in a multiplicative manner and, as such, earlier interventions like pre-k are more effective than later remedial education programs (Cuhna, Heckman, Lochner, & Masterov, 2005). Early interventions like quality pre-k programs have proven to be beneficial, particularly for children who are at-risk (AR; Curby et al., 2009; Magnuson & Waldfogel, 2005; Peisner-Feinberg & Burchinal, 1997). Another framework, the *compensatory theory* (Sameroff & Chandler, 1975), suggests AR children benefit more from pre-k because pre-k compensates for resources to which AR children may not otherwise have access. Many of the resources in pre-k classrooms such as adequate food, books, toys, computers, and highly educated adults, as well as exposure to the stimulation of a structured curriculum, may not be as readily available in the homes or neighborhoods of AR children as those of their not at-risk (NAR) peers. Thus, AR children are likely to have more of a value added from pre-k whereas children NAR may have diminishing returns (Loeb, Bridges, Bassok, Russell, & Rumberger, 2007; Montes, Hightower, Brugger, & Moustafa, 2005; Peisner-Feinberg & Burchinal, 1997).

Consistent with theories supporting pre-k as an intervention, studies have found that attending a high quality pre-k prepares AR children academically for school (Belfield, Nores, Barnett, & Schweinhart, 2006; Currie & Rossin-Slater, 2015; Heckman, Pinto, & Savelyev, 2013). Contrary to the support for pre-k, studies have also found that cognitive gains made among children AR during the pre-k year may "fade out" as early as first grade and typically by third grade, such that other children without pre-k experience catch up and possibly surpass those children in cognitive abilities (Magnuson, Ruhm, & Waldfogel, 2007). However, results related to the "fade out" of academic gains are mixed. For instance, although some researchers describe the cognitive benefits of pre-k as short-term, others have found benefits lasting through elementary, middle and high school, and beyond. For example, one study found relationships between pre-k and fourth grade test scores mediated by kindergarten scores (Dickinson & Porche, 2011). Although the "fade out" is described and seemingly accepted widely, findings from meta-analyses dispute the fade out altogether, linking pre-k to eighth grade performances and beyond (see Barnett, 2013; Camilli et al., 2010; Nelson, Westhues, & McLeod, 2003).

Notwithstanding these inconsistent findings regarding academic gains, research suggests the SE gains made in pre-k persist (Magnuson et al., 2007). This stability is notable because early SE competencies are linked to later success (Heckman et al., 2013). For instance, studies have found early social-emotional (SE) functioning to be a strong predictor of positive life outcomes, including later academic achievement such as high school graduation and positive health behaviors, lower involvement in the justice system, and higher rates of employment in adulthood (Heckman et al., 2013). Such findings highlight the importance of including practices that foster SE development in high

quality, evidence-based pre-k curricula. Given the extensive amount of research on the effects of pre-k on cognitive and SE development and promising findings from such research, popularity of pre-k has grown. As pre-k became more popular, experts in the field of child development and education created recommendations for guidelines to ensure pre-k programs were meeting a minimum standard of quality.

1.2 Importance of Quality and Implementation

Preliminary research supporting the use of pre-k as an early childhood intervention began to highlight the importance of program quality, as higher quality programs yielded better outcomes for children (Burchinal, Vandergrift, Pianta, & Mashburn, 2010; Howes et al., 2008). In fact, multiple national organizations, including the National Institute for Early Education Research (NIEER), National Association for the Education of Young Children (NAEYC), American Academy of Pediatrics, and American Public Health Association, each designed their own recommendations for minimum standards of quality for pre-k classrooms. Program designers, policymakers, and researchers use these recommendations to inform their program planning and to evaluate and monitor programs (Mashburn et al., 2008). The varied sets of recommendations each include aspects from two distinct categories of pre-k quality identified by Mashburn et al. (2008): (1) *design and infrastructure* (e.g., teacher credentials, class size, curriculum, availability of classroom materials); and (2) *direct experiences of children* (e.g., classroom routines, teacher-child interactions, teachers' use of classroom materials). Aspects from both categories are included in the recommendations, and are typically incorporated into program rating systems (e.g., star-

based rating systems, in which a program quality is rated 1-5 stars), or requirements for licensure.

Diverging recommendations about pre-k quality from the four national organizations (or others) along with policymakers' interpretations or rankings of importance among the recommendations may yield variability across programs nationally and within states. Similarly, differences in teachers' training, personal interpretations of curricula and quality standards, and implementation practices can lead to variability across classrooms within the same program. For programs with multiple classrooms, it is important to conduct regular assessments of implementation and fidelity to the programs' curriculum and standards to help ensure all children are receiving the same intervention and same chance of positive outcomes; sound implementation will maximize the potential benefits for all program children.

When individual classrooms lack fidelity to the program model, children in those classrooms are not receiving the intended intervention. In such cases, classrooms lacking fidelity may benefit from professional development interventions to promote consistent positive outcomes across classrooms (Weiland & Yoshikawa, 2013). The use of evidence-based curricula and professional development with regular monitoring to increase fidelity is one of the most effective interventions for classrooms lacking fidelity (Weiland & Yoshikawa, 2013). When programs ensure fidelity across their classrooms, positive outcomes among the children and improvements across children will be easier to attribute to the intervention because each child will be receiving the same, intended intervention. The importance of implementation fidelity was one of the key reasons behind the initial evaluation leading up to the present study. Evaluators were contracted

to monitor fidelity and outcomes to help the program identify whether the model was being implemented with fidelity and whether it benefited their students or if administrators need to make changes to the model.

When implemented with fidelity, program models that employ evidence-based curricula with developmentally appropriate lessons for children are more likely to result in positive child outcomes than models implemented poorly or lacking appropriate curricula (Durlak & DuPre, 2008; O'Donnell, 2008). Without an evidence-based curriculum, pre-k programs risk operating a childcare setting rather than an early education setting. The intentions of pre-k extend beyond childcare and free-play. In one study, children solely engaged in free-play were found to have smaller pre-literacy and math gains than children in three other more structured learning groups (Chien et al., 2010), likely because free-play by itself does not provide the structure for teachers to build on ideas children have been learning and still need to learn.

1.3 Curriculum Components

The most effective curricula combine explicit structured lessons in early math, literacy, and social-emotional skills. Researchers agree it is critical to combine these three types of lessons to develop the early childhood skills needed for later success. There have been mixed findings surrounding which among the three lessons best predicts later success, making it difficult to identify how to focus curricular interventions (Duncan et al., 2007; Magnuson et al., 2007). These varying results strengthen the case for using a curriculum with a combination of the three lesson types, starting with very basic traditional academic skills such as pre-literacy and math.

1.4 Reading and Math

Reading and math are seen as foundational content areas, guided by the notion that children are unlikely to succeed in other subjects such as science and history without these basic skills. Furthering this notion, findings from a meta-analysis by Duncan and colleagues (2007) showed school-entry reading and math abilities consistently predicted later academic achievement. These findings for pre-literacy skills are particularly noteworthy, because reading proficiency in elementary school is highly predictive of high school graduation (Hernandez, 2011). Recognizing the critical need to include pre-literacy and math in pre-k curricula to prepare children for later subjects, the curriculum in the present study incorporates both.

Pre-literacy skills, which include phonological awareness, letter recognition, print awareness, oral language and vocabulary, exposure to print and writing, and narrative skills (Wasik & Hindman, 2011), are the building blocks for reading comprehension and have been shown to strongly predict later academic success (Dickinson & Porche, 2011). Pre-k curricula that build in opportunities for children to learn letters, words, identify print, and begin reading and writing in a more complex manner as the year goes on (and children's skills increase) are recommended by the National Center on Quality Teaching and Learning (2015). Similarly, lessons in early math skills – such as number recognition, counting, one-to-one matching, skip counting, and matching numbers to pictures (Chien et al., 2010) – should also become more complex as the year goes on and children's skills improve. Having explicit instruction time makes it possible for teachers to track children's abilities and adjust lessons appropriately.

Pre-k programs are, as a central goal, designed to help children be ready for kindergarten entry. To that end, early math skills at school entry were found to better predict later academic achievement than pre-literacy skills in at least one meta-analysis (Duncan et al., 2007). Both math and reading are traditional, core components of all school curricula, and with studies suggesting both pre-literacy and early math skills are predictive of positive outcomes (see Dickinson & Porche, 2011; Duncan et al., 2007), using a pre-k curriculum that includes both components is critical. Evidence also suggests inclusion of a third, less traditional, component, social-emotional (SE) development, is necessary to promote academic achievement and positive outcomes (Durlak, Weissburg, Dymnicki, Taylor, & Schellinger, 2011).

1.5 Social-emotional Lessons

Lessons related to SE development and functioning are, in general, less traditional components of public school systems, but the inclusion of SE lessons in pre-k curricula is gaining support among educators, psychologists, and child development experts (Durlak et al., 2011). The evidence suggests that there are immediate and long-term benefits to including SE lessons in pre-k curricula. In the short-term, the inclusion of SE lessons is likely to increase children's emotion knowledge, or accurate understanding of feelings and expressions associated with those feelings (Izard et al., 2011). SE lessons and increased emotion knowledge (and capacity to respond and express emotions appropriately) will assist in the development of SE skills during the pre-k year (Denham et al., 2012; Durlak et al., 2011; Gunter, Caldarella, Korth, & Young, 2012). Children with greater emotion regulation and self-control will be better at behaving and paying attention to teacher-led lessons than those with less self-control. Pre-schoolers with

greater emotion knowledge and self-control have been found to have greater academic competencies (Denham et al., 2012; Eisenberg, Sadovsky, & Spinrad, 2005). In the longer term, studies show better outcomes including employment, health, socioeconomic status, and education levels for those who developed more SE competencies in early childhood (Durlak et al., 2011; Heckman et al., 2013; Reynolds, Rolnick, Englund, & Temple, 2015). While individual child competencies are related to better individual outcomes, it is also important to highlight the degree to which children's SE competencies can influence the learning environment.

Children's individual SE competencies directly relate to their behavior and interactions in the classroom and thus have an impact on the overall learning environment. Put another way, a classroom of children with greater SE competencies is likely to have fewer problem behaviors, creating a better climate for learning and interactions than a classroom of children with fewer SE competencies. As Duncan and colleagues (2007) noted, misbehavior among one or more students in a classroom may prevent other children in the classroom from learning. It follows that fewer behavior problems in a classroom contribute to an environment more conducive for children to pay attention and learn, which can yield better academic achievement. Further, prosocial skills may lead to interactions with peers and adults, which foster language development. By including time for lessons in SE development, math, and literacy, children's chances of academic and life success increase, particularly when the schedule incorporates time for less structured free-play.

