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Father's Early Engagement: Contributions to Children's Cognitive Development in Preschool

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FATHER'S EARLY ENGAGEMENT: CONTRIBUTIONS TO CHILDREN'S COGNITIVE DEVELOPMENT IN PRESCHOOL

By

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To my beloved wife

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ABSTRACT

This study examined the relationship between fathers' engagement patterns and children's cognitive development in early childhood. The study specifically examined fathers' home engagement patterns based on their engagement in caregiving, play, and literacy activities when children were around 9-month-old and 24-month-old, and children's later cognitive development in preschool in relation to their fathers' engagement patterns as measured earlier.

This study used multiple data sources from Early Childhood Longitudinal Study-Birth Cohort (ECSL-B). These sources included 9-month self-administered resident father survey (N=5,700), 2-year self-administered resident father survey (N=4,300), direct child assessment (N=4,850), and parent interviews.

The current study found that there were differences in fathers' actual engagement based on child's gender when infants were around 9-months old. Although majority of father classes were similar for boys and girls, there were two distinct groups of fathers who exhibited different engagement patterns for boys and girls. The results for father-toddler engagement patterns were more consistent across genders. Initial gender-separated analysis showed only minor differences in item response probabilities meaning the disparity of fathers' engagement patterns based on gender mostly disappear when their children are around 2 years old.

The results suggested that fathers who had the highest likelihood of engaging their infant children had generally negative effect on girls' literacy and mathematics scale score in preschool. Additionally, 2-year fathers' engagement classes did not predict children's mathematics and literacy performance in preschool after controlling for family, child and father characteristics. This study concludes with limitations and recommendations for future research.

CHAPTER 1

INTRODUCTION

The effects of early parental involvement on children's academic school readiness have been thoroughly examined in recent decades (Kell, Lubinski, Benbow, & Steiger, 2013). Researchers believe that the healthy development of children is correlated with parent-child relationships and parental involvement (Epstein, 1996; Park, Byun, & Kim, 2011). While earlier child development studies mainly focused on mothers' role, fathers' role has been somewhat neglected. Most likely, this was because mothers were seen as the primary caretakers, and fathers were primarily responsible for making a living, a role typically described as "breadwinning" (Marsiglio, Day, & Lamb, 2000).

It is believed that social and economic changes brought about by the industrial revolution early in the 20th century changed mothers' and fathers' roles in traditional families (Ian, 1999). Due to increasing involvement of women in the workplace and economic difficulties, fathers had to assume more of the caregiving responsibilities (Warin, Solomon, Lewis, & Langford, 1999; Olavarri´a, 2003). Such developments have changed the traditional breadwinning and caregiving roles between mothers and fathers, and have created an environment where parents assume their parenting roles more equally (Carlson & Magnuson, 2011). Consequently, the focus of father involvement has shifted from an indirect "breadwinning" role to the emerging concept of direct fatherhood, and a fathering role.

During the last decade of the 20th century, there was an increased interest by researchers in examining fatherhood and the role of fathers in the family (Lamb, 1997; Doherty, Kouneski, & Erickson, 1998; Dienhart, 1998). Research findings in the areas of both parental and paternal involvement studies have suggested that active parent involvement and a strong partnership

between the home and school can contribute to the healthy development of young children during the early childhood years (Connors & Epstein, 1995; Powell, 1993). These findings provide evidence regarding the extent to which fathers' roles contribute to the healthy development of young children, and in turn have contributed to the increasing popularity of fatherhood research during the past three decades.

Fathers' contribution to child-bearing can be either direct (e.g. a father playing with his child) and/or indirect (e.g. financial contribution) (Cummings & O'Reilly, 1997; Lamb, 1997). There is a growing body of evidence suggesting that supportive paternal behavior is independently effective, much in the same way as supportive maternal behavior. Additionally, there could be families where supportive paternal behavior can be more effective and beneficial to the development of children than that of the mother (NICHD Early Child Care Research Network [ECCRN], 2004; Tamis-LeMonda, Shannon, Cabrera, & Lamb, 2004). Indeed, it seems that there are many ways in which fathers can engage in supportive behaviors with their young children.

Paternal support can include many different activities such as reading a book, helping with homework, taking part in school activities, and playing sports. Regardless of children's ages, there is mounting evidence that father-child interactions can contribute to and stimulate children's emotional, social, and intellectual development. For example, Clarke-Steward (1978) found that intellectual development and skills of 15 – 30 month-old infants were highly correlated with fathers' total interaction time, engagement in play, positive ratings of children, and desire for their children's independence. Studies of paternal behaviors, however, have not been limited to examining interaction time.

The number of studies that investigated the father's role and its effects on children's cognitive development in early childhood are few. The majority of studies limited (Raver, Gershoff, & Aber, 2007; Volling & Belsky, 1991) variable selection to father's financial contribution and marital conflict. Mostly, father involvement was examined without considering the quality of fathers' interaction with their children. Researchers associated the lack of interest with old-fashioned conceptions of fatherhood, complications of working with fathers, and limited availability of data related to fathers (Lamb, 2010). Increased attention on fatherhood research during the 1970s raised questions about complex family relationships and where fatherhood stood within this context (Lamb, 1976; Pedersen, 1980). Thus, fathering roles and concepts of fatherhood became an important part of ongoing research (McHale, 2007).

Recent developments in economics, social life, and culture prompted policy makers and researchers to study father involvement. Efforts were made to expand methods used to gather large amounts of data from families and thereby provide more reliable evidence concerning fathers' roles. Large national data sets now exist to help researchers further analyze the effects of fatherhood on larger and more representative samples. It is now considered important to identify the possible contributing factors of fatherhood in early childhood because the healthy development of children may contribute to later school achievement (Lamb, 2010).

It is well established that children's cognitive development flourishes when paternal involvement is positive. Yet, the ways that fathers can affect their children's cognitive development are somewhat unclear. Although many social scientists claim that parents' genders do not manifest different effects on their children's development (Lamb, 1997), others debate that both mothers and fathers may have a unique effect (Paquette, 2004).

The current study investigated the association between fathers' engagement and young children's cognitive development. This relationship was examined cross-sectionally and longitudinally in 9-month, 2-year, and preschool. The study sample was extracted from the Early Childhood Longitudinal Study, Birth Cohort (the ECLS-B) study. Cognitive performance and gain were examined in relation to the other children in the same age group within the selected sample.

In the previous section, an overview the research problem was presented. This chapter will continue with the statement of the problem and a rationale for conducting the study. The following section discusses the significance of the study, the purposes of the study, the theoretical framework, and outlines the research questions of interest. The chapter concludes with operational definitions of key terms.

Statement of the Problem

Most researchers agree that research on father involvement is limited in comparison to that of mothers, and that fathers still perceive parenting as a mother's responsibility (Arendell, 1997). Yet, despite their limited number, research studies in child development and family studies repeatedly suggest that father involvement is an effective and contributing factor in early childhood development. For example, Martin, Ryan, and Brooks-Gunn (2010) found that children with supportive parents had greater developmental benefits, and they concluded that paternal involvement was a strong predictor of children's social-cognitive abilities. It is quite difficult, however, to differentiate the distinct effects of parents' gender on their children's competence in two parent families, where both parents jointly assume parenting responsibilities (McElwain, Halberstadt, & Volling, 2007).

Fathers' direct engagement has positive effects on children's development and should be included in studies predicting outcomes related to children's development (Futris & Schoppe-Sullivan, 2007). Earlier research studies mainly focused on the overall amount of fathers' accessibility. Additionally, studies on responsiveness mainly focused on the mother-child dyad and tended to neglect fathers' responsiveness (Parke, 2002; Parke & Buriel, 1998). Some researchers concluded that mother responsiveness differed from that of fathers. For example, Lamb (1997) claimed that mothers were more responsive, and that their behaviors were based on caregiving and comforting activities, while fathers were more likely to engage in play activities that were high intensity.

However, some researchers believe that there are no significant differences between fathers and mothers in terms of responsiveness, regardless of the type of activities. Kochanska and Aksan (2004) found no significant difference in fathers' and mothers' responsiveness to their children in different activities when children were 7 months and 15 months old, respectively. The fathers' roles may become crucial where the mother is unable to provide enough support. Martin, Ryan, and Brooks-Gunn (2010) examined the effects of parental supportiveness on children's school readiness in preschool and kindergarten. The findings of their study revealed that father supportiveness mattered most when mother's support was low. These conflicting findings, though surprising, could simply be due to the characteristics (e.g. SES, ethnicity) of the selected samples.

There is some evidence that father involvement follows different patterns across ethic groups. For example, in his review of African American studies of father involvement, Coley (2001a) concluded that there was a strong relationship between father involvement and children's healthy cognitive development, socio-emotional development, and school functioning.

Other studies consistently linked paternal supportive behavior to children's cognitive and socio-emotional development, even when mothers' supporting behavior was statistically controlled (NICHD Early Child Care Research Network [ECCRN], 2004; Tamis-LeMonda, Shannon, Cabrera, & Lamb, 2004). Thus, it seems that typically developing children benefit significantly when they receive high levels of stimulation from their parents.

One of the many benefits of parental involvement is the enhancement of basic skills during the early childhood years. Specific experiences with fathers seem to also help children develop such skills. Fathers contribute to their children's intellectual development by engaging in play activities, providing positive feedback, and encouraging autonomous behavior. For example, researchers found that paternal stimulation was an important factor for the development of mastery motivation of boys (Yarrow et al., 1984). Other studies found parallel results. Children with highly involved parents scored higher on intelligence scales in comparison to children with less involved fathers, regardless of their socioeconomic status (Yogman, Kindlon, and Earls, 1995). Researchers studying parent involvement with older children have reported similar findings. Flouri and Buchanan (2004), for example, found that children of British fathers who were more involved had higher IQ scores when they were seven years old. It seems that there is mounting evidence regarding the positive benefits of paternal involvement with young children.

It is believed that a strong relationship exists between fathers' direct engagement and children's cognitive development, a relationship that seems evident even when children are very young (Martin, Ryan, Brooks-Gunn, 2010; McBride, Rane, & Bae 2001; & Yarrow, MacTurk, Vietze, McCarthy, Klein, & McQuiston, 1984). However, the numbers of studies examining the reciprocal relationship between fathers' direct engagement and children's cognitive development

in the family context are limited (Lamb, 2010). The availability of large secondary data and wide range of information on fathers, their roles in the family, and family characteristics makes it feasible to study the potential effects of father involvement on children's cognitive development. The current study therefore sought to explore the reciprocal relationships between the father, the child, and the family longitudinally.

Significance of the Study

Interest in children's academic achievement and performance during the early childhood years has increased in recent years. While local policymakers are interested in children's overall performance in traditional school subjects, others are concerned with comparing children's academic performance within and across schools, school districts, and nations. Recently, national education performance is being judged by comparing student achievement in different countries. The trends in International Mathematics and Science Study (TIMSS), for example, was initiated and administered for the first time in 1995. TIMSS aims was to measure and compare the mathematics and science achievement of students in the 4^{th} and 8^{th} grades (NCES, 2009). The results of this study hold a special importance for developed countries as a quality indicator of their educational systems. For example, the United States is currently the second largest economy in the world with current gross domestic production (GDP) of 15.68 trillion USD but academic performance of children in U.S. ranks lower compared to other countries with fewer financial resources. Although the current trend shows that elementary and middle school students in the US have been improving consistently from 1995 to 2007, factors like public pressure, deficiency in the current numbers of skilled workers, low educational attainment, and determining the best allocation of financial resources have motivated policy makers to focus and act address the apparent achievement gap.

Improving student achievement and the quality of education provision, no doubt requires close examination, and in depth analysis, and evaluation. When the need arises, policy makers will typically analyze the issue and try to find the most feasible ways to solve problems and thereby improve quality. Yet, before allocating scarce resources, the effectiveness of the proposed methods or interventions should be demonstrated as effective in order to placate taxpayers. Research in psychology and education suggest that intervention is most beneficial when children are very young (Futris & Schoppe-Sullivan, 2007). It follows that economic investment in educational provision may be most fruitful in early childhood (Shonkoff & Phillips, 2000). While investing in direct educational services in early childhood will most likely be beneficial, such investments will probably prove optimal for children's cognitive development when the whole family system is included. To this end, studying the effects of father involvement within the family system could be rewarding. This is because the majority of fathers' child-rearing activities are shaped by important factors within the complex and dynamic family system (Lamb, 2010). Positive child outcomes are most likely the products of interactions among various factors (e.g. father-mother relation, siblings, and positive atmosphere in the family). Understanding the interplay of such factors could contribute, albeit in a small way, to the enhancement of educational provision in early childhood.

Many factors potentially interact with children's cognitive development in the early years such as socio-economic status, school quality, personal characteristics, and parents. Parents' contributions to children's academic achievement are thought important and significant (Pleck, 2008). The father also plays an important role in children's healthy development directly and indirectly. These roles and commitments seem to have an effect on children's school readiness as well as on their overall healthy development (Marsiglio, Amato, Day, & Lamb, 2000; Pleck &

Masciadrelli, 2004). Indeed, the positive correlations among paternal involvement, children's cognitive development, and school functioning have been identified in many studies.