1.6 Informal Learning

The value of a focus on both learning and children's social interactions were highlighted by Vygotsky's (1933) sociocultural theory, in which he described learning as a social process that occurs in one's culture and society and requires interactions for language development and the exchange of knowledge between children, their advanced peers, and adults. Scheduled free-play fosters children's need for social interactions that help build their skills. Consistent with this theory, the Opening the World of Learning (OWL; Shickendanz & Dickinson, 2005) curriculum used in the present study includes time in the daily schedule for child-led play within classroom *centers*, or play areas with specific learning goals embedded within them. Quality of interactions during *center time* is of particular interest in the present study due to its semi-structured nature.

Overall, the extant literature suggests that the most effective curricula combine explicit teacher-led lessons with *playful learning*, or guided free-play in which children select child-led activities with learning goals subtly embedded in them (Hirsh-Pasek, Michnick Golinkoff, Berk, & Singer, 2008). Playful learning is more structured than free-play because there are learning goals incorporated in the activities but it still allows for free social interactions among children. Aligned with Vygotsky's sociocultural theory of learning, playful learning provides time for unstructured conversations between children and adults to share ideas, which builds vocabulary and language proficiency. Playful learning also reinforces math and literacy skills when children frequently use such skills during play and apply them to tasks they enjoy. It also provides opportunities for the children to teach each other, which in turn provides the teacher time for one-on-one conversations with children. By subtly guiding children in conversation, teachers help

children make connections between playful learning activities and the math and literacy lessons they have been learning during explicit teacher-led lesson times (Hirsh-Pasek et al., 2008). Helping children make connections between an idea and the application of that idea to a specific task builds logic and reasoning skills and reinforces the value of explicit teacher-led lessons.

Similarly, when teachers use playful learning and classroom interactions as opportunities to use positive discipline – which highlights appropriate, and redirects inappropriate, child behaviors – it reinforces the SE lessons children have learned during teacher-led lessons. Playful learning allows children to model social skills for one another, learn social norms from peers, work in self-selected groups to form bonds, and resolve interpersonal problems (Hirsh-Pasek et al., 2008). Teachers should allow children to interact freely, but guide conversations during conflict when children are not resolving it on their own. Teachers can use conflict resolution to remind children of the SE lessons they have learned and help them identify and regulate their emotions and empathize with each other. Additionally when teachers use reminders or make connections to SE lessons during positive or calm interactions throughout the day, children can better differentiate between positive and negative feelings and increase their emotion knowledge (Izard, Trentacosta, King, & Mostow, 2004).

Playful learning also provides opportunities for children to build coping skills during play activity (e.g., coping with waiting, taking turns, or sharing popular toys) and children can translate those coping skills to other day-to-day circumstances or stressful scenarios such as performing math and literacy problems (see Elias, 2003). When children are able to translate their SE competencies, coping skills, and, more broadly,

their capacity for emotion regulation to their academic work, they are more likely to complete difficult tasks and achieve more academically (Izard et al., 2004). This academic achievement can be strengthened when children model SE skills for one another during playful learning, but the manner in which teachers model those skills through interactions with the children and other adults throughout the day is also critical to the children's adoption of SE skills, and math and literacy knowledge.

1.7 Teacher-Child Interactions

A key component of quality instruction is a pre-k teacher's ability to manage a classroom and maintain a positive environment by modeling prosocial behaviors (Howes & Ritchie, 2002). Teachers can engage in warm, responsive interactions with children while providing content instruction. Teachers who do not appropriately balance content instruction with warmth can be too rigid and uninviting for children to learn properly (Magnuson et al., 2007). Rigid teaching styles, such as rote memory drills, are not developmentally appropriate for pre-kindergartners, discourage child participation, and do not promote SE growth (Hirsh-Pasek et al., 2008; Pianta, Hamre, & Allen, 2012). Balancing the curriculum content with warm, responsive conversations encourages children to be curious and ask questions, which promotes learning. Warm interactive teaching styles promote initiative taking, a skill necessary for reading and other academic tasks (Burchinal et al., 2008; Izard et al., 2004; Keys et al., 2013). In fact, evidence suggests that, when pre-k teachers accompany explicit lessons with warm, responsive interactions, children have better language and behavior outcomes during kindergarten – using one without the other does not have as strong an effect on child outcomes (Burchinal et al., 2008).

Pre-k teachers play an important role in developing children's social-emotional competence by not only modeling warm, positive interactions, but using positive discipline techniques – which encourage children to identify and talk through their feelings and the feelings of others during misbehavior or conflict – rather than using punitive techniques (Burchinal et al., 2008). In this way, teachers can help children build reasoning skills by linking behaviors or activities to explicit SE lessons, and relate their behaviors to their emotions in order to practice coping and emotion regulation. Such practices are important because emotion knowledge and self-regulation have been linked to academic success (Denham et al., 2012; Eisenberg et al., 2005).

Despite the established connection between SE functioning and academic performance and later life outcomes, early academic performance remains a priority over SE development in many school districts. Often, school principals' measures of success only include scores from standardized testing. The focus on test scores stems from state and federal legislation that highlights test scores and incentives tied to high scores. With exceptions, school districts are often limited in their funding for SE assessments, and assessments are only done when outside evaluators or other private sources of funding will pay for it. By limiting early assessments to those that measure academic functioning, school districts restrict the knowledge that can be obtained about their impact on students. Without ongoing data collection regarding program implementation or classroom practices and a range of indicators regarding children's development and functioning, it is difficult to identify specific relationships among classroom quality, students' academic and SE development, and later student outcomes. Limiting data collection prevents school districts from making informed decisions and changes to classroom instruction.

1.8 Study Rationale

Linking ongoing assessments of the quality of pre-k classroom instruction, academic and SE outcomes during pre-k and beyond would add longitudinal evidence to the extant literature and elucidate the importance of different aspects of quality instruction on SE gains and academic performance. There are few studies examining classroom quality and its proximal and distal relationships to both social-emotional and academic outcomes (see Peisner-Feinber et al., 2001). Such ongoing assessments would be useful on a local scale for districts to target classroom and curricular interventions.

The present study, which builds on findings from a yearlong evaluation of a publicly-funded pre-k program, aims to fill gaps in the literature by examining the relationships among the quality of pre-k classroom instruction, children's pre-k SE development, and their pre-k and kindergarten academic achievement. The evaluation examined several aspects of structural and procedural classroom quality. Among the findings from the original evaluation, a positive relationship was found between children's SE development and teachers' warmth, use of positive discipline, and ability to link child-led activities to explicit classroom lessons through logic and reasoning. Based on those findings from the total pre-k program population assessed in the evaluation, it is expected higher quality instruction will predict larger SE and pre-k academic gains among the subsample of children for whom kindergarten data are also available. Because the literature shows language development and reasoning skills are associated with higher quality instruction, it is expected higher quality instruction in pre-k will predict higher kindergarten achievement scores in math and reading. Moreover, because quality of pre-k instruction is expected to relate to pre-k SE development, and there is a known

relationship between early SE competencies and later academic achievement (e.g., Denham et al., 2012; Durlak, et al., 2011; Eisenberg et al., 2005), higher SE scores in pre-k are expected to partially mediate the positive relationship between classroom quality and kindergarten scores.

The proposed study will examine children enrolled in a publicly-funded pre-k program designed for children at risk of school failure in the Charlotte Mecklenburg School (CMS) system in North Carolina. The curricula for the pre-k program were specifically designed to promote pre-literacy and social-emotional skills, among other basic skills and cognitive development. Assessments of the quality of classroom instruction were collected via fall and spring classroom observations conducted while children were in *centers,* the semi-structured playful learning component of the schedule. Pre-k teachers rated SE development in the fall and spring via the Devereux Early Childhood Assessment (DECA; LeBuffe & Naglieri, 2012), and academic scores were assessed in pre-k and kindergarten via standardized tests administered by the school district. Using data collected during the pre-k and kindergarten year, the present study aims to answer the research questions below.

1.9 Research Questions

1.9.1 Pre-k Academic and Social-emotional Outcomes

Q1. How does quality of pre-kindergarten (pre-k) classroom instruction impact this sample of children's social-emotional development? More specifically, to what degree do students who attended classrooms rated higher on the Warmth and Discipline subscales (via classroom observations) receive better social-emotional

ratings from their kindergarten teachers (than children from classrooms rated lower on those subscales)?

H1. Similar to findings from the total population in the evaluation, higher quality classroom instruction will be related to greater social-emotional gains across the pre-k year in the selected sample.

a. Children in classrooms with teachers who received higher ratings on the Warmth and Discipline subscales will have experienced greater gains in social-emotional development than children in classrooms with teachers who received lower ratings on the two subscales.

Q2. How does pre-k classroom instruction impact children's pre-k academic performance?

a. To what degree do students who attended classrooms rated higher on Warmth, Discipline, or Logic & Reasoning subscales perform better on pre-k standardized academic assessments than children who attended classrooms with lower ratings on those subscales?

i. Which subscale explains the most variance on children's academic scores?

H2. Higher quality pre-k classroom instruction (i.e., higher scores on the three subscales) will be related to better academic performance during the kindergarten year (accounting for kindergarten classroom assignment).

1.9.2 Kindergarten Academic Outcomes

Q3. How does pre-k classroom instruction impact children's kindergarten academic performance?

a. To what degree do students who attended classrooms rated higher on Warmth, Positive Discipline, or Logic & Reasoning subscales perform better on kindergarten standardized academic assessments than children who attended classrooms with lower ratings on those subscales?

    i. Which subscale explains the most variance on children's academic scores?

H3. Higher quality pre-k classroom instruction (i.e., higher scores on the three subscales) will be related to better academic performance during the kindergarten year (accounting for kindergarten classroom assignment).

    i. Children from classrooms with higher ratings on Logic & Reasoning are expected to have higher math scores.

Q4. Are the relationships between measures of pre-k classroom instruction and kindergarten academic performance mediated by students' social-emotional development?

H4. Social-emotional development will partially mediate the relationship between pre-k classroom instruction and kindergarten academic performance.

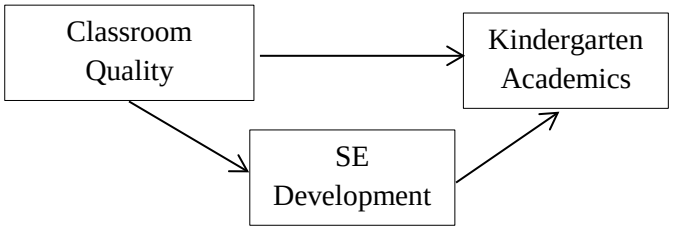

Figure 1: Mediation model

CHAPTER 2: METHODS

The present study builds on and extends a larger evaluation of a pre-k program conducted during the 2013-2014 academic year. Analyses from the larger evaluation showed a positive relationship between teachers' use of warmth and positive discipline practices and children's SE development. This study re-analyzed the relationship between classroom quality (i.e., teacher's use of warmth, positive discipline, and logic and reasoning) and children's development of SE competencies and language during pre-k in a sample of students for whom kindergarten data were available. The present study aimed to then connect secondary data from the evaluation with data collected by the local school district during the 2014-2015 academic year, to assess how pre-k classroom quality relates to academic achievement in kindergarten. Further analyses assessed whether children's pre-k SE functioning is related to kindergarten academic achievement.