Given the positive support in the research literature for the important roles of fathers and that of the fathering concept, the current study sought to map the relationship between fathers' direct engagement and children's cognitive development when their children were 9 months, two years, and when they were in preschool. To this end a secondary data analysis was performed using data from the ECLS-B study. The ECLS-B was not only designed to measure the early home and school experiences of young children over extended periods, it also measured the extent of father involvement during the early childhood years. The data in the ECLS-B are a nationally representative sample of 11,000 children born in 2001. The ECLS-B sample includes 8,392 resident fathers and 2,198 non-resident fathers. The data provide a rare opportunity for researchers because it includes multiple dimensions of father involvement. Another advantage of the data set is that the source of information on father involvement was the fathers themselves. In short, the data offer a valid measure of father involvement. Father involvement can be measured across time through several data collection waves covering early childhood. In the current study, fathers' direct engagement and interaction with their children was measured at 9-months, 2-years, and preschool. These measures were subsequently examined both cross-sectionally and longitudinally.

Earlier research studies on father involvement included only small sample sizes and cross-sectional data, and the majority of these studies employed qualitative methods. Several studies, for example, were based on father interviews and occasionally direct observations (Arendell, 1997). Recent developments in research methodologies and the availability of larger and diverse samples that are statically more meaningful have helped researchers achieve more

generalizable results. The use of nationally representative studies (e.g. ECLS-K, the National Survey of Children, and National Longitudinal Survey of Youth) have played a significant role in this recent development. The availability of these rich data sets allow researchers to employ more complex analytical procedures, and they present opportunities of replication..

Purpose of the Study

The overall purpose of this study was to model father involvement (interaction and engagement) when their children were approximately 9 months, two years old, and in preschool. The analyses sought to use father involvement models to predict children's IRT based cognitive scores within and across four different measurement points. A related purpose was to model children's cognitive growth and change (Bollen & Curran, 2006) over this time period and explore how father involvement models predict children's current and future cognitive development.

Although fathers' contributions to their children's development have been reported in many studies (Goldber, Tan, and Thorsen 2009; Ejiri & Masataka, 2001), research studies examining fathers' contribution on children's cognitive development are somewhat limited. It is hoped that this study will contribute to the growing literature of fatherhood and correct some common misperceptions about fathers' roles by examining fathers' home engagement and interaction with their children in the family context. Existing developmental theories viewed mothers as the major factor in their children development, the current study offers a different perspective by considering the family as a complex system with reciprocal effects one that consistently evolves.

This study also offers some methodological contributions by measuring fathers' direct effect on children's development outcomes, and not simply the presence or absence of a father

figure. Previous studies of father involvement mainly focused on the effects of fathers' absence. In addition, the current study examined the quality father-child interactions as opposed to simply measuring the time they spend with their children. Thus, this will help this study capture father involvement that is supportive.

Several groups of individuals could potentially benefit from the findings reported in this study including parents, teachers, researchers, and policy makers. Parents could benefit from the results by increasing their knowledge of what parenting aspects contribute to the healthy development of their children. The findings could also inform policy makers who may be interested in allocating recourses to policies and practices that that could affect children, families, and schools. Finally, the findings should be of interest to researchers who have engaged in studies concerning of the roles and contributions of fathers in the family context.

Theoretical Framework

Creativity is the driving force behind every human action and without its presence; our advanced society could not exist (Sawyer, 2012). The roots of creative abilities derive from a unique human skill, the ability to transfer knowledge across generations to come (Hirschfeld & Gelman, 1994). This process begins quite early in life for children surrounded by significant others. In most cases, significant others for children are their parents, who guide their children until they can make sense of the world on their own.

The ways that young children learn and how their skills develop have been the subject of ongoing debates for centuries (Anderson, Hughes, & Fuemmeler 2009). Observations of the greatest biologists like Darwin have helped us distinguish our differences from other species in the world we share, and our unique ability to transfer knowledge across generations helped us thrive. What we lack is comprehensive theoretical frameworks that can guide and help

researchers conceptualize and decipher this highly complex and unique ability. Bronfenbrenner's ecological model considers experience as building blocks of human development (Bronfrenbrenner & Morris, 2005). Through experience, factors affecting the development and feelings attached to these factors become unique for every individual.

Unique past experiences determine the direction of human development later in life (Bronfenbrenner & Evans 2000; Bronfenbrenner & Morris 1998). The complex structure and the relationship of objective and subjective are referred to as "driving the course of human development" (p. 797). The ecological model does not focus on objective nor subjective forces alone. The interaction of forces, described as "process", determine the direction and the magnitude of development. As Bronfenbrenner articulates;

> Human development takes place through processes of progressively more complex reciprocal interaction between an active, evolving biopsychological human organism and the persons, objects, and symbols in its immediate external environment. To be effective, the interaction must occur on a fairly regular basis over extended periods of time. Such enduring forms of interaction in the immediate environment are referred to as proximal processes. (Bronfenbrenner & Morries, 2005, p. 797)

Human development and behavior are crafted through an interactive process over the life course (Bronfenbrenner & Morris, 2005). Driving forces (e.g. ability, motivations, and knowledge) are shaped during this process. Children's individual repertoires are guided through these interactions with significant others gradually becoming more complex and eventually giving children the ability to shape their own development. Bronfenbrenner refers to proximal processes as "the primary engines of development" (p. 798).

The relationship between objective and subjective forces is determined by the combination of "person's characteristics, environment, the nature of the developmental outcomes, social continuities, and changes over time" (Bronfenbrenner & Morris, 2005, p.798). The outcome may not be the same from one person to another. A meaningful context is needed to measure the relationship of the elements and their effects on children's development. A model for measuring the effects of proximal process is developed by Bronfenbrenner and he named it as "Process-Person-Context-Time (PPCT) model" (p. 798). The model perceives an individual as an important agent who has the ability to alter the outcome of the processes and shape the development. Proximal processes have several distinct and important features;

1. For development to occur, the person must engage in an activity.
2. To be effective, the activity must take place "on a fairly regular basis, over an extended period of time."
3. Activities must continue long enough to become "increasingly more complex."
4. Proximal processes are multidirectional. There must be influence in both directions.
5. Proximal processes can involve interaction with objects and symbols.
6. Proximal processes must become more extensive and complex, as children grow older and the effect of significant others (Mead, 1934, as cited in Bronfenbrenner & Morris, 2005) should be taken into account.

There are three distinct characteristics of individuals thought to affect human development (Bronfrenbrenner, 2005). "Dispositions" have potential to shape the direction of development. "Resources" also play a major role as a contributing factor.

Skills, knowledge, and experience required for effective execution of "proximal process" are examples of available resources. "Demand" is useful when generating social feedback, and it can either support or hinder the execution of proximal process. Three factors mentioned above determine the scope and direction of proximal process and their unique effects among individuals. Demographic factors come into play here since their unique experiences with gender, ethnicity, age, and socioeconomic factors determine individuals' role in society (2005).

For healthy growth and development, children need a stable environment where they are exposed to "progressively more complex reciprocal activity, on a regular basis over extended period of time" (Bronfenbrenner, 1989, p. 5 as cited in Bronfenbrenner & Morris, 2005). Significant others play an important role in these processes by utilizing these activities. Parents mostly assume these responsibilities, and the level of their determination and commitment ultimately shapes their children's development.

Research Questions

This study was guided by the following research questions:

Research Question 1: How often do fathers engage their infants and toddlers through child-bearing activities?

Research Question 2: How does fathers' home engagement influence children's cognitive development in early childhood?

Research Question 3: Is there evidence of significant gain in children's cognitive development in early childhood related to levels and quality of fathers' direct engagement after controlling for SES, sex, and race?

Research Question 4: Do children's cognitive development benefit from different patterns of fathers' direct engagement after controlling for maternal involvement, age, gender, race, and SES?

In the current study, the first step was to utilize latent class analysis (LCA) to analyze fathers' involvement (interaction and engagement) and children's cognitive development in infancy and through early childhood. LCA was considered appropriate for the study because its fundamental principles allow researchers to examine complex relations of underlying factors present in survey designs (Curran & Hussong, 2002). These models are quite useful for researchers who wish to examine latent trajectories contributing to the observed measures. With the help of SEM researchers can track individual or group performances and compare how their performance diverge from the sample mean over an extended period. This is done by estimating latent factors thought to underlie an observed variable measured multiple times. It is also possible to explore association of multiple growth trajectories with multivariate growth models (Beckett, Tancredi, & Wilson, 2004).

The second part of the analysis examined the development of the association between fathers' direct engagement and interaction and children's cognitive development. The time variable was specified in the model across four different measurement points. First data collection wave, around 9 months of age, was used as reference point for the statistical models. The analyses were then conducted to explore two latent variables: (1) father involvement and (2) children's cognitive test scores. The nature and level of father involvement tends to change as children develop and transit through childhood. Evaluating the complex relationship between two outcomes longitudinally (Fieuws & Verbeke, 2004) becomes feasible with the multivariate

model and allow for the examination of changes associated with father involvement and cognitive development of young children.

Fathers' role and fatherhood are far more than a simple phenomenon that can be explained by a single variable and this concept requires a well-established framework examining the fatherhood contextually. To investigate and explain relationships among fathering indicators and children's cognitive development, Bronfenbrenner's ecological systems theory was selected as a guiding theoretical framework. Any attempt to measure children's cognitive development requires a comprehensive, ever evolving, and detailed approach like Bronfenbrenner's.

CHAPTER 2

LITERATURE REVIEW

A review of literature as it relates to the topic of interest is presented in this chapter. The review is organized into three major sections as follows: (1) discussion of fathers' roles in child-rearing; (2) theoretical background concerning fathers and their children's cognitive development; and (3) relevant research concerning fathers' home engagement and children's academic achievement. This chapter provides an overview of the engagement and interaction of fathers and their children within the family context. This review discusses fathers within the broader family structure and related dynamics, and in doing so examines children's cognitive development in relation to father and mother involvement. The discussion of the various paternal roles focuses specifically on fatherhood research and examines current research trends and findings in family, psychological, and educational research.

Introduction

It is generally accepted that adults, including parents, assume critical roles in young children's lives. Although these roles can be described in many different ways, the following characteristics are typically addressed in the literature: caretaking, nurturing, collaboration, and parenting (Cowan & Cowan, 1988). Researchers seem to have placed more or less emphasis on such characteristics, depending on the focus of their studies. For example, Sahler (1983) placed special emphasis on childrearing and described parenting as one's distinct ability to "oversee child's growth and development" (1983, p.219). It seems that various perspectives can be adopted with which to view and study fathers' roles within the family context.

Parent involvement is considered one of the most influential factors in children's cognitive development, and it has been intensively studied during the last century (Pleck, 2004).

When children reach school age, their ability to cope with the social and cognitive demands of a learning environment determines the quality of their early experiences when they begin school. Parents' major roles in shaping their children's early experiences and development continues as children progress through elementary school, and the direct effects last until they reach early adolescence (NCFF, 1996). The advantages of supportive, sensitive, and stimulating parents seem self-evident. That is, children with such parents are more likely to be well adjusted individuals and outperform their peers both socially and cognitively. Thus, it is hardly surprising that parental involvement in school is an effective predictor of children's school performance. While both mothers and fathers play important roles in their children's development, their individual roles are believed to depend on several factors. Yet, neither maternal nor paternal involvement can be singled out and treated as an isolated force because they interact within the dynamic structure of a family (Parke & McDowell, 1998).

The first research studies of father involvement seem to have been small scale efforts that typically had smaller sample sizes, with many adopting qualitative methods such as interviews with fathers or observations of fathers with their children (NCFF, 1996). Then, as more advanced research methodologies were developed and adopted, and as it became possible to use larger samples, researchers were able to collect data that were statically more meaningful. Thus, in recent years, researchers have been able to report findings that seem more generalizable. For example, the use of nationally representative studies, such as ECLS-K, the National Survey of Children, and National Longitudinal Survey of Youth allowed researchers to report generalizable findings.

It is believed that in recent years in households where both parents were present, fathers have been assuming more of the caregiving responsibilities (Pleck & Masciadrelli, 2004). The

apparent increase in participation by fathers, or father involvement, prompted researchers to devote more attention on the roles of fathers within the family and the effects of father involvement on the development of children's social and cognitive skills. The resulting studies provided evidence in support of the unique additive roles of fathers in the enhancement of children's socio-emotional development, and in turn, prompted researchers to redirect their fatherhood research efforts (Rohner & Veneziano, 2001; Volling, McElwain, Notaro, & Herrera, 2002).

Fathers' Roles in Child-Rearing

Most researchers agree that fathers' overall parenting potential is somewhat limited compared to that of mothers, and fathers tend to perceive parenting as mothers' responsibilities (NCFF, 1996). Father involvement, however, is not simply limited to that of making a financial contribution or being a role model (Duursma, Pan, & Raikes, 2008), as was once thought. The scope of father involvement is now determined based on a number of different factors. These roles and responsibilities are thought to contribute to their children's development as well as to their school readiness in several important ways (Marsiglio, Amato, Day, & Lamb, 2000; Pleck & Masciadrelli, 2004). Yet, while fathers' contributions toward enhancing children's cognitive development is in many ways similar to that of the mothers, there could feasibly be important and significant differences. Researchers with an interest in children's development include studies of fathers in their repertoire of approaches. In doing so they have been able to compare and contrast the effects of both maternal and parental practices on children's development (Denham & Kochanoff, 2002; McDowell, Kim, O'Neil, & Parke, 2002). As is often the case in social research, the results of these studies have not always been consistent. While some studies claim that the gender of a parent does not matter in terms of the parent's influence on their

children's cognitive development, other studies seem to support the opposing position. For example, McElwain, Halberstadt, & Volling (2007) concluded that the roles of mothers and fathers are "complementary" and are not gender related. For example, fathers' positive engagement was found to contribute children's cognitive development when their mother was inexperienced and young (Futris & Schoppe-Sullivan, 2007). These findings are similar to those reported by Martin, Ryan, & Brooks-Gunn's (2010) in their "parental buffering" study. The numerous inconsistent findings across studies in different fields point to the complex nature of the relationship between children's social-cognitive development and contributing factors within social contexts (Carpendale & Lewis, 2006). One interesting position is that the variation in the level of support by mothers and fathers may help children develop better awareness of their environment and realize that people may show different reaction to emotional events (Dunsmore & Halberstadt, 1997).

One promising area of research has been the study of how fathers support their children's language development during the early years. Researchers have developed various theoretical perspectives in their attempts to explain the unique contributions of fathers on their children's language development. Several studies claimed that fathers use a language that is of a more complex nature. That is, these researchers claim that fathers tend to use more complex sentences, grab children's attention in talk, and use authoritarian language (Gleason, 1975; Rowe, Coker, & Pan, 2004). In their examination of the differences between mothers' and fathers' interactions with their children, LaBounty, Wellman, Olson, Lagattuta, Liu and Liu (2008) observed parent-child conversations during a picture-book task. The study reported that mothers and fathers differed in their interactions with their children. Each individual parent seemed to have a common and distinct effect on the development of their children's social-cognitive abilities.

Mothers made a major contribution to the development of Emotinal Undersanting (EU) by using "emotion casual explanatory language" (p.764) and "referencing emotions" (p.764). Fathers interaction, however, seemed to promote concurrent and later Theory of Mind (ToM) development because they mainly used "casual explanatory language referring to desires and emotions" (p.770). Specifically, fathers' interaction was significant in predicting the development of children's mental state understanding. Their findings support the proposition that mothers and fathers have distinct effects on children's cognitive development. Moreover, the findings suggest that it is important to include both parents when studying children's socio-cognitive development.

Beyond the study of mothers and fathers independently, researchers have studied the individual and joint effects of parenting styles. In a longitudinal study, LaBounty, Wellman, Olson, Lagattuta, and Liu (2008) examined the effects of different parenting styles during parent-child conversations on children's social-cognitive development. The result indicated that mothers and fathers differed in their contribution to their children's social-cognitive development. While the mother seemed to promote children's emotional development by the way they carry out conversation, fathers seem to contribute toward the competence associated with "theory of mind" by using "casual explanatory" language.

Fathers and Young Children's Development

The theoretical background guiding the study is outlined in the following section. In doing so, the theoretical perspective is introduced, the rationale is discussed, and relevant assumptions surrounding the rationale are explained.

Children's ability to connect and make sense of the outside world is directly related or associated with their developing social-cognitive abilities. These abilities guides children

through the understanding of underlying reasons and foundations for human behavior. The early experiences and mastery of these skills help children establish effective, meaningful social interactions and healthy relationships (Hughes & Dunn, 1998). Parents' reactions to their children's emotions shape early development and provide them with opportunities to practice newly developed skills. The caregivers mostly provide early experiences of socialization and it is important to distinguish the parents' reactions toward their children in different circumstances or within different contexts.

A strong relationship is thought to exist between a father's involvement and his child's cognitive development, and this association seems to begin when children are very young. Fathers' contributions to their children's cognitive development and school achievement can be both direct and/or indirect (Pleck 2007) and these contributions occur through several mechanisms. Yet, despite the recognition that multiple mechanisms seem to be in play, to date there is a lack of a comprehensive theoretical framework that can guide researchers as they conceptualize the highly complex relationship between father involvement and children's cognitive development. A situation that gradually became more apparent during the last century (Day & Lamb, 2004; Pleck 2007).

Since the field of research concerning father involvement lacks a recognized or accepted theoretical basis, for the purposes of the current study an attempt was made to apply a recognized theory to the problem and situation being addressed. An analysis of various theories identified the ecological systems theory as a plausible frame of reference for the study. The ecological systems theory can be used to conceptualize the relationship between father involvement and children's cognitive development. The ecological systems theory puts a special emphasis on experience because it plays a vital role in human development (Bronfenbrenner & Morris, 2005).

Children's earlier experiences can have a significant effect on the trajectory of human development during a later point in time (Bronfenbrenner & Evans 2000; Bronfenbrenner & Morris 1998 as cited in Bronfenbrenner 2005). Children's early experiences with their fathers can shape their development in many ways, however, interactions leading to these experiences must take place consistently. Bronfenbrenner and Morris describe these "enduring form of interaction in the immediate environment" as proximal processes. (Bronfenbrenner & Morris, 2005, p. 797). Human development and behavior are crafted through an interactive process during the life course (Bronfenbrenner & Morris, 2005). For young children especially, their individual repertoire is guided through these interactions with significant others, and these interactions gradually become more complex and guide them to shape their own development. As Bronfenbrenner and Morris states "Proximal processes are posited as the primary engines of development" (p. 798). The reciprocal interaction happens between the adult(s) available in the immediate environment and the child. Also, characteristics of significant others play a major role in the construction of "progressively more complex interaction and emotional attachment".

Bronfenbrenner and Morris states that individuals' demographic factors come into play here since their unique experiences with gender, ethnicity, and age determine their role in society (2005). Resources such as being in a rich and stimulating environment may support or discourage exploration as children interact with proximal processes. The physical environment can do enhance (generative) or harm (disruptive) the developmental process.

Generative characteristics of the environment can promote healthy development and it can also prevent the effects of disruptive characteristics associated with confusing environments (Bronfenbrenner & Morris, 2005). The quality of the relationship fathers establish with their children based on their developmental levels and needs can contribute to generative

characteristics of the environment and promote children's socio-emotional, physical, psychological, cognitive, and linguistic development. The necessary skills for social competence and academic achievement starts developing from early infancy. Fathers contribute to children's social competence and academic achievement in a variety of ways. Fathers participate and engage in activities that promote and improve their children's social competence and academic achievement (Gadsden, Fagan, Ray, & Davis 2004). Fathers who are sensitive, caring, and are able to establish secure relationships with their offspring are more likely to create a generative environment and contribute toward their children's early experience. For example, highly involved fathers were found to promote better emotional states, better cognitive abilities, and lessened sexually oriented stereotyped beliefs of their children (Pleck & Pleck, 1997). These findings suggest that paternal involvement can contribute to young children's school experience in various ways.

Children's ability to learn seems to flourish when adults exhibit sensitive and stimulating behaviors. Attachment theory points to the importance of parent-child relationships, and how these interactions and relationships shape children's early experiences. Drawing on attachment theory, researchers found that fathers' sensitivity mediates the early development of children's cognitive abilities, even after controlling for mothers' sensitivity (Tamis-Lemonda, Shannon, Cabrera, & Lamb 2004). In the same study, fathers' stimulating behaviors were found to be effective predictors of children's positive cognitive development, even with minimized or no maternal stimulation.

Fathers' contribution to the cognitive and socio-emotional development of children has been studied extensively. In his review of African American studies of father involvement, Coley (2001b) concluded that there is a strong relationship among father involvement and children's

healthy cognitive development, socio-emotional development, and school functioning. Other studies consistently linked parental supportive behavior to children's cognitive and socio-emotional development, even after statistically controlling mothers' supporting behavior (NICHD Early Child Care Research Network [ECCRN], 2004; Tamis-LeMonda, Shannon, Cabrera, & Lamb, 2004). When children receive high amount of stimulation, they are able to follow the appropriate developmental path, with subsequent advantages for further developing their skills and abilities.

In an earlier study it was reported that children's intellectual competency was correlated with both maternal and paternal stimulation (Clarke-Stewart, 1978). The father's contribution toward supporting their children's intellectual development includes engaging in play activities, providing positive feedback, and encouraging autonomous behavior. For example, Yarrow, MacTurk, Vietze, McCarthy, Klein, and McQuiston found that paternal stimulation was an important factor for the development of mastery motivation of boys (1984). Similar findings have been reported in other studies. For example, children's with more involved fathers scored higher on intelligence test than did children with less involved father, regardless of their socioeconomic status (Yogman, Kindlon, & Earls, 1995). Such findings are not restricted to younger children since studies with older children yielded the same findings. Flouri and Buchanan (2004) found that children of British fathers who are more involved in early childhood had higher IQ at the age of 7. In another study, Shannon, Tamis-LeMonda, London, and Cabrera (2002) found that urban toddlers showed better cognitive performance during play when their resident father was more responsive. More involved fathers not only contribute to their children's intellectual development, they also promote positive language development and verbal skills.

Fathers' Engagement and Children's Academic Achievement

Measuring fathers' involvement has always been problematic. Fathers' contribution to children's development and well-being has not been widely studied, and to a certain extent has been underestimated. This was primarily because fathers were mainly considered to be "bread-winners". There was neither effort nor evidence to support the notion that fathers played a significant role in their children's development; that is beyond their role as being the primary "breadwinner". This common misconception gradually changed during the 1990's, as government agencies and other public departments began paying attention to fathers' roles. Lending support to this new direction, and perhaps serving as a catalyst was a memorandum issued by President Clinton in 1995 (Clinton, 1995). Given the official "seal of approval" for father involvement studies there was a surge of interest in studying paternal behaviors with their children.

Research studies initiated by the National Center for Educational Statistics (NCES) suggested that father involvement can have positive effects on children's academic achievement. Some studies even reported positive effects of father involvement after controlling for mother's contributions (Lamb, 2010). Finding from these studies helped dispel the common misconceptions concerning the ineffectiveness of father involvement change. Thereafter, having established the fact that father involvement in childrearing and early education within the family is important and significant, research continued at a growing rate in subsequent years.

Father involvement studies once treated involvement as the time spent together with children, rather than examining the quality of the relationship, or the interaction between fathers and their children. Father involvement is an umbrella term that may mean and refer to many different fathering practices. Developments in father involvement research required researchers

to describe involvement more precisely and detailed in order to reach a common agreement when studying the subject. Lamb and his colleagues (Lamb, Pleck, Charnov, & Levine, 1987) stated that father presence has multiple dimensions (responsibility, availability, and engagement) and these dimensions should all be considered when studying the father presence.

Differences in Fathering Patterns

A father is considered responsible when he takes actions to protect, care for, engage, and make arrangement for his child. For example, when a father takes his child to an evaluation center for his learning disability, his action is considered a responsible act. Responsibility is considered a planned action that requires planning, evaluating, monitoring, and decision-making (Pleck, 2008). Although, responsibility overlaps with engagement and availability, an available and/or engaging father might not necessarily be a responsible one. Responsibility covers a wide range of actions and behaviors. Unlike the vast literature on mother involvement, father involvement research lacks necessary evidence to support the importance of responsible fathering behaviors.

Availability refers to fathers' physical presence, regardless of any direct interaction (Lamb, 1997). A father may be available all the time but this does not mean he is responsible or engaging with his child. Father involvement was once considered as the time fathers spend with their children. Older studies (Lamb, 2010) examined the relationship between the total time that fathers spent with their children and children's developmental outcomes. Treating fathers' physical presence as a factor may be misleading for father involvement studies because the quantity of time with children may not reflect the quality at all (Palkovitz, 1997). For example, a father and his child may be in the same room all day long, but the father may not interact with his child at all.

Father engagement has multiple characteristics, and it has often been mistaken for overall time spent with children in earlier studies. In later studies, engagement was considered as fathers' direct interaction with their child during activities such as playing games and having meals together (Cowan, Cowan, Pruett, Pruett, &Wong, 2009; Miall & March, 2005). Caregiving activities such as helping to dress and preparing a meal are also considered as engagement (Olmstead, 2010). The amount of father engagement seems to decrease when children grow older (Fish, New, & Van Cleave, 1992). Fathers' are more likely to engage their toddlers than their infants although, some studies contradict these findings. Fathers' involvement and interaction seems to peak when children are between 5 and 15 years old (Snarey, 1993). However, infancy can play an important role in helping with fathers' awareness of parenthood, which in turn, would greatly increase the amount of involvement in childrearing activities (Cox, Owen, Lewis, & Henderson 1989).

Findings from father involvement studies suggested that the quality of the engagement between a father and his child yields positive outcomes for children (Cowan, Cowan, Pruett, Pruett, &Wong, 2009; Futris & Sullivan, 2007). These positive outcomes start early from infancy and lasts until early adolescence. Conversely, when father engagement is minimal or negative and mothers are unable to buffer, the children's emotional, social, and cognitive development may face difficulties.