2.1 Measures

2.1.1 Pre-k Social-emotional Development

Students' SE competencies were assessed via the Devereux Early Childhood Assessment (DECA) for Preschoolers, 2nd edition (LeBuffe. & Naglieri, 2012). Teachers completed the DECA for each student in their classroom in November 2013 and May 2014 to provide an indicator of children's SE development within the preschool year.

The DECA has two independent global scales, one measuring social-emotional competencies, called *Total Protective Factors* and another measuring *Problem*

Behaviors. The *Total Protective Factors* global scale is made up of three subscales assessing children's abilities in *Initiative, Attachment,* and *Self-regulation,* on which higher scores indicate more positive behaviors.

- *Initative* describes children's ability to take actions to meet their needs (e.g., good problem solving skills, being responsible, showing self-awareness, enjoying challenges, and initiating peer interactions).
- *Self-regulation* reflects children's ability to express emotion and manage behavior constructively (including frustration tolerance, cooperation with peers, and being patient, respectful, and considerate).
- *Attachment* assesses children's ability to promote and maintain positive connections with other children and significant adults by showing affection, trust, and optimism.
- *Problem Behaviors* include aggression, withdrawal, and lack of emotional control. Lower scores on this indicate more positive functioning.

2.1.2 Pre-k Academic Functioning

The Peabody Picture Vocabulary Test, 4th edition (Dunn & Dunn, 2007), a measure of receptive vocabulary often used as a screening test of verbal ability, was administered to each child in the fall of 2013 and spring of 2014. Each pre-k teacher had a trained colleague administer the PPVT to her students. Raw scores were converted into standardized scores ranging from 20-160 by the school district, with an average score of 100 (SD=15).

2.1.3 Pre-k Classroom Quality

In order to assess classroom quality and fidelity to the program's curricula, the university-based evaluation team worked with pre-k program administrators and staff to identify key dimensions and qualities of interest. An iterative process was used to develop a structured observation measure, and the measure drew (or adapted) items from multiple sources. The observation measure included selected items from the Early Childhood Environment Rating Scale-Revised (ECERS-R; Harms, Clifford, & Cryer, 1998) and items from a fidelity checklist designed by David Dickinson, the co-creator of the OWL curriculum used by the program. Dichotomous items (i.e., yes or no) were used to record whether each behavior described in an item occurred during the observation.

Observers were trained to conduct classroom observations by a local pre-k specialist. Classrooms were observed in the fall and spring during the 2013-2014 academic year to assess fidelity of implementation and classroom quality. Based on consultation with pre-k program staff, the observations occurred during the morning meeting and centers (i.e., playful learning) portions of the schedule because staff determined that these two times provided optimal opportunity for informal interactions between the teacher and children. By observing classrooms during activities that allow for informal interactions, observers were better able to assess how teachers interacted with individual students. Ninety-five percent of classrooms were assessed 95% by pairs of observers (5% had one observer) and reconciled responses following each observation to increase reliability of observation scores.

The present study focused on three aspects measured in the classroom observations – staff warmth, use of positive discipline techniques, and use of logic and

reasoning. Table 1 includes example items from the three scales (see Appendix A for the full scales). Subscales for staff use of *Warmth, Positive Discipline,* and *Logic and Reasoning* were developed during the evaluation. A conceptual review of 136 items included in the measure yielded eight constructs (Dickinson & Rowe, 2009 previously developed two of those constructs, assessing writing and morning discussion in the Enhanced Language and Literacy OWL Implementation Checklist). Members of the evaluation team identified which construct or scale each item was tapping into based on content. Only items with response variability above 5% were included in scale development. Following this inclusion of items based on content, internal consistency of each scale was tested using Cronbach's alpha; items that meaningfully decreased alphas were dropped. For the present study, the identified subscales were further assessed via confirmatory factor analysis (CFA).

CFA was conducted via SPSS Amos (Arbuckle, 2010) to verify the content of the subscales of interest for the present study and determine whether indicators from the spring classroom observations or the average of fall and spring indicators was most appropriate. Seven indicators included in the original subscales loaded onto more than one factor or did not load at all and were removed from the model. A comparison of spring scores and scores derived from the average of items in the fall and spring observations showed that using the average of items was a better fitting model representing the three factors or subscales (i.e., Warmth, Positive Discipline, Logic and Reasoning), as evidenced by the model specifications in Amos. Standards for model specifications suggest the root mean square error of approximation (RMSEA) of .08 is an adequate model and .05 is a close-fitting model A comparative fit index (CFI) above .9 is

recommended and a chi squared minimization (CMIN) below 3 is recommended (Hu & Bentler, 1999). Consideration of all model specifications for the present study (RMSEA=.07, CFI=.85, CMIN=1.4, CI=.02-.11) indicate the final factors comprised of averaged fall and spring scores are statistically sound. The use of average scores across multiple observations were used to account for day-to-day variability. Newly computed indicators were calculated by averaging fall and spring observation scores for items. The new indicators were then added together to compute subscale scores. Adding indicators to compute factor scores is preferred over averaging when the factors are exploratory and untested (see DiStefano, Zhu, & Mindrila, 2009). Cronbach's alphas for each subscale are considered questionable, but acceptable (Warmth: α=.64, Positive Discipline: α=.56, Logic and Reasoning: α= .67), but because the CFA indicated the scales were unidimensional, we proceeded with the subscales (Gliem & Gliem, 2009).

Table 1: Classroom quality subscales

Subscale	Example Item 1	Example Item 2
Warmth	*Staff show warmth through appropriate physical contact (e.g., pat on the back)*	*Staff respond sympathetically to help children who are upset, hurt, or angry.*
Positive Discipline	*Staff react consistently to children's behaviors*	*Staff prevent most behavior problems; are skilled in using redirection and other non-punitive strategies.*
Logic and Reasoning	*Concepts are introduced in response to children's interests or needs to solve problems (ex. Talk children through balancing a tall block building)*	*Staff talk about logical relationships while children play with materials that stimulate reasoning (ex. Sequence cards, same/different games, size and shape toys)*

2.1.4 Kindergarten Academic Functioning

Measures of children's academic functioning in kindergarten were administered three times throughout the 2014-2015 academic year. As part of the local school district's standardized assessment processes, the following measures were used in all schools.

The Measure of Academic Progress (MAP; Northwestern Evaluation Association, 2008) is a norm-referenced, standardized measure used to assess children's academic development and functioning in reading and math, so teachers can tailor instruction to their students. Kindergarten assessments of academic progress were administered three times across the school year (i.e., fall, winter, and spring). For the present study, individual composite MAP scores for fall and spring math and reading were provided by the local school district.

Composite scores from the Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Good & Kiminski, 2002), another assessment regularly administered by teachers, were also provided by the local school district as another indicator of students' literacy skills.

2.2 Participants

Pre-k program eligibility requirements stipulated that students had to be 48-59 months of age at the start of the school year. Eligibility was also dependent on a multi-component screening process that included the Brigance Early Childhood Screen (Glascoe, 2010), a parent survey, semi-structured interviews with caregivers / parents (including an assessment of child and family risks, information about parental employment and income, and subsidized childcare status), and qualitative reporting of observations about the child's interview behavior, personality, and developmental level.

Screenings were used to determine the degree to which children were at risk of school hardships or failure. Children deemed most at-risk for school failure via the screenings were permitted to enroll in the program. Enrolled children were assigned to one of 173 pre-k classrooms across 50 schools; this school assignment was based on proximity to each child's residence and the availability of open slots. The number of classrooms within each school ranged from two to seventeen, with a maximum enrollment of 18 children per classroom.

Stratified sampling was used to select teachers for observations such that all 50 schools were represented and approximately 50% of classrooms in each school were observed. Seventy-five pre-k classrooms were observed once in the fall and again in the spring during the 2013-2014 academic year.

Only children from those 75 observed classrooms were considered eligible for the present study. The sample for the larger evaluation from which the present sample was drawn included 2,415 students, 56% of whom were male, 46.5% were Latino, 37.8% were African America, 6.3% White, 6.5% Asian, and 2.7% Other Ethnicities. Twelve percent of the original sample were designated EC status and 7% LEP.

The sample of eligible students was further reduced for the present study based on availability of pre-k academic and social-emotional scores and kindergarten academic scores. Inclusion in the present study required availability of fall and spring PPVT (pre-k), DECA (pre-k), DIBELS (kindergarten), and MAP (kindergarten) scores. Limited information was available about children designated with *exceptional child* (EC) status, which identifies children with a diverse range of physical, developmental, and behavioral emotional concerns, who may receive other educational services. Because it was not

possible to understand the nature of the EC classification for individual children and examine for possible differences, children with EC status were removed from the sample. Moreover, one pre-k teacher did not complete the spring DECA for any student and was removed from the sample, reducing the sample of classrooms to 74.

The final sample for analysis included 450 students across 74 pre-k classrooms and 265 kindergarten classrooms. In this final sample, the number of students per pre-k classroom ranged from one to thirteen (M=6, SD=3). The student sample in the present study differed from the original pre-k sample, with a lower proportions of male, African American and White students in the final sample, and a higher proportion being female and Latino. The sample was 47.1% male and 52.9% female. Using the school system's classification for race and ethnicity, the sample included 54.4% Latino, 30.9% Black, 7.1% Asian, 5.1% White, and 2.4% Other races or ethnicities. Due to the small number of children representing these racial or ethnic categories, children from Asian, White, and Other ethnicities were grouped together as an 'Other' category for the purposes of analyses. A large proportion (41.3%) of students were identified as having *limited English proficiency (LEP)* in either pre-k (5.1%), kindergarten (32.4%) or both (3.8%). LEP status was strongly correlated with being a non-native English speaker (r=.87, p<.001). Due to multicollinearity among LEP and English as a second language (ESL) status, only LEP was used for analyses. LEP status encompassed a larger proportion of students and included 97% of children who spoke ESL.

CHAPTER 3: ANALYTIC APPROACH

Randomization is not practical in school or classroom assignments because children typically attend the school closest to their home. Because children attend the school closest to their home, children at one school are inherently different than those in another school. Collectively, children in one school are more likely to have similar backgrounds to one another (i.e., SES, access to resources, exposure to neighborhood-level adversities) than those in another school. This nested nature of the data (i.e., children nested within classrooms, and classrooms nested within schools) required hierarchical linear modeling (HLM) to assess appropriately the relationships between classroom quality and individual child outcomes (Raudenbush & Bryk, 1986). HLM is able to account for the influence of the school, classroom, and individual child characteristics via multiple sub-models within a larger model (Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2004). Due to the low number of teachers represented in each school (i.e., teachers with children in the final sample), analyses would have limited ability to detect the effect of school characteristics. Recommendations for samples sizes vary, though 10 groups at the highest level have been cited as a minimum and greater than 50 groups has been cited as optimal (Bell, Morgan, Kormrey, & Ferron, 2010; Maas & Hox, 2005). An average of 30 units per level is recommended, though studies indicate the sample size of the highest level is most important for reducing Type I error and

models with 100 or more level-2 groups can detect differences with as few as five units per group (Bell et al., 2010). The sample for the present study included one teacher per school in 50% of cases, and a maximum of four teachers at a school. As such, a two-level model was used to account for classroom and individual characteristics, rather than a three-level model accounting for school, classroom, and individual characteristics.