Engagement behavior is delivered in a variety of ways. For example, responsive behavior may be considered as part of the act of engaging children. The description of responsiveness emphasizes the importance of mutual relationship and often it is seen as "the quality of the parent's (mostly mother's) style of reacting to the child's signals and bids directed to the parent" (Kochanska & Aksan, 2004). Play activities could have an important role because

the majority of time allocated for child engagement happens during play, and these activities have been found to increase fathers' involvement (Marsiglio, 1991; Tiedje & Darling-Fisher, 1993). In fact, most men choose to engage their children via play activities, rather than performing any other caregiving tasks (Lamb, Pleck, Charnov, & Levine 1987; LaRossa & LaRossa, 1989). While caregiving activities were mostly perceived as mothers' responsibility, the evolution of women's social and economic roles in society minimized the differences between mothers and fathers. These changes altered fathers "breadwinning" and "sex role defining" images which has ushered a new era have started to assume more responsibilities in caring for their children (Parsons & Bales, 1955).

Caregiving consists of a wide range of behaviors and tasks that are important to maintain the healthy development of children (Gadsden, Fagan, Ray, & Davis 2004). The learning experiences and cognitive development of infants with supportive parents tend to be better compared to those who do not have the support of a parent (Nepomnyaschy, Magnuson, & Berger, 2012).

Fathers' unique contribution to their children's social-cognitive development can also be observed in children's daily interactions and relationships with their peers (Parke, Dennis, Flyn, Morris, Killian, McDowell, & Wild, 2004). For example, in one study children's popularity was predicted by fathers' active involvement. Fathers who actively engage in physical play and establish warm social interaction are likely to have children that are more popular among their friends. Children experience the emotional reading of another person with their fathers, and this experience is likely to contribute to children's relationships with their peers and friends. Gottman, Katz, and Hooven's (1997) found that fathers' sensitivity toward the emotions of their

5-year-old children promoted better skill competency for the same children when they were 8-years-old.

The positive effects of parents' supportive reaction to their children's emotions was a significant predictor of children's popularity among peers and social competency in many studies (Denham&Grout, 1993; Eisenberg, Fabes, Carlo, & Karbon, 1992; Fabes, Leonard, Kupanoff, & Martin, 2001). In a related study, father engagement predicted children's comprehension of pictures about a social relationship in a story book positively affecting their relationship with their peers (Rah & Parke, 2008). Similar results were supported by Martin, Ryan, and Brooks-Gunn's (2010) study where they noted that father engagement was a strong predictor of children's social-cognitive abilities.

McBride, Schoppe-Sullivan, and Ho (2005) studied the effects of father involvement in school apart from the influence of wider family and neighborhood. They found variations in children's academic scores were predicted by fathers' involvement even after controlling for maternal factors. Fathers' positive contributions, however, seem to stand out during the preschool years. When fathers engage in supportive interaction during these critical years, children's language and cognitive outcomes are likely to be better (Cabrera, Shannon, & Tamis-LeMonda, 2007). Nord, Brimhall, and West (1997) claimed that fathers' high level of involvement in school seemed to contribute children's academic performance and positive school experience and those children are less likely to repeat a grade. In a similar study, Chen, Liu, and Li (2000) likewise found that fathers contributed to children's academic performance and school achievement. The positive influence of fathers was also observed in children's sporting performance (Jodl, Michael, Malanchuk, Eccles, & Sameroff, 2001).

Fathers' influence and positive outcomes related the paternal factors are likely to determine future school achievement even after netting out mothers' involvement (Scott, 2004). For example, Duursma, Pan, and Raikes (2008) found that fathers' book reading predicts children's cognitive abilities, although it failed to predict their language abilities. Likewise, Labrell (1990) found that French infants problem-solving ability was predicted by fathers' indirect and structured support during interaction and activities. In addition, American fathers' perception of their children's ability and task importance predicted their children's performance on cognitive tasks (Bhanot & Jovanic, 2009).

The research on father involvement have also uncovered some distal effects. For example, longitudinal analyses have revealed that father involvement at age 7 and 11 predicted children's national exam scores when they were 17 years-old (Lewis, Newson, & Newson, 1982). In another study, researchers confirmed the positive correlation of father participation in a "father involvement project" and their children's mathematics readiness scores (Fagan & Iglesias, 1999). Another longitudinal analysis by Martin, Ryan, and Brooks-Gunn (2007) reported that children who had supportive parents when they were 2 years old were more likely to have better linguistic and mathematics skills at the age of 5, and parents support for autonomous thinking predicted mathematics and reading score (Belsky et al. 2008) when children were between 6 and 8 years old.

Fathers' direct support with young children's school related work predicted children's later interests. Lyytinen, Laakso, & Poikkeus (1998) reported that fathers of Finnish children who to read their children when they were between 14 to 24 months old seemed to predict their children's subsequent interest in books. Fathers' direct participation and perception about the

value of being involved in literacy activities may also predict children's school readiness (Gadsden & Bowman, 1999).

Two-parent Families

The number of parents in the same house seems to be a relevant and effective factor when predicting children's cognitive performance. Martin, Ryan, and Brooks-Gunn (2007) found that children with two supportive parents had better scores on cognitive measures. That is, children with one supportive parent had lower scores in comparison to those with two supportive parents in their lives. It is important to note, however, that to attain such benefits, both parents should work together, or collaborate to create the optimal supportive environment for their child or children. It seems that parents' cooperation is one of many important factors that ca help support and enhance children's developing abilities. Parental cooperation, however, does not involve the direct relationship between parents and their children. It is rather the parents' ability to coordinate, organize, cooperate, and support their spouse to maximize benefit for their children's development (Gadsden, Fagan, Ray, & Davis 2004).

Fathers' involvement is also thought to be mediated by the mothers' role (Hochschild, 1989; Lamb and Oppenheim, 1989, Belsky, Gilstrap, & Rovine, 1984). Arendell (1997) claims that fathers' perception toward involvement and the amount of actual involvement is most likely to be shaped by their wives. In another study, a warm and close relationship between couples was found to be associated with the fathers' more active involvement, and infants' received higher amount of stimulations and responses regardless of mother's employment status in these families (Tiedje & Darling-Fisher, 1993). Such findings echo those of earlier studies of father involvement reporting that parenting responsibilities and parenting tasks and activities were

more evenly distributed in "middle and middle-upper class" families (Kimball, 1988; Ehrensaft, 1987).

While cooperation or collaboration of both parents seem important and relevant, it does not necessarily mean that both parents should engage in the same tasks and activities with their children. There is some evidence that there are greater benefits for children when the interactions with the mother and father are contextually and structurally different. Relatedly, the complexity of the language that fathers use can be explained by the limited interaction time with their children. Some researchers claim that fathers can be emotionally distant to their children and to some extent clueless about their children's level of language mastery, possibly due to their limited interaction with their children (Ely, Berko-Gleason, Narasimhan, & McCabe, 1995). Therefore, lacking such understanding, they will often use complex and challenging language when they speak to their child. It is argued the use of such language and the related "challenge" can be contributing factor in linguistic development. Thus, the unique characteristic of fathers' communication and the challenges it presents could help children connect to, and make sense of, the outside world. Through these interactions, children's can make sense the world around them and meet the cognitive and linguistic demands of an otherwise challenging environment.

The challenge presented by parents is a controversial issue in several studies. According to Martin, Ryan, and Brooks-Gunn, (2010) fathers' dominations during their conversations with their children, their unwillingness to understand children, and their choice of words creates a different experience for their children. This experiences in turn, forces the children to learn and adapt, and to put more effort to keep up with the conversation. Yet, in contrast, other researchers such as Fagan and Iglesias (1999) claim that children's language development is negatively

affected when their fathers do not possess good conversational skills, and that their children's linguistic and language development is more likely to fall behind.

These results suggest that the experiences and development of young children across families can be diverse and unique depending on several factors. In their attempts to classify parental effects researchers coined the term "parental buffering" to describe the joint effects of parents (Martin, Ryan, & Brooks-Gunn, 2010). This is when one parent is unable to accommodate the child's developmental progress and needs, the other parent assumes this responsibility and helps the child flourish his/her abilities and skills. The effects of father involvement seems best when the mother is not able to or willing to stimulate her child. Martin, Ryan, and Brooks-Gunn tested the effects of parental buffering on children's school readiness. They used a secondary data set from Study of Early Child Care and Youth Development provided by National Institute of Child and Health & Human Development (NICHD). The sample consisted of 723 54 month-old children. The results supported "parental buffering" concept. Father involvement seems to be most effective in children's school readiness when the mothers' support is average or below the average. The "buffering" relation is replicated with mothers too. Mothers' effects are most visible when fathers scored average or lower. Another important finding from Martins and Brooks-Gunn's (2010) study was that mothers' supportiveness still mattered when father supportiveness scores were high. Although these findings suggests that mothers supportiveness matters more and father only serves as "buffers", the research on parental buffering is at its early stages and more studies are needed to identify any viable conclusions.

Marital Quality

Self-reported marital quality has been found to be highly correlated with father involvement (Volling & Belsky, 1991). Fathers were found to be highly involved with their children when the relationship with their spouse was warm and trustworthy (Crouter & Crowley, 1990; Cowan, Cowan, Pruett, Pruett, & Wong 2009). Parents' contributions are not limited to their relationship with their children, the support they provide to each other may also play a robust role in the development of their children (Crnic & Booth, 1991; May & Strikwerda, 1992). For example, there is substantial evidence linking marital satisfaction and children's healthy development (Belsky, Young-Blade, Rovine, & Volling, 1991). Studies of marriage and families revealed that improved child outcomes were predicted when both parents were satisfied and felt fulfilled. A fulfilling marriage experience seems to promote parents' sensitive, supportive, and responsive behaviors, and these factors seem to be related to better or imporved experiences for their children (Belsky, Young-blade, Rovine, & Volling, 1991; Howes & Markman, 1991). On the other hand, marriages that lack harmony seem to limit the effectiveness of parents and thereby adversely affect children's problem behaviors (Kerig, Cowan, & Cowan, 1993).

Socioeconomic Status

Children from poor families tend to indicate worse outcome in comparison to their peers from higher SES backgrounds (Brooks-Gun & Duncan, 1997). Additionally, fathers' education attainment could influence the nature of their interactions with their children (Tamis-Lemonda et al., 2004). Fathers' with more education are more likely to be employed and contribute toward their families' overall SES. Father's educational level could also interfere with how they perceive their involvement, as well as their interactions with their children. Educated mothers'

tended to engage in more activities with their children, and the activities were often more purposeful and goal-oriented (Schady, 2011). The families' SES may grant certain privileges to its members (Carlson & Corcoran, 2001). Thus, when a father does not have to worry about maintaining the family's income level, he may be able to spend more time with his children. Based on this brief review of relevant studies it seems that are numerous ways in which socioeconomic status interacts with or effects fathers involvement with their children.

Maternal Involvement

Children benefit from shared activities when both mothers and fathers are part of the activities. Mothers' interaction with their children during these activities seem to vary based on fathers' levels of involvement; and their engagement in academic activities were found to contribute to their children's cognitive development (Martin, Ryan, & Brooks-Gunn, 2007). Mothers' sensitivity and responsiveness, in particular, seems to plays a significant role. Some studies found that there were important advantages for children when the mothers' had higher levels of sensitivity and responsiveness (van den Boom, 1994).

Child Characteristics

Child's gender is thought to be another factor that can affect the nature and levels of mothers and fathers engagement with children (Raley & Bianchi 2006). In some families, fathers tend to allocate more time for their sons (Hofferth and Anderson 2003), while their interaction with their daughters are, in comparison, limited. While these differences can be explained by many factors, one plausible explanation is that the difference to the fathers' perceptions, culture, or because fathers and their sons share similar interests (Raley & Bianchi 2006).

Family Characteristics

Family characteristics is also a factor that researchers often cite as relevant to the study of father involvement. It is claimed that family characteristics can moderate the level of father involvement. In single parent families, for example, fathers often have to work extra hours and as a result they are not able to allocate enough hours for their children (Carlson & Corcoran, 2001). Research findings suggest that unwed-couples living in the same household do not significantly differ from married couples when it comes to fathers' involvement with their children (Marybeth, 1978; Carlson & Corcoran, 2001). Yet, family size seems to have varying effects. Children in larger families may both benefit and suffer from certain issues (Guo & VanWey, 1999). For example, families with more children may prohibit fathers from allocating enough time for each of their children. On the other hand with two parents present in the household the impact of a larger family could become less of an issue. This is because of the simple fact that within larger families, there would more adults to interact with the children.

Father Characteristics

Finally, some researchers have found that the relationship between fathers and their children may vary depending on fathers' age. Older fathers could have more experience and resources, and therefore, could involve in more meaningful and relevant activities with their children (McGrath, Mortensen, Pedersen, Ehrenstein & Petersen, 2013). It seems, however, that the effect of a father's age and how it might be related to certain child outcomes is unclear. The findings reported by Saha et al. (2009) that children of older fathers tend to score poorer on cognitive measures, seems to contradict those of McGrath, Mortensen, Pedersen, Ehrenstein & Petersen (2013).

Summary

In conclusion, the effects of fathers' home engagement and activities on their young children has been a somewhat controversial topic. The arguments, to date, seem to have centered on details concerning the fathers' roles in and how there relate to their children's development. While some researchers recognized the effects of fathers' direct engagement as being important and significant, others seem more skeptical. For some, the majority of fathers' child-rearing activities are shaped by various factors within the complex and dynamic family system (Lamb & Lewis, 2010). On the whole, however, fatherhood studies during last decade has generally confirmed the important contribution of fathers' positive involvement.

Such consensus regarding father involvement seems consistent with the assumptions posited in the ecological systems and attachment theories. The ecological systems theory proposes that significant others in a child's immediate environment can contribute to the generative characteristics of the environment (Bronfenbrenner & Morris, 2005), and thereby help young children's maximize their early experience. Furthermore, attachment theory posits that when children develop a secure emotional attachment to their caregivers through child-rearing activities, their development is less likely to be disrupted (Tamis-Lemonda, Shannon, Cabrera, & Lamb 2004). It seems that, the overall findings reported in this brief review become more meaningful when viewed through the lenses of these two theoretical perspectives.

The ecological system theory also explains the findings of positive relationships between paternal engagement and children's learning and skill development. Studies have found positive correlations between child's intelligence and the amount of stimulation provided by significant others (Clarke-Stewart, 1978). Fathers, in some situations, are also believed to have a positive effect on children's intellectual development. This effect seems to be in certain contexts such as

when fathers engaged children in play activities by providing positive feedback, and encouraging autonomous behavior (Yarrow, MacTurk, Vietze, McCarthy, Klein, and McQuiston, 1984). Similar types of father engagement is also thought to be related to children's overall academic achievement (Lamb, 2010).

The review of literature reveals that measuring father involvement in terms of the time that fathers spend with their children could be too simplistic. While the earlier studies of father engagement measured the effects of total time fathers spend with their children, more recent studies chose a different approach. This was most probably due to the fact that simply focusing on the time factor limited researchers' ability to make assumptions about different types of fathering styles. Gradually, as more father involvement studies were conducted and reported, the general conceptualization of father engagement was refined. Fathers' engagement is now described as the fathers' presence with three dimensions; responsibility, availability, and engagement. Although these dimension overlap each to a certain degree, the majority of cross-sectional studies have generally found positive correlations between fathers' engagement and children's cognitive development. It seems that fathers can engage their children through numerous activities such as playing games, preparing a meal, or reading a book. In and of itself, such activities can be beneficial and rewarding for children. Yet, it is the relationship between father involvement and children's cognitive development that is most noteworthy, and of particular interest to educators and researchers. In sum, father involvement and father engagement does matter, and children's cognitive development seems to benefit when their fathers consistently engage in caregiving, play, and literacy activities (Cowan, Cowan, Pruett, Pruett, &Wong, 2009; Futris & Sullivan, 2007).

CHAPTER 3

METHODOLOGY

The purpose of the current study was to examine the relationship between fathers' direct engagement with their children when they were 9 and 24 months respectively, and also the children's cognition when they attended preschool. The following investigations were conducted:

- Exploring patterns of father's engagement with their 9 and 24 month old children using descriptive analysis and latent class analysis (LCA).
- Comparing the levels of fathers' engagement with their young children. Here, patterns of fathers' home engagement identified through latent class analysis were compared.
- Examining the effects of fathers' engagement on children's cognitive performance and development when they were in preschool.
- Examining the effects of fathers' direct engagement on children's cognitive development by gender, race, socioeconomic status after controlling for maternal involvement and previous assessment performance.

This study used data from Early Childhood Longitudinal Study-Birth Cohort (ECSL-B). The ECLS-B presents a range of information from approximately 14,000 children born in 2001. Data collection started when the sampled infants were around 9-month-old and continued until children entered kindergarten. The ECLS-B study consists of a nationally representative sample from the population of approximately four million children from diverse cultural backgrounds. The ECLS-B data offer several advantages over other data sets in terms of the variables of interest for the current study. For example, the data have exclusive resident father and non-resident father involvement information, collected through self-administered questionnaires (Bronte-Tinkew, Scott, & Horowitz 2009). Information about fathers' socio-economic status,

perceptions of being a father, and involvement with their children were also collected (NCES, 2005).

In the following sections, the methodology of the current study is presented. The first section briefly describes the purpose and sampling design of the ECLS-B study. The discussion continues with a description of the participants' characteristics. The third section addresses the data collection procedures including sample design, assessment instruments, and administration of data collection. In the final section, the selected measures, research design, and the data analysis plan is presented.

Description of the Data

The ECLS-B is a nationally representative study sponsored by several U.S. agencies (e.g. US Department of Education and National Center for Education Statistics). The ECLS-B study was initiated to provide researchers with opportunities to capture and explore the early experiences of young children. The data collection started in 2001 when children were around 9 months old and tracked the same children until kindergarten entry. Information about children's well-being, development, care, education, and early school experiences is included in the data. Additionally, the study was designed to oversample twins, children with critical birth weight, as well as some ethnic minorities (e.g.,Chinese, Asian and Pacific Islander, American Indian and Alaska Natives). The methodology of the ECLS-B study offers several advantages over previous studies examining father involvement. It presents opportunities for researchers to examine resident father and non-resident father involvement as well as the effects of father involvement on children's development (Bronte-Tinkew, Scott, & Horowitz 2009).

Several characteristics of the ECLS-B study are unique: (1) the study introduced self-administered questionnaires for resident and non-resident fathers and (2) it is the first nationally

representative study combining information collected through direct assessments and parent reported surveys from birth through kindergarten entry.

The data collection took place in four different waves; (1) Fall 2001 through Fall 2002 when children were around 9 months old from July to December in 2001, (2) when children were around 24 months old, (3) when children enrolled in preschool in 2005 and 2006, and (4) when children entered kindergarten in 2006 and 2007. In the kindergarten 2006 wave, data were collected from 75 percent of children who were first-time kindergarteners. The data from the remaining 25 percent of children were collected in the kindergarten 2007 wave because these children did not meet minimum age requirement for kindergarten entry in the Fall of 2006 (NCES, 2010).

The design of the ECLS-B is such that researchers are able to examine young children's development and their abilities in early childhood from birth to kindergarten entry. The study provides rich descriptive data about children and their families. Researchers can track growth trajectories and examine related child and family characteristics and their effects on children's current and later development in cognitive, socio-emotional, and physical domains.

Sampling Design

The ECLS-B study employed a complex sampling design with stratification and clustering for case selection. To account for under and over represented populations, advance unequal probability techniques were employed as the selection method. Field interviewers (FI) conducted parent interviews and direct child assessments in each wave. The first two data collection waves focused on collecting data based on children's age. In the last three waves of data collection, the focus shifted to measuring children's progress in early grade levels. The 9-month wave included a nationally representative sample of 10,700 children. The total sample

size in 2-year, preschool, kindergarten 2006, and kindergarten 2007 waves were 9,850; 8,900; 6,950; and 1,900 respectively (NCES, 2004; 2006; 2008; 2010).

The age-oriented initial sampling design was replaced with grade-level oriented sampling design later in the study. The initial sampling design plan of the ECLS-B included a visit to children's homes. Data collection took place when children were around the target age. The data collection in 9-month and 2-year waves were similar. The sampling design was revised for the preschool wave to collect data when children were at a particular stage of schooling. In the kindergarten wave, data were collected when children entered kindergarten for the first time in two different academic years (kindergarten 2006 and kindergarten 2007) because about 25 percent of children were not age-eligible for kindergarten in the fall of 2006 (NCES, 2010).

The ECLS-B study used clustered list-frame design for sampling children born in 2001 because the design presented several advantages over other sample selection methods. Children were sampled into primary sampling units (PSU), and to reduce the cost of sampling, secondary sampling units (SSU) were created as needed. The resources (registered births) of the National Center for Health Statistics (NCHS) were used to sample children born in 2001 (NCES, 2004).

The target population excluded children with the following characteristics; (1) mother who gave birth to a child when she was younger than 15 years old, (2) children who were deceased before the 9-month wave data collection, and (3) children who were adopted before the first wave of data collection started.

PSUs were created with data from contiguous counties. Information from several public agencies (Metropolitan statistical area and NCHS health service area) was used as a guide to define and form PSUs. After including specific analytic domains of interest, there were 36 sampling subgroups (sampling strata). The minimum required sample size required for different

race/ethnicity groups, birth weight, and twins was calculated using Measure of Size (MOS), which considers the weight developed for each analysis domain. The purpose of computing MOS was to distribute subjects equally within PSUs, and the assign the minimum required cases for each of 36 sampling strata (NCES, 2004).

"A composite measure of size (MOS) that utilized the analysis domains was computed for each PSU using the formula given in Folsom, Potter, and Williams (1987). First let

N_k= average number of births in 1994-1996 in the k-th case stratum;

n_k= required sample size for the k-th case stratum; and

$f_k = n_k \,/\, N_k$.

Let M_{ik} denote the number of births in the k-th case stratum within the i-th PSU. The adjusted MOS for the i-th PSU. The adjusted MOS for the i-th PSU is computed as

$$M_i = \sum_k f_k M_{ik}$$

(NCES, 2004, p. 4-10).

Initial estimations revealed twenty-four PSUs with sufficient sample size. These PSUs were designated as "certainty selection", and each PSU become a stratum (NCES, 2004) from which additional two PSUs were selected. The remaining PSUs were grouped together based on common variables (e.g. census region, Minority status, Median income). There were a total of 96 PSUs in the main ECLS-B sample. An additional 18 PSUs were created to acquire enough precision for the American Indian (AI) analysis domain. In order to decrease travel related costs, additional SSUs were selected from PSUs. A total of 149 SSUs were created from 44 (out of 96) core ECLS-B PSUs. The final selection included 53 SSUs out of 149 SSUs without disturbing the distribution of analysis domains across entire PSUs.

PSU construction was based on metropolitan statistical area (MSA) definitions. However, there were some exceptions. For example, when areas had lower chance of selection, different procedures were followed. Minority status, birth categories, and median income stratification variables were determined in each stratum. Equal distribution of samples in each stratum was controlled by using serpentine sort within SES variables using MOS. Selecting adequate sample size for AI sample presented a challenge because the number of AI births were low, and their location of residence and density caused problems for an adequate sample drawing. This resulted in developing an additional PSU frame for AI population to support adequate PSU sample selection (NCES, 2004).

A total of 14,197 cases were sampled in the 9-month wave but only 10,870 cases had complete parent data. Among these children with complete parent data, 4,900 were White; 1,746 were Black; 1,517 were Hispanic; 1,209 were Other Asian/Pacific Islander; 880 were American Indian; and 637 were Chinese. Of this sample, 8,090 children had normal birth weight; 1,512 children had moderately low birth weight; and 1,473 children had very low birth weight. Lastly, 9,513 children were non-twin and 1,357 children were twins (NCES, 2004).

In each data wave, there were additional information collected from various sources in addition to child assessments and parent interviews. The data in the first wave came from three sources; (1) parent, (2) child, and (3) father. Parents completed self-administered survey and computer-assisted personal interviews (CAPI). Child data were based on direct child assessments and observations. Fathers completed self-administered questionnaires (NCES, 2004).

The 2-year wave included parent interviews, resident and non-resident self-administered father questionnaires, and direct child assessments. For children attending a child care, telephone interviews were conducted with their child care providers. Additionally, if children attended

child care for more than 10 hours a week, field interviewers observed the child care setting (NCES, 2006).

Preschool data collection included information about the resident father through self-administered questionnaire. Care providers completed phone interviews for children attending preschool and child care. Field interviewers completed observations in education and child care settings if children participated in care for more than 10 hours a week (NCES, 2008).

In the kindergarten 2006 data collection wave, telephone interviews were administered to education and care providers. If children were enrolled in kindergarten or in higher grades, teachers completed a questionnaire. Home-schooled children were excluded from the teacher questionnaire (NCES, 2010). Kindergarten 2007 data collection wave included information from children enrolled in kindergarten. The majority of children in this wave either did not enroll in kindergarten in the previous wave or repeated kindergarten in 2007.

The number of cases in the 2-year wave reduced to 9,835 parent interviews and 9,189 children assessments. In the preschool data collection wave, 8,941 parents completed the parent interviews and 8,744 children completed assessments. Kindergarten 2006 data collection yielded 7,022 completed parent interviews, and 6,915 child assessments (NCES, 2004; 2006; 2008; 2010).

To preserve precision for American Indian and Alaska Native subsample, cases with no parent data in previous data waves were left out. The Kindergarten 2007 wave tracked down children who did not participate in the previous data collection as well as children who were repeating kindergarten. The last wave of data collection aggregated 1,917 complete parent interviews and 1,902 children assessments. When children died or moved out of the United States, their cases were excluded (NCES, 2010) from the study.

The initial step of the consent process was to acquire appropriate permission from states to use the information on birth certificates. The birth certificates included information necessary for contacting parents, and they were also used for data stratification. Samples were constructed using information from 46 states and Washington D.C. Some states had restrictions and rules regarding using information from consent forms and contacting parents using this information. For example, while a number of states required passive consent and did not require active permission from parents to be contacted, other states required active consent from parents. In several states, the ECLS-B consents were obtained through the Pregnancy Risk Assessment Monitoring System. In some states, when birth certificate registration was created, parents could choose not to be contacted in the future. Finally, some states did not allow birth certificates to be revealed and used for contacting parents for longitudinal studies (NCES, 2004).

Adjusting for Underestimated Population – Sampling Weights

True random sampling offers several advantages. Each case in a random sample has an equal probability of being selected from a population. The sampling design of the ECLS-B lacked this advantage due to its complex sampling design. To adjust proportions and avoid over or underestimations of subgroups in a population, a procedure called "weighting" was employed. Weights are useful in several conditions. For example, when sampling is not proportional; survey nonresponse rate is high; or when a group or individuals are underrepresented, weights can help researchers adjust the data and generate representative results for selected samples, and reduce selection bias (NCES, 2004; 2006; 2008; 2010).