The use of cross-classified HLM analysis accounts for possible interactions between students' pre-k and kindergarten classroom-level variances by regrouping students based on their pre-k and kindergarten classroom enrollment such that students with the same pre-k and kindergarten teacher would be grouped together at level-2 (Raudenbush & Bryk, 2002). Cross-classification was deemed unnecessary because the number of students per kindergarten classroom was so small (*M=2, SD=1),* resulting in a nearly 1:1 ratio of students per pre-k and kindergarten grouping.

To assess the relationship between quality of instruction (classroom-level) and pre-k academic and SE outcomes (student-level), two separate sets of models were run (three for pre-k SE and one for pre-k academic outcomes), accounting for classroom- and student-level characteristics via two-level HLM. Given the exploratory nature of the study, a series of model building for each dependent variable was conducted. Each series included steps in which all three level-2 predictor variables were entered simultaneously, then in pairs, and finally predictors were entered independently. These steps were completed to determine the best fitting model for each outcome of interest. For example, models with simultaneous entry used all three subscales (i.e., Warmth, Positive Discipline, and Logic and Reasoning; W-PD-LR), three models used pairs of subscales

(i.e., W-PD, W-LR, PD-LR), and three models used each subscale independently (i.e., W, PD, LR). Gender, ethnicity, and LEP status were accounted for at the student-level.

Dependent variables were spring scores of receptive vocabulary / pre-literacy knowledge (PPVT) and SE functioning (DECA), both student-level indicators. Each DECA subscale (Attachment, Self-Regulation, Initiative, and Behavior Concerns) was examined separately rather than as the global Total Protective Factors score to facilitate identification of specific relationships between qualities of children's classroom experiences and child functioning. Student's fall scores on PPVT and DECA were included in the models assessing the corresponding spring score. Inclusion of fall scores as covariates allowed the examination of differences across spring scores given equal fall scores; that is, it accounted for differences in fall functioning.

To assess the relationships between pre-k classroom quality and kindergarten academic outcomes, fall and spring MAP reading scores, fall and spring MAP math scores, and fall and spring DIBELS composite scores were used as outcome variables in six sets of models. A structurally similar approach was used with the pre-k analyses: models accounted for students' fall scores when predicting spring scores, and a series of model building with varying combinations of classroom-level predictors (Warmth, Positive Discipline, Logic and Reasoning) were run to determine the best model. All tested models can be found in Appendix B.

Unconditional models without predictors were run to assess intra-class correlations (ICC) for each outcome variable. ICC indicates the amount of variance in each predicted outcome (i.e., PPVT, MAP, DIBELS, DECA scores) explained by classroom-level differences by calculating the ratio of variance at the student- and

classroom-levels (Raudenbush & Bryk, 2002). ICC is used to determine the necessity of using HLM rather than traditional regression analyses. There are no cutoff rules for ICC, however low ICCs (below .2) typically indicate HLM analyses will not yield different results than traditional regression because there is limited variability due to level-2 characteristics (Woltman, Feldman, MacKay, & Rocchi, 2012). While some suggest HLM is not necessary when low ICCs are calculated, it has been noted HLM may be beneficial in validating hypothesis tests and confidence intervals whereas traditional regression may invalidate them, when ICCs are close to zero (Hayes, 2006). Kreft, Kreft, and de Leeuw (1998) recommend using HLM when the ICC is above .1.

Pre-k outcomes including students' receptive vocabulary skills and SE functioning had moderate ICCs ranging from .28 to .53, while kindergarten outcomes including math and reading abilities had low ICCs ranging from .02 to .09. The low ICCs for kindergarten outcomes indicate the differences in students' abilities are largely attributable to individual student differences rather than differences in their pre-k classrooms. Classroom-level differences explained 16.6% of the variance for spring PPVT; they accounted for 53.2% of the variance for spring Attachment, 42.5% for Initiative, 42.7% for Self-Regulation, and 28.5% for Behavior Concerns scores on the DECA. Classroom-level differences explained 1.8% of the variance in fall MAP reading scores, 3.8% in fall MAP math scores, 7% in spring MAP reading, 6% in spring MAP math, 9% in fall DIBELS, and 7.4% in spring DIBELS scores. The remaining variance for each outcome can be attributed to individual student differences. Despite the low ICCs for kindergarten outcomes, HLM analyses were conducted to examine the nature of the relationships.

As one of the study's central hypotheses, it was expected that any relationship found between classroom quality and SE development would partially explain any relationships identified between pre-k classroom quality and kindergarten outcomes because children with higher SE functioning tend to perform better academically (Denham et al., 2012; Eisenberg et al., 2005). However, because pre-k classroom quality was not significantly related to kindergarten achievement, mediation models were not tested for the present study. The relationships between students' SE functioning in the spring of pre-k and their academic achievement in kindergarten were tested using hierarchical multiple regression in SPSS 21 (IBM Corp., 2012).

CHAPTER 4: RESULTS

4.1 Relationships between Classroom Quality and Pre-k Academics

HLM analyses began with a test of the relationship between pre-k classroom quality and children's pre-k academic functioning via PPVT scores. Consistent with findings from the larger evaluation from which this study grows, none of the indicators of pre-k classroom quality were significantly related to children's pre-k academic functioning. A full listing of these results, while not included here, are available from the author.

4.2 Relationships between Classroom Quality and Pre-k Social Emotional Functioning

When assessing the relationships between classroom-level variables and student SE functioning, the models in which Warmth was the only classroom-level predictor were the best fit for the Attachment, Self-Regulation, and Initiative subscales, explaining 35.5%, 29.9%, and 33.7% of the total classroom-level variance (i.e., the ICC), respectively, for each outcome. The model with Warmth and Positive Discipline as classroom-level predictors was the best fit for Behavior Concerns, explaining 47.7% of the total classroom-level variance. The effect size, or model fit, was assessed via Kreft, Kreft, and de Leeuw's (1998) formula for pseudo R^2. These findings indicate that the degree to which teachers use Warmth and/or Positive Discipline in interactions with students explains about one-fourth to one-half of the total classroom-level variance in

students SE functioning. As noted in the ICCs, classroom-level variance accounted for 28% - 53% of

the variability in students' SE scores, indicating Warmth and Positive Discipline had an overall large effect on students SE functioning.Higher ratings of teacher Warmth were related to higher ratings of student Attachment (β= 2.87, p<.05) and lower ratings of Behavior Concerns (β = -2.5, p<.05). These findings indicate that children in classrooms in which teachers had higher Warmth ratings had stronger relationships with adults and children and had fewer behavior problems, as reported by their teachers. The positive relationship between Warmth and Initiative scores trended toward significance (β = 1.98, p=.07), indicating children in classrooms in which teachers had higher Warmth ratings tended to show greater self-awareness and problem solving skills. Table 2 summarizes findings for the models examining the association between Warmth, and Warmth and Discipline and the DECA subscales.

Table 2: Parameter estimates for students' spring social-emotional outcomes

	Attachment	Self-Regulation	Initiative	Behavior Concerns
Intercept	53.37	54.93	57.22	41.6
Warmth	2.86*	1.19	1.98†	-2.5*
Discipline				1.35
Female	2.02*	1.05†	1.07	-0.52
Black	-1.14	-1.44*	-0.16	2.11*
Other	-0.02	0.19	1.94†	-0.83
LEP	-0.92	-0.87	-1.02	-0.58
Fall SE Score[1]	0.39**	0.47**	0.48**	0.53**

Note. 1. Fall SE Score refers to the corresponding spring subscale. † Indicates p<.1
* Indicates p<.05, **Indicates p<.001

4.3 Relationships between Classroom Quality and Kindergarten Academics

There were no significant relationships between pre-k classroom quality and children's kindergarten academic achievement. Given the low ICCs for kindergarten

outcomes, which indicate limited variance due to classroom-level characteristics, it is not surprising relationships were not detected. Fit statistics were assessed to identify the role each classroom-level indicator (Warmth, Positive Discipline, Logic and Reasoning) played in explaining any of the classroom-level variance. For each outcome of interest (i.e., fall and spring MAP math, reading, DIBELS) models, including different classroom-level predictors (i.e., W-PD-LR, PD-LR, PD-W, W-LR, W, LR, PD), were identified as the best fit based on pseudo R^2 calculations. For instance, models with Positive Discipline as the only classroom-level predictor explained the most variance when assessing MAP spring math scores (32.96%) and spring DIBELS scores (15.66%). The model with Warmth and Positive Discipline explained the most variance for MAP fall reading (35.24%) and the model with Warmth as the only predictor explained the most variance in MAP fall math (24.56%) and spring reading (52.29%). None of the conditional models explained the variance for fall DIBELS scores better than the unconditional model without predictors, as indicated by negative effect sizes. Despite null findings, these effect sizes indicate teacher characteristics explain about one-sixth to one-half of the overall between-classroom variance in students' outcome scores, which is notable.

One of the questions of interest for the present study was whether SE functioning partially mediated any relationship between classroom quality and students' academic functioning. Due to null findings between classroom quality and academic functioning, mediation models were not examined for the present study. Relationships between SE functioning and academic outcomes were assessed to fully illustrate the relationships between pre-k and kindergarten outcomes.

4.4 Relationships between Pre-k Social Emotional Functioning and Kindergarten Academic Outcomes

Pre-k spring SE subscale scores were entered into the regression simultaneously after accounting for demographic characteristics, and there were several significant relationships between children's pre-k SE functioning and their kindergarten academic achievement scores. Both Initiative and Behavior Concerns had the expected relationship with academic outcomes, such that children with greater self-awareness and problems solving skills (i.e., Initiative) and fewer behavior problems (i.e., Behavior Concerns) at the end of pre-k performed better on standardized tests of academic achievement in kindergarten. Children's spring Initiative scores were significantly related to fall DIBELS (β =.51, p<.001) and MAP fall reading (β =.44, p<.001) and math (β =.51, p<.001), and spring reading (β =.13, p<.001) and math (β =.13, p<.05). Children's scores on Behavior Concerns, in which higher scores indicate more behavior problems, were significantly related to MAP fall reading (β = -.17, p<.001) and math (β = -.21, p<.001), and spring reading (β = -.13, p<.001) and math (β = -.12, p<.001) scores.

Children's Attachment scores related significantly to their kindergarten academic achievement scores; however, the identified relationships were contrary to the hypothesized positive relationship. That is, Attachment was negatively related to fall DIBELS (β = -.24, p<.001) and MAP fall reading (β = -.14, p<.05) and math scores (β = -.27, p<.001), and spring reading (β = -.11, p<.05) scores. These findings indicate that children with higher levels of teacher-rated Attachment at the end of pre-k tend to perform worse on kindergarten assessments than children with lower ratings of Attachment. These findings are discussed in the discussion and implications section of this paper.

Table 3: Coefficients for pre-k and kindergarten academic outcomes

	PPVT	Fall Reading	Fall Math	Spring Reading	Spring Math	Fall DIBELS	Spring DIBELS
HLM Classroom-level Quality Predictors							
Intercept	89.37	137.73	132.97	145.12	142.80	43.43	139.25
Warmth	1.19	-0.98	-0.07	0.78		0.33	
Discipline		1.23			0.44	-0.99	5.39
Female	0.33	2.36**	1.84*	1.06	0.19	2.16	6.54*
Black	2.21*	1.69	1.53	2.06*	0.11	5.03*	0.38
Other	0.26	2.43	2.91*	3.05*	1.96†	6.05†	11.61†
LEP	-0.4	-1.35	-2.14†	-0.04	-0.92	-5.5	-1.42
Fall Score^	.46**			0.71**	0.88**		1.05**
HMR Student-level Prosocial Predictors							
Intercept		127.61	118.09	46.98	26.24	25.59	90.46
Spring Attachment		-0.13*	-0.26**	-0.11*	-0.04	-0.48**	-0.38
Spring Initiative		0.39**	0.49**	0.13*	0.15*	0.98**	0.27
Spring Self-regulation		-0.10	0.01	0.02	-0.07	-0.23†	0.16
Female		2.41*	1.88*	1.13	0.17	2.45	6.98*
Black		1.87†	1.94†	2.14*	0.35	4.62*	0.57
Other		1.73	2.07†	2.9*	1.66	3.12	13.55*
LEP		-0.73	-1.41	0.12	-0.43	-3.85†	-2.25
Fall Score^				0.68**	0.85**		1.01**
HMR Student-level Behavior Concern Predictors							
Intercept		144.66	142.39	55.15	34.82	59.63	100.78
Behavior Concerns		-.16**	-.22**	-.14**	-.15**	-.37**	-.17
Female		2.04*	1.42	.78	-.19	1.24	6.31†
Black		2.08*	2.09†	2.37*	.68	5.27*	.74
Other		2.26†	2.67*	2.85*	1.66	4.32	13.38*
LEP		-1.36	-2.13*	-.01	-.67	-5.12*	-2.23
Fall Score^				.69**	.85**		1.03**

Note. ^Fall Score refers to the corresponding spring subscale. † indicates $p < .1$, * indicates $p<.05$, **Indicates $p<.001$

4.5 Disparities in Social-emotional and Academic Outcomes as a Function of Student Characteristics

Student-level predictors such as gender, race/ethnicity, and LEP status were related to several outcomes; significance varied as a function of independent variables included in the final model. Three final models included 1) classroom-level independent variables (i.e., Warmth, Positive Discipline, and Logic and Reasoning), 2) prosocial skills (i.e., Attachment, Self-regulation, and Initiative), and 3) Behavior Concerns. In all three final models, Black students and students from Other race/ethnicities received significantly higher scores ($p<.05$) on the kindergarten MAP spring reading assessment than Latino students. Black students scored higher than Latinos on the fall DIBELS assessment ($p<.05$), and female students scored significantly higher than males in all three models on the MAP fall reading assessment.

In two of the three final models, females and students from Other race/ethnicities scored significantly higher on MAP fall math and spring DIBELS. In one of the final three models, students with LEP status scored lower on MAP fall math and fall DIBELS ($p<.05$) and Black students score higher than Latinos on the MAP fall reading ($p<.05$). No student-level characteristics were associated with MAP spring math scores. Significant relationships between race and SE functioning were also found. Black students received worse ratings on Self-regulation ($p<.05$) and Behavior Concerns ($p<.05$) during pre-k than Latino students. Regardless of race, females received higher scores on Attachment ($p<.05$).

CHAPTER 5: DISCUSSION

This study examined the relationship between pre-k classroom quality, as measured by teachers' use of Warmth, Positive Discipline, and Logic and Reasoning in teacher-child interactions with students identified as being at risk for school failure, and (a) children's pre-k academic and SE functioning and (b) their kindergarten academic achievement. It also sought to examine the nature of children's SE functioning in pre-k and its relationship to kindergarten achievement.

5.1 Relationships between Classroom Quality and Academic Outcomes

The expected relationships between pre-k classroom quality measures and students' pre-k and kindergarten academic achievement were not significant in this sample. These null findings suggest that, individually, the measured aspects of classroom quality are not related to children's development of literacy or math skills. Research indicates teachers' use of warmth in interactions with children creates a more inviting learning environment, promoting conversation and questions from students, which leads to greater development (Magnuson et al., 2007). However, the research assessing the impact of teacher warmth on children's academic outcomes also highlights the importance of the balance between warmth and content instruction (Burchinal et al., 2008). In the present study, indicators of quality were assessed individually to better understand discrete relationships between those indicators and children's outcomes. Because the indicators were assessed as individual predictors rather than computing a

global quality score including Warmth, Logic and Reasoning, and Positive Discipline together, the present study does not account for any possible interaction between teachers' warmth and content instruction or teachers' ability to balance the use of the three indicators of interest.

Although the present study measured teachers' inclusion of logical relationships in conversations with children, the observation protocol did not measure whether the children understood the concepts as explained by the teacher, or whether there was clarity in the descriptions. The measure merely reflected whether teachers tried to explain logical relationships. Inclusion of other measures of classroom content instruction in addition to Logic and Reasoning, or measures of clarity of instruction may also be necessary to fully measure content instruction. As a result, the findings cannot provide insight into any potential relationship between overall classroom quality (i.e., quality of content and interactions) and students' academic outcomes. These potential relationships should be assessed as a next step to understand the ways in which overall classroom quality may relate to learning. Burchinal and colleagues (2008) found that children learned more in pre-k and sustained their academic gains through kindergarten when their pre-k teachers encouraged reasoning skills, used positive discipline techniques, had frequent interactions with children and provide clear, positive feedback, though these indicators were combined as a composite score.

5.2 Relationships between Classroom Quality and Pre-k Social Emotional Functioning

As expected, aspects of classroom quality were significantly related to children's SE functioning. When teachers interacted with students in a warm manner by responding sympathetically to children's needs, showing respect for children, and using appropriate

physical contact (such as pats on the back to support students), students in their classrooms evidenced more growth in SE functioning. Specifically, students were more likely to have stronger relationships (as measured by Attachment) with other children and with adults when their teachers demonstrated greater levels of Warmth in their classroom interactions. Students also had fewer behavior problems (as measured by Behavior Concerns), such as throwing tantrums, fighting with other children, or getting easily distracted or upset in classrooms, when their teachers received higher ratings of Warmth. Students tended to show higher levels of Initiative, using independent thought and taking action to meet their own needs, when teachers exhibited greater Warmth, but the relationship did not reach statistical significance. These relationships between Warmth and SE functioning suggest a warm and supportive classroom environment may be more conducive to SE growth.

These findings are consistent with prior findings that warm, supportive interactions between teachers and students in pre-k are related to greater social competence and fewer behavior problems among at-risk students (Burchinal et al., 2008; Cadima, Verschueren, Leal, & Guedes, 2016). Such findings are important given the noted relationship between social competence and academic performance and later life outcomes (Heckman et al., 2013).

Attachment in this context refers to students' ability to make and maintain positive relationships with adults and peers, which has been identified as a direct result of teacher warmth and as an essential characteristic for academic engagement and achievement (see Furrer, Skinner, & Pitzer, 2014). Further, in the present study, teachers' warmth was related to fewer behavior problems among students. Prior work (Hamre &

Pianta, 2001) has shown that the ability to make positive connections with others is related to fewer behavior problems. This suggests that teachers who interact more warmly with their students may develop stronger relationships with their students (as evidenced by the relationship to Attachment), which could then lead to fewer behavior problems. It is important to note, the findings do not imply teachers' use of warmth causes students' SE development, but there is a relationship between the two. In fact, Mashburn and colleagues (2006) suggest teacher-reported measures of students' SE competencies are biased as a result of teacher and classroom characteristics, such that teachers with less experience, smaller class size, and more positive attitudes (i.e., warmth) may rate their students more positively on measures of SE competence. Ambiguity regarding the directionality of these relationships warrants further examination.

5.3 Relationships between Social Emotional Functioning and Kindergarten Academic Outcomes

Students' SE functioning at the end of pre-k was significantly related to their kindergarten achievement. Children with fewer Behavior Concerns and greater levels of Initiative at the end of pre-k performed better on kindergarten measures of math and literacy. These findings underscore the need to emphasize SE development during pre-k and throughout early childhood. Behavior Concerns include characteristics such as having a short attention span, and getting easily distracted or upset (LeBuffe & Naglieri, 2012). Children with fewer Behavior Concerns might certainly be expected to perform better on assessments of academic achievement. The definition of the DECA Initiative subscale includes characteristics such as good problem solving skills and enjoying challenges (LeBuffe & Naglieri, 2012), which may make test taking less stressful for

children with higher Initiative ratings, leading to better performance (e.g., Ramirez, Gunderson, Levine, & Beilock, 2013). Children with greater levels of Initiative and fewer Behavior Concerns are likely to be able to pay better attention during class lessons and ask questions when confused leading to a better understanding of the content instruction (Denham et al., 2012; Eisenberg et al., 2005; Lebuffe & Naglieri, 2012). While the relationships involving Behavior Concerns and Initiative were expected, the negative relationship between Attachment and the standardized test scores was not.

When children had higher levels of Attachment, a protective factor, they performed worse than children with lower Attachment scores. This relationship should be explored more thoroughly, but it could suggest that children receive higher scores on the Attachment in pre-k because they enjoy interacting with others, which may become problematic if the child is talking rather than paying attention to instruction. This unexpected relationship between Attachment and academic performance may also be explained by the teacher bias in SE ratings as described by Mashburn and colleagues (2006). Teacher bias in SE ratings could lead to inflated ratings of Attachment and an inaccurate relationship between Attachment and academic functioning.

The analyses in the present study were unable to detect a direct relationship between classroom quality and students' kindergarten outcomes, but the findings suggest an indirect relationship via SE functioning. As discussed in the previous section, students from classrooms with warm, supportive environments tend to develop stronger relationships and become more engaged with their teachers and peers (Reyes, Brackett, Rivers, White, & Salovey, 2012), which was evidenced by greater ratings of Attachment. Warm supportive interactions were also expected to yield greater academic achievement

scores, but the relationship was not significant. It is plausible, that Attachment is a moderating variable, weakening the relationship between Warmth and academic achievement. The positive relationship between Warmth and Attachment, and the negative relationship between Attachment and academic outcomes may suggest that Attachment is reducing any relationship between Warmth and achievement scores leading to type II error. Conversely, the relationship between Warmth and achievement is likely strengthened via students' Initiative and Behavior Concern scores because those scores have less to do with teacher-student relationships. The present study did not account for overall quality, which could also impact the detected in relationships. For example, teachers rated high on the Warmth measures likely have variability in their use of Positive Discipline and Logic and Reasoning. Teachers high in Warmth, but low in the other two quality scales may help children develop Attachment characteristics with little academic learning, which could lead to a negative association between Attachment and academic achievement.