The ECLS-B study offers two types of weighting adjustments; sample-based weight adjustment (e.g. nonresponse adjustments) and population-based weight adjustments (e.g. raking). Data from both respondents and non-respondents contributed to the weight development

in sample-based adjustments to help achieve a representative sample. Without sample-based adjustments, non-respondents could not be represented in the sample. In addition, population-based adjustments use available data from respondents to create a representative sample of a population (NCES, 2010).

The weights for the ECLS-B data were developed for each data wave in a sequence as data collection progressed. Each child had initial selection probabilities and base weights. The base weight served as the foundation for calculating weights in later waves (i.e. 9-month wave weights were calculated with base weights). In the kindergarten 2006 data, another set of weight were created for AI population data reduction. Because kindergarten had two data collection point based on children's ages and grade levels, appropriate weights for analyzing these samples were developed and included in the data. Developing weights for each measure was pointless because weights for measures could be estimated from the combination of other measures. Weights for component combination were developed for each data wave based on analytic interest (NCES, 2010).

The probability of sampling a child from a population is equal to the product of the probabilities of being selected from each sampling group. The following procedure was used to calculate selection probabilities in each wave.

"For birth certificates sampled in PSU sampling stratum h, PSU i, SSU j, case stratum k at time t, the selection probability was

$$P_{kt} = P_{hi}P_{hij}P_{hijkt}$$

where

P_{hi} = the probability of selection of PSU i in stratum h;

P_{hij} = the probability of selection of SSU j within PSU i, stratum h; and

P_{hijkt} = the within-SSU probability of selection for a case in case stratum k at time t (NCES, 2010, p. 153)."

Although the ECLS-B sample plan was to develop an overall probability for each birth from each subpopulation, there were two exceptions. First, weight estimation for American Indian and Alaska native sample could not follow this procedure due to limited number of selection possibilities. Second, sampling rates in March 2002 was reduced due to budgetary reasons. For each case in the ECLS-B sample, a base weight was assigned. The base weight was employed to quantify the potential of representation for each case (birth certificate of children born in 2001).

The base weight for a given birth record was calculated as the reciprocal of the overall probability of selection:

$$W_{kt} = \frac{1}{P_{kt}}$$

(NCES, 2010, p. 153).

Both overall selection probabilities and base weights were used to adjust for sample-based and population-based weight adjustments in and across all data collection waves.

9-Month Weights. The decision for developing weights for 9-month wave was based on the researchers' intentions, analytic interests, and cross tabulation of frequencies. 9-Month wave weights were developed if parent interviews, child assessments, and father questionnaires were complete. Parent interviews were treated as complete when the first section of items (the child development part) was completed, and 10,688 cases were recorded as complete. For child assessment, each case required to have complete data on either mental scale, motor scale, or the physical measurements. A total of 10,221 cases met the requirements and were counted as

complete. The criterion for father was to have either or both resident and nonresident father survey completed, and 6,998 cases were recorded as complete (NCES, 2004).

Three main data resources showed seven possible combinations for developing weights. Developing weight for each measure would have been ideal but practical considerations made it unnecessary. A total of four weights were developed based on the analytic interest. Because most child assessment data at the 9-month wave were collected with parent data, developing separate weights was unnecessary for neither child assessment nor the combination of child assessment and parent interviews. No weights were developed for the combination of child assessment and father interviews, as those weights could be inferred from the weight developed for the combination of child assessment, parent interviews, and father data. A number of cases lacked father data but had complete child and parent data. This led to the development of a weight for parent and child data combined with parent, child, and father data. A total of 170 cases did not have child data, and this issue led to the development of weight for parent and father data combined. Lastly, a number of cases had complete parent data but lacked child assessment, and a weight for child assessment was generated (NCES, 2004).

2- Year Weights. From the data collected in 2-year wave, 10 sets of weight were developed based on the most common analytic interests. In addition to parent, child, and father data for sampling weights calculation, child care provider and child observations data were taken into account. First, when 28 percent of items were complete in selected sections of parent interview, case was classified as qualified for weight calculation. A total of 9,835 cases were used. For child data to be eligible, completion of one of the following was sufficient; physical measurements, BSF-R motor scale, or BSF-R mental scale. The total number of complete cases was 9,218. Third, father data were treated as complete when cases had either complete resident

father survey or complete non-resident father survey. There were special cases which required both surveys to be completed, and these cases were used if both surveys were completed. The total number of eligible father-level data summed up to 6,546. Fourth, for child care provider data, there were two different treatments based on the child care setting, and a total of 3,235 cases were qualified. Lastly, for child care observations, there were two different scenarios based on the child care environment; completed observation booklet for home-cared children or completed center care director for children in center-based care. A total of 1,410 cases were recorded as complete and included in weight calculations (NCES, 2006).

There were three main components in the 9-month wave and 5 main components in the 2-year wave. Combining these components from both data waves would have resulted in a large number of weights being calculated. However, developing weights for each measure and possible combination yields would have been impractical and costly. A decision was made to develop weights based on the analytic interest. The child-level data suffered from three percent loss in the 2-year wave, and this development played a major role in decisions for developing weights. In total, 10 sets of weight were developed in the 2-year wave (NCES, 2006) including four weights developed for father data. The parent interview also had separate sections for father respondents, and information on this section can be used for analyzing father data.

Preschool Weights. For the preschool wave, the number of weight developed was limited to 11 due to the associated cost. The focus during the weight development was to maximize the benefit from child assessment data. The main components in the preschool wave were parent interviews, child assessments, resident father questionnaire, Early Care and Education Provider (ECEP) telephone interview, and Child Care Observation (CCO). The main purpose of developing preschool weights was to adjust to 2-year wave weights. The total number of complete cases for

parent, child, resident father, ECEP, and CCO were as follows: 8,941, 8,754, 6,100, 6,010, and 1,779 respectively (NCES, 2008).

Developing weights for the ECLS-B data was a sequential process, and weights for each wave were constructed based on the previous wave. Each weight developed for the preschool wave followed the same guideline except weight W31R0. W31R0 was developed for American Indian Natives cases whose parents did not respond to parent interview at 2-year data collection wave (NCES, 2008).

Weights Selected for the Current Study

The National Center for Educational Statistics suggest that if there is no weight available for a particular research interest, weight with more components should be considered in the analysis because it may help with adjusting non-response in the components intended for analysis. Based on NCES recommendation, missing data was examined for potential bias.

Several weights were used in this study for both the cross-sectional and longitudinal analyses. The construction of weights in the ECLS-B allows researchers to conduct analyses based on their analytic interests and related constructs. Weights were developed for analyses of the parent data, child assessment, center-type analysis or combination of most analytic domains. For the current study, the following weights were used:

> W1F0: 9-month resident father self-administered survey measures
>
> W22F0: 2-year resident father self-administered survey measures
>
> W31C0: Preschool child assessment data with both 9-month and 2-year child assessment data, with or without any wave of parent interview data. (NCES, 2010, p.205-206)

Procedures

Overview of Data Collection

In the first two, age-oriented waves of the ECLS-B, data were collected when children were around 9 months old and 2 years old. In grade-oriented preschool and kindergarten waves, data were collected when children enrolled in preschool and kindergarten (kindergarten 2006 & kindergarten 2007). Data were collected from several sources. Parent data were collected using a computer-assisted personal interviewing instrument (CAPI) and self-administered questionnaires. Child data were collected through direct assessment and observations. Resident fathers and non-resident fathers completed self-administered questionnaires. Care providers and education providers were administered telephone interviews (ECEP, WECEP). In both the kindergarten 2006 and the kindergarten 2007 waves, school data were obtained through the Common Core of Data (CCD) and Private School Universe Survey (PSS). Additionally, teachers completed self-administered questionnaire (TSAQ) (NCES, 2010).

Preparations for Data Collection

Parents were notified through mail before the actual data collection took place. After making the initial contact with families, parent interviews, child observation, and father questionnaires were administered during house visits. Field interviewers recorded observations and completed remark forms after the home visit. 9-month data collection wave was divided into 13 regions and each region had one field supervisor (FS) and from 14 to 19 field interviewers (FI) (NCES, 2004).

A four-day training protocol was provided for lead trainers and field supervisors. This training focused on (1) data collection procedures and protocols, and (2) familiarize FIs with the Interviewer Management System (IMS) and the Field Management System (FMS). The purpose

of IMS was to assist interviewers during the data collection on the field, and help them record the data for children and their families. FMS helped field interviewers transfer the collected data to the contractors. Before the training in-person, field interviewers received a training for conducting home studies. A four-hour training provided basic information about the study and its design; contacting family for the first time; basics of home visit, recording information, and other relevant information related to the procedures (NCES, 2004).

For the 2-year data collection, primary sampling units were assigned to seven regions. Each region had an FS and from ten to twenty FIs. Similar training procedures were followed for training field staff. The necessary training was provided to the staff for field procedures and protocols. The preschool data collection wave CAPI played a major role in parent data collection. States were assigned into five different regions, and each region had its own field staff (NCES, 2006). For easier data collection and effective management, states were assigned into four regions in kindergarten 2006. Each region had its own staff members assigned. One supervisor (RS), five FSs, and from twelve to fourteen FIs were assigned to each region. The number of regions in kindergarten 2007 was seven and regions had one or two RS, one FI, and from nine to twelve FIs.

Data Collection

The ECLS-B data was collected in five different waves beginning in 2001 and ending in 2008. Table 3.1 shows detailed information on timing of each data collection wave.

Table 3- 1

Data Collection Waves

Wave	Start Date	End Date
9-month	October 2001	December 2002

Table 3- 1 (continued)

Wave	Start Date	End Date
2-year	January 2003	April 2004
Preschool	August 2005	July 2006
Kindergarten 2006	September 2006	June 2007
Kindergarten 2007	October 2007	June 2008

Direct Child Assessment. Field interviewers visited each child's home and administered child assessments in 9-month data collection wave. Interviewers tried to choose the best times of the day to work with infants; that is when the infants were most likely to be attentive. The direct child assessment consisted of three main components; (1) BSF-R, (2) NCATS, and (3) physical measurements. BSF-R was designed to measure child's development. NCATS is an activity designed to observe interaction of a child and caregiver through video recording. Information gathered during the home-visit was recorded in the Child Activity Booklet. In 2-year data collection wave, the direct child assessment included BSF-R for mental and motor development, physical measurements, and recording a video for interaction between caregivers and the child initiated by Two Bags Task. Toddler Attachment Sort (TAS-45) was also completed for each child (NCES, 2004; 2006).

During the preschool wave, fine and gross motor skills and cognitive developments were measured using separate instruments. The assessments for cognitive development were completed using the Child CAPI instrument and Child Activity Booklet. Interaction between the child and caregiver was video-recorded while they were performing the Two Bags Task. Children's physical measurements were also recorded. The direct child assessments in the kindergarten wave measured cognitive development, fine and gross motor skill development, and physical development. The cognitive development assessment in this wave provided two

standardized measures; early reading skills and early mathematics skills. The physical measurement data was recorded in the Child Assessment Booklet (NCES, 2008).

The Child CAPI instrument was, again, used to administer the cognitive assessment in the preschool wave. Parents completed the first section of the child CAPI to determine whether the child needed accommodation. Regardless of the parent-reported data, every child was administered an initial set of items to determine his/her proficiency in English. When children showed proficiency in English, the assessment proceeded in English. Spanish speaking children were administered the cognitive assessment in Spanish by bilingual field interviewers. If the child showed no understanding in English or Spanish, the direct cognitive assessment ended. The child CAPI instrument was available in two languages; English and Spanish. For families who did not speak English nor Spanish, language interpreters assisted field interviewers (NCES, 2008).

Child Observations. In 9-month and 2-year data collection waves, field interviewers collected information about the home environment and children's behaviors. FIs also completed a self-administered survey, The Interviewer Remarks, and the child observations with the aid of computer-assisted instruments (CAI). Questions for the child behavior section were selected from the Behavior Rating Scale (BRS), and questions for the home environment section were selected from the Home Observation for Measurement of the Environment (HOME) (NCES, 2004; 2006).

During the preschool data collection wave, an additional component, Center Directors SAQ, for center-based care was added. Administration of this component was completed if the child was enrolled in a center-based program. The quality of care environment was measured based on the type of care provided. The Early Childhood Environment Rating Scale-Revised

Edition (ECERS-R) for center-based care and the Family Day Care Rating Scale (FDCRS) for home-based care were used to measure the quality of the environment (NCES, 2008).

Parent Interview. During the 9-month and 2-year waves, field interviewers conducted CAPI to parents, and parents completed a self-administered questionnaire. CAPI instruments covered 22 topics related to the child's development and progress. During the preschool and kindergarten 2006 data collection waves, parent data were collected using the Parent CAPI instrument covering factors related to the child development, family characteristics, and care arrangements. The Kindergarten 2007 data collection wave involved the use of a shorter version of the Parent CAPI instrument (NCES, 2004; 2006).