Students performed better on five of the six kindergarten achievement tests when they received higher ratings of Initiative and lower rating of Behavior Concerns. Students also tended to receive better SE competency ratings such as higher Initiative and lower Behavior Concerns scores when their teacher received higher ratings on the Warmth subscale. Much like Attachment scores, these findings suggest students' SE competencies may fully explain an indirect effect of teacher warmth on students' academic functioning or moderate the effect. These findings have implications for policy and practice.

These findings are relevant for early childhood educators. Consistent with prior studies (Blair & Diamond, 2008; Curby et al., 2009; Durlak et al., 2011), the present

study underscores the importance of SE development during pre-k, as it strongly predicts kindergarten achievement. It also supports the importance of the types of interactions teachers have with their students as a means of developing SE competencies. These findings reinforce the importance of teacher-child interactions in the pre-k classroom and an emphasis on modeling and teaching social-emotional skills to pre-k students in combination with other classroom content instruction.

Given the variability in teachers' ratings on the Warmth, Positive Discipline, and Logic and Reasoning indicators, professional development to improve curriculum implementation fidelity and emphasize the importance of supportive teacher-child interactions could be used to improve students' academic achievement (Early et al., 2007). By improving pre-k teachers' abilities to support their students through warm interactions and balancing content instruction, children in pre-k are more likely to develop social emotional competencies and classroom skills that are necessary to succeed in school (Izard et al., 2011). Such findings in a sample of students from minority backgrounds who were deemed at-risk for school failure are encouraging and have implications for closing the achievement gap.

Although the finding was null, it is important to consider the lack of association between measures of Self-regulation and student achievement. Self-regulation has been identified as a primary social skill related to school performance (Denham et al., 2012; Eisenberg et al., 2005; Masten & Coatsworth, 1998) although the pathways between the relationship are still being examined (McClelland & Tominey, 2011). McClelland and Tominey (2011) note the relationship between self-regulation and academic achievement may be reduced by an accumulation of risk factors such as being an English language

learner, and that subjective measures of self-regulation (such as the DECA) may be less accurate than objective measures (e.g., Pre-school Self-Regulation Assessment; Smith-Donald, Raver, Hayes, & Richardson, 2007). A more clear understanding of the role of Self-Regulation and childhood adversities in students' academic performance is needed.

5.4 Relationship between Student Characteristics and Academic and Social-emotional Outcomes

Female students tended to perform better on some kindergarten academic assessments, but not all, which is consistent with prior studies (Mashburn et al., 2008; Peisner-Feinberg et al., 2001). Latinos and students with limited English proficiency tended to perform worse on measures of academic achievement than other students. These findings indicate the need to provide more targeted interventions to boys and Latinos, particularly those whose parents are not native English speakers.

Targeting interventions toward Latino children is of particular importance in the local school district, where the proportion of Latinos enrolled doubled between 2013 and 2015. Gormley (2008) noted high quality pre-k can be as effective, if not moreso for Latino English language learners than their peers. Gormley (2008) recommended changes to promote greater development among Latino children, which include hiring more Latino and bilingual teachers.

CHAPTER 6: LIMITATIONS AND FUTURE DIRECTIONS

This study has several limitations. Missing data reduced the sample by nearly half, which may have limited the ability to detect significant relationships. Many of the students were removed from the sample as a result of one or more missing DECA items. DECA subscale scores cannot be calculated if a single item is missing (Lebuffe & Naglieri, 2012), and students were removed from the sample if a subscale score was missing. Other missing data were a result of students being absent or not enrolled at the time of testing. The inclusion criteria resulted in the final sample differing demographically from the original pre-k sample. As a result, caution should be taken when generalizing the findings to the entire pre-k program.

Due to multicollinearity, ESL and LEP could not be entered into the models together. LEP was selected because there was greater overlap (i.e., more ESL children were also LEP than vice versa). This loss of information is not considered substantial, but should be noted. A more substantial limitation is the decision to identify children in the final sample as EC or LEP status if they were ever identified by the school district – in either pre-k or kindergarten – as being EC or LEP. While there was overlap, many children were only designated EC (27%) or LEP (91%) status in one grade, typically during kindergarten. It is unclear if these differences are due to changing criteria between pre-k and kindergarten for each status, or differences in the ability to detect disabilities in pre-k, or a combination of both. Ultimately, students with EC status were removed from

the sample because EC status can be given to children with disabilities, who typically receive extra school interventions as a result. Because it was unknown how EC designation would affect a student's performance, students with that designation were removed from the sample. More information about these classifications is needed from the school district to better understand the implications of the decisions for the present study and future investigations. Further, limited information about contextual factors such as students' SES, or maternal education levels, which are known to interact with students' SE development and academic abilities, were not available for the present study. Future pre-k assessments should include those characteristics as covariates to account for any differences across students' family background.

The use of three classroom quality indicators as separate predictors of children's outcomes presents further limitations. The CFI for the model was below the .9 cutoff (Hu & Bentler, 1999), which could lead to model misspecification. Further analysis of the subscale makeup should be examined to determine a more appropriate model. Further, the classroom quality indicators were not individually related to academic outcomes. Global scores of classroom quality, considering all three constructs as a classroom profile, may prove to be more predictive of children's outcomes. This sample should be further assessed to determine if there is a relationship between classroom quality profiles (accounting for all Warmth, Positive Discipline, and Logic and Reasoning scores) and kindergarten achievement. A further limitation of the present study is the focus on relationships between pre-k indicators and kindergarten outcomes to the exclusion of national norms or a comparison group. Without comparing children's academic scores to local or national norms, conclusions about the impact of the pre-k program are limited.

Because there was no comparison group in the present study and the observed classrooms did not largely differ in their physical resources, aspects of design and infrastructure in the classroom quality measures were excluded. Stronger relationships on the overall impact of the pre-k program assessed in the present study could be uncovered with further assessment of additional aspects of teaching quality and via quality profiles that take into account variability across the quality measures.

Finally, the relationship between pre-k quality and kindergarten achievement was likely weakened by the summer months during which children may lose abilities gained in pre-k. Assessing students' SE competencies in kindergarten may benefit future studies because having a second measure of SE functioning may reduce bias and account for any gains lost during summer months. The many complex relationships warrant further analyses to fully understand the relationships between pre-k classroom quality, students' SE development, and students' kindergarten academic achievement. A full mediation model assessing the link between pre-k classroom quality and kindergarten academic achievement via students' SE functioning is the next step to better understand the relationship between pre-k classroom quality and students' later academic achievement.

CHAPTER 7: CONCLUSION

Findings in the present study support the already extensive literature highlighting the importance of SE functioning on students' academic achievement (Eisenberg et al., 2005; Izard et al., 2011). Increasing the focus on SE development during early childhood and measuring children's SE development up through third grade, when academic abilities tend to stabilize, can help pre-k and early elementary teachers bolster students' academic performance. A clearer understanding of students' strengths and areas in need of improvement as it relates to their SE functioning may be a large part of the solution to closing the achievement gap. Further, understanding how teachers' interactions and behaviors can strengthen students' SE development and including such information in trainings is critical to supporting teachers in the classroom.

REFERENCES

Arbuckle, J. L. (2010). IBM SPSS AMOS (Version 19) [Computer Program]. Chicago: SPSS Inc.

Barnett, W.S. & Yarosz, D.J. (2004). Who goes to preschool and why does it matter? In Frede, E.C. & Barnett, W.S. (Eds.) *Policy Facts Series, National Institute for Early Education Research.*

Barnett, W.S. (2013). *Getting the facts right on pre-k and the president's pre-k proposal*. New Brunswick, NJ. National Institute for Early Education Research.

Barnett, W.S. (2015). The state of preschool: State preschool yearbook. National Institute for Early Education Research.

Belfield, C. R., Nores, M., Barnett, S., & Schweinhart, L. (2006). The High/Scope Perry Preschool Program: Cost-benefit analysis using data from the age-40 followup. *Journal of Human Resources, 41,* 1, 162-190.

Bell, B. A., Morgan, G. B., Kromrey, J. D., & Ferron, J. M. (2010). The impact of small cluster size on multilevel models: a Monte Carlo examination of two-level models with binary and continuous predictors. *JSM Proceedings, Survey Research Methods Section*, 4057-4067.

Blair, C., & Diamond, A. (2008). Biological processes in prevention and intervention: The promotion of self-regulation as a means of preventing school failure. *Development and Psychopathology, 20,* 3, 899-911.

Brown, B. V., Bogard, K., & Child Trends, Inc., Washington, DC. (2007). Pre-kindergarten to 3rd grade (pk-3) school-based resources and third grade outcomes. *CrossCurrents*, 5, (2007-27). Washington, DC: Child Trends. . Retrieved from: http://www.childtrends.org.

Burchinal, M., Howes, C., Pianta, R., Bryant, D., Early, D., Clifford, R., & Barbarin, O. (2008). Predicting child outcomes at the end of kindergarten from the quality of pre-kindergarten teacher–child interactions and instruction. *Applied Developmental Science, 12,* 3, 140-153.

Burchinal, M., Vandergrift, N., Pianta, R., & Mashburn, A. (2010). Threshold analysis of association between child care quality and child outcomes for low-income children in pre-kindergarten programs. *Early Childhood Research Quarterly, 25*, 166-176.

Cadima, J., Verschueren, K., Leal, T., & Guedes, C. (2016). Classroom interactions, dyadic teacher–child relationships, and self–regulation in socially disadvantaged young children. *Journal of Abnormal Child Psychology, 44,* 1, 7-17.

Camilli, G., Vargas, S. Ryan, S. & Barnett, W. S. (2010). Meta-Analysis of the effects of early education interventions on cognitive and social development. *Teachers College Record*, 112, 579-620.

Campbell, F. A., & Ramey, C. T. (1995). Cognitive and school outcomes for high-risk African-American students at middle adolescence: positive effects of early intervention. *American Educational Research Journal, 32,* 743-72.

Chien, N. C., Howes, C., Burchinal, M., Pianta, R. C., Ritchie, S., Bryant, D. M., …Barbarin, O. A. (2010). Children's classroom engagement and school readiness gains in prekindergarten. *Child Development, 81*, 1534-1549.

Cuhna, F., Heckman, J.J., Lochner, L., & Masterov, D.V. (2005). Interpreting the evidence on life cycle skill formation. University College London. Discussion Papers in Economics.

Curby, T. W., LoCasale-Crouch, J., Konold, T. R., Pianta, R. C., Howes, C., Burchinal, M., … Barbarin, O. (2009). The relations of observed pre-k classroom quality profiles to children's achievement and social competence. *Early Education and Development, 20*, 346-372.

Currie, J., & Rossin-Slater, M. (2015). Early-life origins of life-cycle well-being: research and policy implications. *Journal of Policy Analysis and Management,* 34, 208-242.

Denham, S. A., Bassett, H. H., Way, E., Mincic, M., Zinsser, K., & Graling, K. (2012). Preschoolers' emotion knowledge: Self-regulatory foundations, and predictions of early school success. *Cognition & Emotion, 26,* 4, 667-679.

Dickinson, D. K., & Porche, M. V. (2011). Relation between language experiences in preschool classrooms and children's kindergarten and fourth-grade language and reading abilities. *Child Development, 82,* 870-886.

DiStefano, C., Zhu, M., & Mindrila, D. (2009). Understanding and using factor scores: Considerations for the applied researcher. *Practical Assessment, Research & Evaluation, 14*, 20.

Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., Pagani, L. S., ... Japel, C. (2007). School readiness and later achievement. *Developmental Psychology,* 43, 1428-1446.

Dunn, L. M., Dunn, D. M., & Pearson Assessments. (2007). *PPVT---4: Peabody Picture Vocabulary Test*. Minneapolis, MN: Pearson Assessments.

Durlak, J. A., & DuPre, E. P. (2008). Implementation matters: A review of research on the influence of implementation on program outcomes and the factors affecting implementation. *American Journal of Community Psychology, 41*, 327-350.

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students' social and emotional learning: a meta-analysis of school-based universal interventions. *Child Development, 82,* 1, 405-432.

Early, D. M., Maxwell, K. L., Burchinal, M., Alva, S., Bender, R. H., Bryant, D., Cai, K., ... Zill, N. (2007). Teachers' education, classroom quality, and young children's academic skills: Results from seven studies of preschool programs. *Child Development, 78,* 2, 558-580.

Eisenberg, N., Sadovsky, A., & Spinrad, T. L. (2005). Associations of emotion-related regulation with language skills, emotion knowledge, and academic outcomes. *New Directions for Child and Adolescent Development, 109,* 109-118.

Elias, M. (2003). Academic and social-emotional learning. *Educational Practices Series*. International Bureau of Education.

Furrer, C., Skinner, E., & Pitzer, J. (2014). The influence of teacher and peer relationships on students' classroom engagement and everyday motivational resilience. *National Society for the Study of Education, 113,* 1, 101-123.

Glascoe, F.P. (2010). *Technical Report For the BRIGANCE® Screens*. North Billerica, MA: Curriculum Associates, Inc.

Gliem, R. R., & Gliem, J. A. (2003). *Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales*. Midwest Research-to-Practice Conference in Adult, Continuing, and Community Education.

Good, R. H., & Kaminski, R. A. (Eds.). (2002). *Dynamic Indicators of Basic Early Literacy Skills* (6th ed.). Eugene, OR: Institute for the Development of Education Achievement. Available at http://dibels .uoregon.edu.

Gormley, W. T. (2008). The Effects of Oklahoma's Pre-K Program on Hispanic Children*. *Social Science Quarterly*, *89*(4), 916-936.

Gunter, L., Caldarella, P., Korth, B. B., & Young, K. R. (2012). Promoting social and emotional learning in preschool students: A study of "Strong Start Pre-K". *Early Childhood Education Journal*, 40, 3, 151-159.

Haberman, M. (1991). The pedagogy of poverty versus good teaching. *Phi Delta Kappan, 73,* 4, 290-94.

Hamre, B. K., & Pianta, R. C. (2001). Early teacher–child relationships and the trajectory of children's school outcomes through eighth grade. *Child development*, *72*(2), 625-638.

Harms, T., Clifford, R.M., & Cryer, D. (1998). Early childhood environment rating scale-revised. *Teachers College Press.*

Hayes, A. F. (2006). A primer on multilevel modeling. *Human Communication Research, 32*, 4, 385-410.

Heckman, J., Pinto, R., & Savelyev, P. (2013). Understanding the mechanisms through which an influential early childhood program boosted adult outcomes. *American Economic Review, 103,* 6, 2052-2086.

Hernandez, D., (2011). *Double jeopardy: How third-grade reading skills and poverty influence high school graduation*. The Annie E. Casey Foundation. Retrieved from: www.gradelevelreading.net/wordpress/wp-content/uploads/2010/10/Double JeopardyReport040511FINAL.pdf

Hirsh-Pasek, K., Golinkoff, R., Berk, L., & Singer, D. (2008). *A mandate for playful learning in preschool: Presenting the evidence.* New York, NY: Oxford University Press

Howes, C., & Ritchie, S. (2002). *A matter of trust: Connecting teachers and learners in the early childhood classroom.* New York, NY: Teachers College Press.

Howes, C., Burchinal, M., Pianta, R.C., Bryant, D., Early, D., Clifford, R.M., Barbarin, O., (2008). Ready to learn? Children's pre-academic achievement in pre-kindergarten programs. *Early Childhood Research Quarterly, 23*(1), 27-50.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1–55.

IBM SPSS statistics version 21 (2012). *Boston, Mass: International Business Machines Corp*.

Izard, C., Woodburn, E., Finlon, K., Krauthamer-Ewing, E., Grossman, S., & Seidenfeld, A. (2011). Emotion knowledge, emotion utilization, and emotion regulation. *Emotion Review, 3,* 1, 44-52.

Izard, C. E., Trentacosta, C. J., King, K. A., & Mostow, A. J. (2004). An emotion-based prevention program for Head Start children. *Early Education and Development, 15*, 4, 407-422.

Keys, T. D., Farkas, G., Burchinal, M. R., Duncan, G. J., Vandell, D. L., Li, W., Ruzek, E. A., & Howes, C. (2013). Preschool center quality and school readiness: quality effects and variation by demographic and child characteristics. *Child Development, 84,* 4, 1171-1190.

Kreft, I. G., Kreft, I., & de Leeuw, J. (1998). *Introducing multilevel modeling*. Sage.

LeBuffe, P.A. & Naglieri, J.A. *2012 Devereux Early Childhood Assessment for Preschoolers 2nd ed*. Lewisville, NC: Kaplan Early Learning Company.

Loeb, S., Bridges, M., Bassok, D., Fuller, B., & Rumberger, R. W. (2007). How much is too much? The influence of preschool centers on children's social and cognitive development. *Economics of Education Review, 26,* 1, 52-66.

Maas, C. J., & Hox, J. J. (1999). Sample sizes for multilevel modeling. *American Journal of Public Health, 89*, 1181-6.

Magnuson, K. A., Ruhm, C., & Waldfogel, J. (2007). Does prekindergarten improve school preparation and performance? *Economics of Education Review, 26,* 1, 33-51.

Magnuson, K. A., & Waldfogel, J. (2005). Early childhood care and education: Effects on ethnic and racial gaps in school readiness. *Future of Children, 15,* 1, 169-196.

Mashburn, A. J., Hamre, B. K., Downer, J. T., & Pianta, R. C. (2006). Teacher and classroom characteristics associated with teachers' ratings of prekindergartners' relationships and behaviors. *Journal of Psychoeducational Assessment, 24*(4), 367-380.

Mashburn, A. J., Pianta, R. C., Hamre, B. K., Downer, J. T., Barbarin, O. A., Bryant, D., … Howes, C. (2008). Measures of classroom quality in prekindergarten and children's development of academic, language, and social skills. *Child Development, 79,* 3 732-749.

Masten, A. S., & Coatsworth, J. D. (1998). The development of competence in favorable and unfavorable environments. *American Psychologist, 53,* 205–220.

McClelland, M. M., & Tominey, S. L. (2011). Introduction to the special issue on self-regulation in early childhood. *Early Education & Development, 22*(3), 355-359.

Montes, G., Hightower, A. D., Brugger, L., & Moustafa, E. (2005). Quality child care and socio-emotional risk factors: No evidence of diminishing returns for urban children. *Early Childhood Research Quarterly, 20,* 3, 361-372.

National Center for Education Statistics, (2015). Fast facts: Preprimary education enrollment. Institute of Educational Sciences. Retrieved from https://nces.ed.gov/fastfacts/display.asp?id =516 on August 11, 2015.

National Center on Quality Teaching and Learning (2015). *Preschool curriculum consumer report.*

Nelson, G., Westhues, A., & MacLeod, J. (2003). A meta-analysis of longitudinal research on preschool prevention programs for children. *Prevention & Treatment, 6*, 31, 1-35.

Northwest Evaluation Association. (2008). *RIT scale norms for the Measure Of Academic Progress (MAP).* Portland, OR: Northwest Evaluation Association.

O'Donnell, C. L. (2008). Defining, conceptualizing, and measuring fidelity of implementation and its relationship to outcomes in k-12 curriculum intervention research. *Review of Educational Research, 78,* 1, 33-84.

Peisner-Feinberg, E. S., Burchinal, M. R., Clifford, R. M., Culkin, M. L., Howes, C., Kagan, S. L., & Yazejian, N. (2001). The relation of preschool child-care quality to children's cognitive and social developmental trajectories through second grade. *Child Development, 72*(5), 1534-1553.

Peisner-Feinberg, E. S., & Burchinal, M. R. (1997). Relations between preschool children's child-care experiences and concurrent development: The cost, quality, and outcomes study. *Merrill-palmer Quarterly, 43,* 3, 451-77.

Pianta, R., Howes, C., Burchinal, M., Bryant, D., Clifford, R., Early, D., & Barbarin, O. (2005). Features of pre-kindergarten programs, classrooms, and teachers: Do they predict observed classroom quality and child-teacher interactions? *Applied Developmental Science, 9,* 3, 144-159.

Pianta, R. C., Belsky, J., Houts, R., & Morrison, F. (2007). TEACHING: Opportunities to learn in America's elementary classrooms. *Science, 315,* 5820, 1795-1796.

Pianta, R. C., Hamre, B. K., & Allen, J. P. (2012). Teacher-student relationships and engagement: Conceptualizing, measuring, and improving the capacity of classroom interactions. In *Handbook of Research on Student Engagement* (pp. 365-386). Springer US.

Ramirez, G., Gunderson, E. A., Levine, S. C., & Beilock, S. L. (2013). Math anxiety, working memory, and math achievement in early elementary school. *Journal of Cognition and Development, 14,* 2, 187-202.

Raudenbush, S., & Bryk, A. S. (1986). A hierarchical model for studying school effects. Sociology of education, 1-17.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (Vol. 1). Sage.

Raudenbush, S., Bryk, A., Cheong, Y. F., Congdon, R., & Du Toit, M. (2004). HLM 6. Lincolnwood, IL: Scientific Software International.

Reyes, M. R., Brackett, M. A., Rivers, S. E., White, M., & Salovey, P. (2012). Classroom emotional climate, student engagement, and academic achievement. *Journal of Educational Psychology, 104,* 3, 700.