Father Interview. Self-administered resident father questionnaires included information on fathers' involvement, their education, employments, and their attitudes and perception about their roles as fathers (NCES, 2004; 2006). For the 9-month, 2-year, and preschool data collection waves, identification of father's residency status was determined from the Parent CAPI instrument. The last section of the Parent CAPI presented questions related to the identification of household members. Resident father was defined as either a person (partner or spouse) living in the house together with the child or biological father living in the same house in the Parent CAPI survey. Non-resident fathers were simply biological fathers who did not reside in the same house with the child. If the child had a resident father in the house, field interviewers administered the SAQ resident father questionnaire (Questions for Fathers and Other Important people). When a resident father was not present in the home, FIs left a copy of the Resident Father SAQ to be completed later and to be mailed. FIs followed-up by calling fathers if they did not complete the survey in two weeks. About 6.7% of the surveys were completed over the phone.

Measures and Variables

Dependent Variable: Child outcome

Preschool and Kindergarten Cognitive Assessments. The two main cognitive domains measured in the preschool and kindergarten waves were early reading and mathematics. Additionally, general knowledge was measured in preschool. The time limit for administration of the cognitive assessments was 35 minutes. The preschool and kindergarten waves of the ECLS-B measured early reading and early mathematics skills using instruments that were adapted from several reliable assessment scales. Among them were the Test of Early Mathematics Ability-3, the Peabody Picture Vocabulary Test, the Preschool Comprehensive Test of Phonological and Print Processing, and the PreLAS 2000. Relevant skills included sound knowledge, letter recognition, print conventions, and word recognition. Early mathematics skills were measured in two levels. Children's performance on the first level was used to determine how the second level would continue (NCES, 2008; 2010).

BSFD-II items were not appropriate for measuring the cognitive level of children after 48 months of age. Cognitive assessment at preschool wave covered the following domains; language, literacy, mathematics, and color knowledge. "The ECLS-B 48-month Assessment: Framework and Measures" (NCES, 2008, p. 23) was used to construct a framework for direct child assessment at preschool wave and led to the development of "Recommended Cognitive Assessment Instrument for the ECLS-B Preschool Battery: Results of the 2003 Pilot Test" (p.23). This guide includes recommended items from relevant instruments. Field tests were completed in 2004 with 1,245 children to evaluate items. The combination of items from the Peabody Picture Vocabulary Test (PPVT, various forms), the Preschool Comprehensive Test of Phonological and Print Processing (Pre-CTOPPP), the PreLAS 2000, and the Test of Early Mathematics Ability-2

(TEMA-2) were used. Additionally, items from the Family and Child Experiences Study (FACES), the Head Start Impact Study, and the ECLS-K were used (NCES, 2010).

Preschool Language Assessment. This assessment was designed to measure children's vocabulary and receptive language skills. It was also used to measure children's proficiency in English. The initial 15 items were administered to determine children's base level and the direction of assessment (NCES, 2008).

Preschool Literacy Assessment. Literacy assessment measured key components and indicators for early literacy. The literacy assessment instrument included 35 items across the following domains; phonological awareness, letter sound knowledge, letter recognition, print conventions, and word recognition (NCES, 2008).

Preschool Mathematics Assessment. For the mathematics assessment, there was a single instrument with a common set of items. Children were administered the common set of items, and supplemental items were administered when children performed poorly on the common set of items. Children who performed well also received a set of more difficult items. The following constructs were included in the mathematics assessment; number sense, counting, operations, geometry, pattern understanding, and measurement (NCES, 2008).

Cognitive Score Types. For measuring mental score during the 9-month and 2-year waves, three types of IRT based scores were developed that represent children's performance on cognitive assessments; proficiency probabilities, scale scores, and standardized T-scores. Additionally, during the preschool and kindergarten waves, subtest scores and theta scores were developed. IRT scale scores "represent estimates of the number of items children would have answered correctly if they had received all of the scored questions in a given content domain" (i.e., all 85 early reading or all 71 mathematics items) (NCES, 2010, p. 52). The IRT-based

overall score scale is calculated for the child's probability to correctly answer each item based on the difficulty of the item. The calculation of "the probability that a child would have gotten an item correct is dependent on the discrimination, difficulty, and guessing parameters of that item" (NCES, 2010, p. 47-48). Overall IRT scale scores were used in this study to obtain cognitive scale scores because children's performance on the domain of interest can be analyzed using this type of score.

Children were exposed to different items based on their skill level. Item response theory (IRT) was employed to develop cognitive assessment scores and "to maximize information on which each estimate of ability is based" (NCES, 2008, p.40). IRT based ability scores are calculated by taking item difficulty level and pattern of right/wrong answers into account. Based on each child's ability estimate, his/her performance was scaled to the full BSID-II (NCES, 2004; 2006). The 2-year data collection wave had 19 core items but the full BSID-II had a total of 36 items. Children's raw score could be anywhere between 0 and 36. The BSID-II has a total of 178 items and children's mental scale score could fall anywhere between 0 and 178. The actual mental score range for the 2-year wave is from 92.35 to 174.14. During the preschool data collection wave two scores, color knowledge and children's expressive language, were not IRT based. IRT based scale scores were generated for the reading and mathematics assessments. Standardized T-scores were also developed based on children's performance.

Reliability of the Cognitive Measurement Instruments based on IRT scores

IRT-based reliabilities for BSF-R mental score in 9-month and 2-year waves, and Mathematics assessment and early reading assessment in preschool wave are reported in Table 3-2 below.

Table 3- 2

Reliability of Cognitive Assessment Instruments

Domain	9-Month	2-Year	Preschool
BSF-R Mental	0.81	0.88	
BSF-R Motor	0.94	0.73	
BSID-II	0.87	0.87	
Mathematics Assessment			0.89
Early Literacy Assessment			0.84

Independent Variable: Father Engagement Patterns

The self-administered father questionnaire (SAFQ) had 13 items related to father engagement and interaction. These items measured care activities, play activities, and cognitive stimulation in 9-month. Fathers answered all questions on a scale ranging from 1 to 6 based on how often they performed activities stated in each question. The 2-year SAFQ had 14 items for measuring father engagement and interaction. Fathers' engagement in academic activities was measured through the use of three items: reading books, telling stories, and singing songs. These items had 4 answer choices ranging from not at all to every day. These three items were used to create LCA analysis. Items in the play and interaction category included holding the child, tickling the child or other playful activities, taking a walk with the child outside or play outside, having the child do errands, playing peek-a-boo, playing sports. These six items were also used for the LCA analysis.

Control Variables

Age-adjusted 9-month and 2-year Mental Scale Score. The ECLS-B 9-month and 2-year waves included information on children's cognitive, socio-emotional, psychomotor, and physical development. Data was collected using several direct and indirect assessments. The Bayley Short Form-Research Edition (BSF-R) was used to measure children's development from birth to 42 months. BSF-R is a shortened version of the Bayley Scales of Infant Development, Second

Edition (BSID-II). The BSID-II aims to measure two major developmental domains: mental and motor development. Mental ability scale measures the cognitive development of young children. The large number of items in BSID-II and time required to administer led to the development of a shorter version, BSF-R. The core set of mental scale had 13 items with 9 basal items and 9 ceiling items. Administration started with easier items and progressed toward more difficult items. The Basal set of items were used when items were too difficult for the child, and ceiling items were administered when the child easily answered the items presented. The target age groups of BSF-R in 9-month wave were from 8 months to 11 months. The majority of children (83%) were assessed between this age rang (NCES, 2004; 2006).

The administration of BSF-R took place during home visits. Field interviewers worked with the child alone using several techniques such as modeling and using verbal prompts. Field interviewers critiqued other FIs administration of the instrument for standardizing the administration and scoring. For their critique, FIs needed to have a score of 85 percent or higher with each other and they needed to have a consistency score of 90 percent or higher. (NCES, 2004; 2006; 2008; 2010).

Maternal Involvement index. The academic activities parent engaged in with their children were also recorded with identical three items: (1) reading books, (2) telling stories, and (3) singing songs. Parents were asked to indicate the frequency of these activities in a given week. Answers ranged from not at all (1) to every day (4). Also, items in maternal the Play and Interaction category were similar to father's play and interaction activities. Items included here were tickling the child, playing peek-a-boo, and taking a walk with the child outside or play outside. These six items were used to create maternal involvement index.

Maternal employment status. Information on maternal employment status were collected through Self-Administered parent questionnaire. Mothers reported their work statuses as working more than 35 hours, working less than 35 hours, looking for work and not looking for work.

Parent Age. Parents' age was determined from X*HMAG_B and X*HFAG_B. These variables indicate parents' age in each data collection wave.

Parent Identifiers. Variables X/Y*MOMTYP and X/Y*FTHTYP were generated to indicate resident guardians. X/Y*HPARNT identifies both parents and whether guardians are biological parents or not. These set of variables from the parent interview.

Father's race/ethnicity. Father's ethnicity is indicated in the parent CAPI interview. The majority of the parent interviews were conducted with mothers, and they were asked to choose race(s) from 15 race categories. Father race is indicated in the composite variable X1HFRACE.

Child's age during the assessment. The child's age is given in months and based on the total day difference from the child's birth to direct child assessment date. The total numbers of days were converted into months. The variable X*ASAGE (* representing the wave) is the chronological age of a child in months at the time of assessment.

Child's Gender. The X*CHSEX variable wase created based on the information from parent interview. The two categories here are 1= female and 2= male.

Ethnicity. Ethnicity in the ECLS-B data consisted of six categories: "American Indian/Alaska Native", "Asian/Other Pacific Islander", "Black", "White", "Hispanic", and "more than one race". Y1CHRACE is a single variable that includes ethnicity of each child based on several ethnicity and race variables. If a parent indicated a race for a child, parent-reported race was used in the classification regardless of other ethnicity and race variables.

Household size. The X/Y*TOTAL variable was generated to show the total number of individuals residing in the house. Additional variables, X/Y*LESS18 and X/Y*18OVER, indicate whether individuals living in the house is older or younger than 18 years of age. A variable for determining number of siblings, X/Y*NUMSIB, was generated.

Family socioeconomic status (SES). Composite variables for socioeconomic status were created using parent CAPI interview. The following components were used to create composite SES variables;

1. Father/male guardian's education;
2. Mother/female guardian's education;
3. Father/male guardian's occupation;
4. Mother/female guardian's occupation; and
5. Household income. (NCES, 2010, p. 540)

Two measures of SES were created; continuous measure of SES, X*SESL and categorical measure of SES, X*SESQ5 (five SES quintiles).

Participants

The ECLS-B study is representative of children born in US in 2001. By using appropriate weights the selected sample can be generalized to the general population of children born in 2001 in the US. The sample of children in the 9-month, 2-year, and preschool waves were included in the study (NCES, 2004; 2006; 2008; 2010).

Children's IRT-based standardized scale scores, father's home interaction and engagement, children's age at the assessment, gender, ethnicity, mother's home involvement, and socioeconomic status variables were included in the analyses. Children with a resident father in their household were included in the cross-sectional analyses. Cases with missing outcome

variables (cognitive assessment or missing cognitive assessment component) were excluded from the analyses.

Research Design

The study had two main goals. The first was to examine fathers' engagement patterns and to determine the nature, amount, and frequency of resident fathers' interaction and engagement with their children in early childhood. Thus, fathers' interaction and engagement were examined in a systematic manner using LCA. Second, the effects of fathers' direct engagement in 9 month and 2 year on children's academic achievement were examined longitudinally. The study employed a correlational study design. Correlational designs helps researchers answer questions when the effects of independent variables on a dependent variable(s) are of interest (Russo, 2011; Leedy & Ormrod, 2001) among subgroups of population with different level of exposure to the same conditions. The nature and design of the ECLS-B study allows researchers to explore prevalent conditions among groups, and help them determine if the differences in these conditions produce the observed difference in selected outcome variables.

Variables

Age variables. This group includes children's chronological age at the time of assessment and relative age to the group mean age.

Socio-demographic variables. Gender, race, and socioeconomic status are in this category.

Concominant variables. Children's age at the time of assessment, their initial cognitive ability are in this category.

Outcome variables. The outcome variable for the study were children's IRT-based standardized mathematics and literacy assessment scored in preschool. IRT-based cognitive

scores in first two waves were based on the BSF-R, and the cognitive scores are comparable between these two waves.

Design Effect (DEFF)

The nature of the complex sampling design in the ECLS-B data requires additional steps to ensure standard errors, significance tests, and coefficients are properly estimated. The majority of methods and statistical analysis techniques are beneficial when a sample is selected through a pure random sampling design. To counter-balance the effect of stratified clustered design of the ECLS-B data, DEFFs were estimated. "The design effect compares the statistical efficiency of survey estimates from complex sample designs to what would have been obtained under a simple random sample (SRS) of the same size." (NCES, 2004, p.4-28).The replication method used to calculate the design effect is called the "paired jackknife replication method".

> "In a stratified clustered design like the ECLS-B, stratification generally leads to a gain in efficiency over simple random sampling, but clustering has the opposite effect because of the positive intracluster correlation of the units in the cluster. Also, the oversampling of rare domains is beneficial for analyses concentrating on those domains, but inefficient for analyses that cut across the oversampled domains due to the differential weighting effect. The basic measure of the relative efficiency of the sample design is called the design effect (DEFF), defined as the ratio, for a given statistic, of the variance estimate under the actual sample design to the variance estimate that would be obtained with an SRS of the same sample size:

$$DEFF = \frac{Var_{DESIGN}}{Var_{SRS}}$$

The square root of the design effect, DEFT, is defined as

$$DEFT = \frac{SE_{DESIGN}}{SE_{SRS}}$$

where SE is the standard error of the estimate. The design effect indicates the increase or decrease in the variance relative to simple random sampling, and the square root of the design effect indicates the same for the standard error." (NCES, 2004, p. 4-29).