Reynolds, A. J., Rolnick, A. J., Englund, M., & Temple, J. (2010). *Childhood programs and practices in the first decade of life: A human capital integration*. New York: Cambridge University Press.

Sameroff, A. J., & Chandler, M. J. (1975). Reproductive risk and the continuum of caretaker casualty. In F. D. Horowitz (Ed.), *Review of Child Development Research*, 4, 187–244. Chicago: University of Chicago Press.

Shickendanz , J. A., & Dickinson, D. K. (2005). *Opening the world of learning: A Comprehensive early literacy program*. Saddle River, NJ: Pearson Early Learning.

Schweinhart, L. J., Montie, J., Xiang, Z., Barnett, W. S., Belfield, C. R., & Nores, M. (2005). *Lifetime effects: the High/Scope Perry Preschool study through age 40*. Ypsilanti, MI:
High/Scope Press. © High/Scope® Educational Research Foundation 194-213.

Smith-Donald, R., Raver, C. C., Hayes, T., & Richardson, B. (2007). Preliminary construct and concurrent validity of the Preschool Self-regulation Assessment (PSRA) for field-based research. *Early Childhood Research Quarterly, 22*, 2, 173-187.

U.S. Census Bureau (2015). Population estimates tables 1990s – 2000s. Retrieved from http://www.census.gov/popest/data/historical/index.html on August 11, 2015.

Vygotsky, L.S. ([1933] 1978). In L.C. Moll, (ed.) Vygotsky and education: Instructional implications and applications of sociohistorical psychology. New York, NY: Cambridge University Press.

Wasik, B. A., & Hindman, A. (2011). Improving vocabulary and pre-literacy skills of at-risk preschoolers through teacher professional development. *Journal of Educational Psychology, 103,* 455-468

Weiland, C., & Yoshikawa, H. (2013). Impacts of a prekindergarten program on children's mathematics, language, literacy, executive function, and emotional skills. *Child Development, 84,* 2112-2130.

Woltman, H., Feldstain, A., MacKay, J. C., & Rocchi, M. (2012). An introduction to hierarchical linear modeling. *Tutorials in Quantitative Methods for Psychology*, *8*, 1, 52-69.

APPENDIX A: CLASSROOM QUALITY SUBSCALES

Staff Warmth [fall α – .76 ; spring α – .75]

- Staff usually respond to children in a warm, supportive manner (Ex. staff and children seem relaxed, voices cheerful, frequent smiling). Y N
- Staff show warmth through appropriate physical contact (Ex. pat child on the back, return child's hug). Y N
- Staff show respect for children (Ex. listen attentively, make eye contact, treat children fairly, do not discriminate). Y N
- Staff seem to enjoy being with the children. Y N
- Staff respond sympathetically to help children who are upset, hurt, or angry. Y N

Positive Discipline [fall α – .72 ; spring α – .79]

- Staff react consistently to children's behavior (ex. Different staff apply same rules and use same methods; basic rules followed with all children) Y N
- Staff actively involve children in solving their conflicts and problems (ex. Help children talk out problems and think of solutions; sensitize children to feelings of others) (regularly, not always) Y N
- Staff's instructional skills prevent most behavior problems (OF) Y N
- Staff is alert to behavior problems, and responds appropriately to deal with them (OF) Y N
- Staff prevent most behavior problems; are skilled in using redirection and other non-punitive strategies (RECAP strategies used) (OF) Y N
- Staff is alert to problem behavior and handle situations appropriately (uses RECAP strategies such as visual cues, tangible reinforcers, or gentle reminders about behavior expectations) (OF) Y N
- Staff stop negative and hurtful peer interactions (Ex. stop name calling, fighting). Y N

Logic and Reasoning [fall α – .67 ; spring α – .70]

- Some concepts are introduced appropriately for ages and abilities of children in group, using words and concrete experiences (ex. Guide children with questions and words to sort big and little blocks or to figure out the cause for ice melting) (≥2) Y N
- Staff talk about logical relationships while children play with materials that stimulate reasoning (ex. Sequence cards, same/different games, size and shape toys, sorting games, number and math games) (≥1) Y N
- Children encouraged to talk through, or explain their reasoning when solving problems (Ex. Why they sorted objects into different groups; in what way are two pictures the same or different) (≥2) Y N

- Staff encourage children to reason throughout the day, using actual events and experiences as a basis for concept development (ex. Children learn sequence by talking about their experiences in the daily routine or recalling the sequence of a cooking project) (≥2) Y N
- Concepts are introduced in response to children's interests or needs to solve problems (ex. Talk children through balancing a tall block building; help children figure out how many spoons are needed to set the table) (≥2) Y N
- Staff encourage use of mathematical thinking, including counting or measuring, and supports children's efforts (OF) Y N
- Staff embed skills instruction within broader content instruction (OF) Y N
- Staff provide support/scaffolding to encourage children's discovery learning (OF) Y N

APPENDIX B: HLM MODELS

Unconditional Models 1&2

Predicting pre-k academic and social-emotional functioning:

Level-1 (student-level): $\mathbf{Y_{ijk} = \pi_{0jk} + e_{ijk}}$

Where:

- Y_{ijk} stands for student *i's* (literacy or social-emotional) score in teacher *j's* classroom within school *k.*
- π_{0jk} is the mean score of all students' (literacy or social-emotional) score in teacher *j's* classroom within school *k*
- e_{ijk} is the random child effect (i.e., deviation of child *ijk*'s score from the classroom mean)

Level 2 (teacher-level): $\boldsymbol{\pi_{0jk} = b_{00k} + r_{0jk}}$

Where:

- π_{0jk} is the predicted mean of all students' (literacy or social-emotional) scores in teacher *j's* classroom within school *k*
- b_{00k} is the mean (literacy or social-emotional) score in school *k*
- r_{0jk} stands for the random effect (i.e., the deviation of classroom *jk*'s mean from the school mean)

Level-3 (school-level): $\boldsymbol{b_{00k} = \gamma_{000} + u_{00k}}$

Where:

- b_{00k} is the predicted mean (literacy or social-emotional) score in school *k*
- γ_{000} is the grand mean (of literacy or social-emotional scores)
- u_{00k} is the random school effect (i.e., the deviation of school *k*'s mean from the grand mean)

Conditional Models 1&2

Predicting pre-k academic and social-emotional functioning:

Level-1 (p students):

$$\boldsymbol{Y_{ijk} = \pi_{0jk} + \sum_{p=1}^{p} \pi_{pjk}\, a_{pjk} + e_{ijk}}$$

Where:

- π_{0jk} is the intercept for classroom *j* in school *k*
- π_{pjk} are level-1 coefficients
- a_{pjk} are child *P*'s characteristics (i.e., race, gender) that predict (literacy or social-emotional scores)
- e_{ijk} is the random child effect (i.e., deviation of child *ijk*'s score from the predicted score based on the student-level model)

Level-2 (j classrooms): $\boldsymbol{\pi_{pjk} = b_{p0k} + \sum_{q=1}^{Q_p} \beta_{pqk} X_{qjk} + r_{pjk}}$

Where:

- b_{p0k} is the intercept for classroom *p* in school *k* in modeling the classroom effect π_{pjk}
- b_{pqk} are level-2 coefficients
- X_{qjk} is a classroom characteristic used as a predictor of the classroom effect (i.e., staff warmth, positive discipline, and logic and reasoning scores)
- r_{pjk} is the level-1 random effect; that is, the deviation of classroom jk's level-1 coefficient, π_{pjk}, from its predicted value based on the classroom-level model

Level-3 (school-level): $\boldsymbol{b_{00k} = \gamma_{000} + u_{00k}}$

Where:

- b_{00k} is the predicted mean (literacy or social-emotional) score in school *k*
- γ_{000} is the grand mean (of literacy or social-emotional scores)
- u_{00k} is the random school effect (i.e., the deviation of school *k*'s mean from the grand mean)

<u>Unconditional Models 3, 4, & 5</u>

Predicting kindergarten academic functioning (i.e., MAP [3] and DIBELS [4] scores): via pre-k classroom quality (and pre-k SE scores [5])

Level-1 (student-level): $\mathbf{Y_{ijk} = \pi_{0jk} + e_{ijk}}$

Where:

- Y_{ijk} stands for student *i's* (MAP or DIBELS scores) score in teacher *j's* classroom within school *k*.
- π_{0jk} is the mean score of all students' (MAP or DIBELS) score in teacher *j's* classroom within school *k*
- e_{ijk} is the random child effect (i.e., deviation of child *ijk*'s score from the classroom mean)

Level 2 (teacher-level): $\boldsymbol{\pi_{0jk} = b_{00k} + r_{0jk}}$

Where:

- π_{0jk} is the predicted mean of all students' (MAP or DIBELS) scores in teacher *j's* classroom within school *k*
- b_{00k} is the mean (MAP or DIBELS) score in school *k*
- r_{0jk} stands for the random effect (i.e., the deviation of classroom *jk*'s mean from the school mean)

Level-3 (school-level): $\boldsymbol{b_{00k} = \gamma_{000} + u_{00k}}$

Where:

- b_{00k} is the predicted mean (MAP or DIBELS) score in school *k*
- γ_{000} is the grand mean (of MAP or DIBELS scores)
- u_{00k} is the random school effect (i.e., the deviation of school *k*'s mean from the grand mean)

Conditional Models 3, 4, & 5

Predicting kindergarten academic functioning: (i.e., MAP [3] and DIBELS [4] scores)

Level-1 (p students):

$$\boldsymbol{Y_{ijk} = \pi_{0jk} + \sum_{p=1}^{p} \pi_{pjk}\, a_{pjk} + e_{ijk}}$$

Where:

- π_{0jk} is the intercept for classroom *j* in school *k*
- π_{pjk} are level-1 coefficients
- a_{pjk} are child *P*'s characteristics (i.e., race, gender, [SE functioning]) that predict (MAP or DIBELS scores)
- e_{ijk} is the random child effect (i.e., deviation of child *ijk*'s score from the predicted score based on the student-level model)

Level-2 (j classrooms): $\boldsymbol{\pi_{pjk} = b_{p0k} + \sum_{q=1}^{Q_p} \beta_{pqk}\, X_{qjk} + r_{pjk}}$

Where:

- b_{p0k} is the intercept for classroom *p* in school *k* in modeling the classroom effect π_{pjk}
- b_{pqk} are level-2 coefficients
- X_{qjk} is a classroom characteristic (i.e., staff warmth, positive discipline, and logic and reasoning scores) used as a predictor of the classroom effect
- r_{pjk} is the level-1 random effect; that is, the deviation of classroom jk's level-1 coefficient, π_{pjk}, from its predicted value based on the classroom-level model

Level-3 (school-level): $\boldsymbol{b_{00k} = \gamma_{000} + u_{00k}}$

Where:

- b_{00k} is the predicted mean (MAP or DIBELS) score in school *k*
- γ_{000} is the grand mean (of MAP or DIBELS scores)
- u_{00k} is the random school effect (i.e., the deviation of school *k*'s mean from the grand mean)