Table 3-3 below shows DEFFs for each cognitive score across three different data waves (NCES, 2004; 2006; 2008; 2010).

Table 3- 3

Design Effects

	DEFF	DEFT
9-month – W1F0	1.80 53	1.3436
2-year – W22F0	1.77 93	1.3339
Preschool – W31C0	2.32 79	1.5257

STATA (13) was used in the current study to conduct the statistical analyses. The ECLS-B manual suggests that DEFT should be used to correct the standard error when performing statistical analysis as STATA assumes that the sampling design is random sampling. Below is the formula to calculate standard error of design.

$SE_{DESIGN} = \sqrt{DEFF \times Var_{SRS}} = DEFT \times SE_{SRS}$ (NCES, 2004, p.4-29).

Variance of random sampling design (Var_{SRS}) can be computed as shown in the formula below.

"Means

$$\mathrm{Var}_{\mathrm{SRS}} = \frac{1}{\mathrm{n}} \frac{\sum_1^{\mathrm{n}} \mathrm{w_i} \, (\mathrm{x_i} - \overline{\mathrm{x}}_{\mathrm{w}})^2}{\sum_1^{\mathrm{n}} \mathrm{w_i}} = \mathrm{SE}_{\mathrm{SRS}}^2$$

where $\mathrm{w_i}$ are the sampling weights, n is the number of respondents in the sample, and the sample mean $\overline{\mathrm{x}}_{\mathrm{w}}$ is calculated as follows:

$$\overline{x}_w = \frac{\sum_1^{\mathrm{n}} \mathrm{w_i x_i}}{\sum_1^{\mathrm{n}} \mathrm{w_i}}$$

Proportions

$$\mathrm{Var}_{\mathrm{srs}} = \frac{\mathrm{p}(1-\mathrm{p})}{\mathrm{n}} = \mathrm{SE}_{\mathrm{SRS}}^2$$

where p is the weighted estimate of proportion for the characteristic of interest and n is the number of cases in the sample. In both cases of means and proportions, the standard error assuming simple random sampling should be multiplied by DEFT to get the standard error of the estimate under the actual design." (NCES, 2004, p.4-30).

The ECLS-B study manual describes the procedure for using the paired jackknife replication method for specific statistical software including STATA. The following command line was used to adjust for DFFs.

"svyset [pweight = wt0], jkrweight(wt1-wt90) vce(jackknife) mse" (NCES, 2008, p.198).

Data Extraction

The ECLS-B is restricted data and it is only made available to qualified researchers. Data access requires application for the restricted-use data license. The ECLS-B data file and its associated electronic codebook are stored on a DVD and kept in a locked, secure room in the

School of Teacher Education at FSU. The secure room has a computer which requires each user to have their own log in account with password. Once the ECLS-B data DVD is installed on the computer, an electronic codebook allows users to explore and search variables, and create and save taglists. After selecting variables and saving them in a taglist, electronic codebook software lets users extract data for several statistical packages including STATA.

Data Analysis

The data analysis was conducted in three main steps using Stata (13) and an additional plugin for LCA (Lanza, Dziak, Huang, Wagner, & Collins, 2014). The following research questions were investigated through descriptive, cross-sectional analysis, and longitudinal analysis;

Research Question 1: How often do fathers engage their infants and toddlers through child-bearing activities?

Research Question 2: How does fathers' home engagement influence children's cognitive development in early childhood?

Research Question 3: Is there evidence of significant gain in children's cognitive development in early childhood related to levels and quality of fathers' direct engagement after controlling for SES, sex, and race?

Research Question 4: Do children's cognitive development benefit from different patterns of fathers' direct engagement after controlling for maternal involvement, age, gender, race, and SES?

Descriptive Data Analysis

In this section, percentages, means, frequencies, standard deviations, skewness statistics, mean comparisons, and Pearson Product Correlation Moment correlations were included. The

sample characteristics and paternal involvement pattern based on several family characteristics are presented.

The investigation, at first, was exploratory and attempted to describe patterns of fathers' interaction and engagement based on previous research and theory. The literature suggests that fathers' engagement and interaction at home with their children are related to a combination of factors. For example, maternal involvement, child characteristics, contextual factors, and family related factors could have direct and/or indirect effects on fathers' involvement.

Cross-sectional Data Analysis

The first step of the analysis was to determine direct and bivariate associations. Fathering practices were investigated and fathering profiles were created based on those practices using latent class analysis (LCA). LCA is useful when identifying characteristics of different class membership based on covariates (Collins & Lanza, 2010). Observed categorical variables were used to create these latent classes of fathering profiles. For each of 9-month, 2-years, and preschool data collection points, a baseline model was developed. These baseline models were evaluated by examining likelihood ratio X^2. LCA estimated following parameters: 'the item-response probabilities (p's) and the latent class prevalences (ϒ's)" (Collins & Lanza, 2010, p. 154). The following baseline model was used for each data collection point:

> "Let y = $(r_1, \ldots, r_j)$ represent the vector of a particular subject's responses to the J variables. Let L represent the latent variable with c = 1,…,C latent classes. Finally, I($y_j = r_j$) is an indicator function that equals 1 when the response to variable j = r_j, and equals 0 otherwise and $\Upsilon_c(X)$ is a standard baseline-category multinomial logistic model(e.g., Agresti, 1990).

$$P(Y = y|X = x) = \sum_{C=1}^{C} \Upsilon_c(X) \prod_{j=1}^{J} \prod_{r_j=1}^{R_j} p_{j,r_j|c}^{I(y_j=r_j)}$$

(Collins & Lanza, 2010, p. 153).

Once probabilities for fathering profiles were calculated based on Bayes' theorem (Lanza et al. 2007), each case was assigned to a latent group and a categorical variable was created using these probabilities. The effects of fathering profiles on children's cognitive skills were analyzed using ordinary least squares (OLS) regression, because the outcome measure of interest is a continuous measure. The effects of these fathering profiles were then evaluated across ethnic groups.

Longitudinal Data Analysis

In the longitudinal part of the study, the effects of fathering profiles on children's cognitive development in preschool was examined. Father involvement profiles helped the current study identify whether father's high level of home engagement and interaction influenced children's cognitive development over time. Initial models only included the outcome, fathers' classes, age-adjusted previous score, and chronological age. In the next model, controlling variables were included.

Children literacy and mathematics performance in preschool were examined in relation to father interaction and engagement level. Ordinary least square (OLS) regression models were used to analyze the relationship between fathers' direct engagement patterns and children cognitive development. Eight models were developed for measuring fathers' engagement patterns in 9 months and 24 months on girls' and boys' literacy and mathematics performance.

For the preschool year

$$Y_{ij} = \beta_{0j} + \beta_{1j}(\text{Father Classes}) + \beta_{2j}(\text{Previous Score}) + \beta_{3j}(\text{Assessment Age}) +$$
$$\beta_{4j}(\text{Special Education}) + \beta_{5j}(\text{Black}) + \beta_{6j}(\text{Asian}) + \beta_{7j}(\text{Hispanic}) +$$
$$\beta_{8j}(\text{Multirace}) + \beta_{9j}(\text{Other}) + \beta_{10j}(\text{Region}) + \beta_{11j}(\text{SES}) +$$
$$\beta_{12j}(\text{Relationship Happines}) + \beta_{13j}(\text{Mother Inv. Index}) +$$
$$\beta_{14j}(\text{Children under 18}) + \beta_{15j}(\text{Mother Work Status}) + \beta_{16j}(\text{Father's Age}) + r_{0i}$$

β_{0j} is the predicted preschool mathematics or reading scale score for White girls (or White boys) with LIF fathers, with no special education status, from Northeast region, with happy parent reported relationship status, with mothers who work more than 35 hours.

$\beta_{1j}(\text{Father Classes})$ is the slope used to compare each of four classes of fathers versus LIF fathers on preschool mathematics or literacy performance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age, mother involvement, special education status, relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

$\beta_{2j}(\text{Previous Score})$ is the effect of age-adjusted previous mental score (9 month or 2 year) on preschool mathematics or literacy performance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age, mother involvement, special education status, relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

$\beta_{3j}(\text{Assessment Age})$ is the effect of assessment age in months on preschool mathematics or literacy performance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age, mother involvement, special education status,

relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

$\beta_{4j}(\text{Special Education})$ is the slope used to compare children with reported special education status versus children with no reported special education status on preschool mathematics or literacy performance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age, mother involvement, special education status, relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

$\beta_{5j}(\text{Black})$ is the slope used to compare Black children versus White children on preschool mathematics or literacy performance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age, mother involvement, special education status, relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

$\beta_{6j}(\text{Asian})$ is the slope used to compare Asian children versus White children on preschool mathematics or literacy performance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age, mother involvement, special education status, relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

$\beta_{7j}(\text{Hispanic})$ is the slope used to compare Hispanic children versus White children on preschool mathematics or literacy performance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age, mother involvement, special education status, relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

$\beta_{8j}(\text{Multirace})$ is the slope used to compare children with multiracial race versus White children on preschool mathematics or literacy performance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age, mother involvement, special education status, relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

$\beta_{9j}(\text{Other})$ is the slope used to compare children in other race group versus White children on preschool mathematics or literacy performance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age, mother involvement, special education status, relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

$\beta_{10j}(\text{Region})$ is the slope used to compare each of three regions versus Northeast region on preschool mathematics or literacy performance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age, mother involvement, special education status, relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

$\beta_{11j}(\text{SES})$ is the slope used to compare each of four remaining SES quintiles versus SES quintile on preschool mathematics or literacy performance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age, mother involvement, special education status, relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

$\beta_{12j}(\text{Relationship Happines})$ is the slope used to compare no-relationship happiness versus yes-relationship happiness on preschool mathematics or literacy performance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age,

mother involvement, special education status, relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

$\beta_{13j}(\text{Mother Inv. Index})$ is the effect of mother's involvement index on preschool mathematics or literacy performance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age, mother involvement, special education status, relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

$\beta_{14j}(\text{Children under 18})$ is the effect of children under 18 years old in the household on preschool mathematics or literacy performance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age, mother involvement, special education status, relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

$\beta_{15j}(\text{Mother Work Status})$ is the slope used to compare each of three remaining mother work status versus mothers who work more than 35 hours on preschool mathematics or literacy performance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age, mother involvement, special education status, relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

$\beta_{16j}(\text{Father's Age})$ is the effect of father's age on preschool mathematics or literacy performance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age, mother involvement, special education status, relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

r_{0i} is the unexplained residual variance after controlling for race, socioeconomic status, mental score in 9 month or 2 year, assessment age, mother involvement, special education status,

relationship happiness, children in the household under 18 years old, mother's work status, and father's age.

Summary

This chapter was organized into two main sections; a brief introduction to ECLS-K study and data analysis plan. I first explained the design, development, and procedures of the ECLS-B study. The nature of the ECLS-B data lets researchers conduct empirical analyses involving a wide range of information systems that have reciprocal influences. Unlike earlier studies, special attention is given to fathers' direct engagement and their decisive role in the development of their children. These factors formed the basis for the current research which involved the analyses of data from the ECLS-B study.

In the second section of the chapter, a data analysis plan was presented. Briefly, with the help of existing literature, the purpose was to construct latent classes for fathers' home involvement. Then, father engagement patterns were compared based on ethnic groups and observed similarities and differences among these groups in relation to fathers' home involvement and their children's cognitive development. Structural relationship between fathers' direct engagement in 9 month and 2 year and children's cognitive development in preschool was examined in a final, full model which included previous measurement models of fathers' home engagement.

CHAPTER 4

RESULTS

The purpose of the current study was to examine (1) father's direct engagement and interaction patterns with their infants and toddlers, and (2) determine their longitudinal effects on children's literacy and mathematics performance when they were in preschool. The effects of fathers' engagement patterns on children's cognitive development were compared based on children's gender and ethnicity to examine possible cultural differences and practices. Relevant child characteristics (assessment age, previous score, special education status and race), family characteristics (region, socio-economic status, relationship happiness, mothers' involvement, number of children in household less than 18 years old and mothers' work status), and father characteristics (fathers' age) were included in the analysis. This study addressed the following research questions:

Research Question 1: How often do fathers engage their infants and toddlers through child-bearing activities?

Research Question 2: How does fathers' home engagement influence children's cognitive development in early childhood?

Research Question 3: Is there evidence of significant gain in children's cognitive development in early childhood related to levels and quality of fathers' direct engagement after controlling for SES, sex, and race?

Research Question 4: Do children's cognitive development benefit from different patterns of fathers' direct engagement after controlling for maternal involvement, age, gender, race, and SES?

In this chapter, the results of statistical analysis are presented in two main parts. In the first part, "fathers and their infants," fathers' engagement patterns with their infants (when infants are around 9 months old) and their relationships with children's literacy and mathematics performance are examined. In the second part, "fathers and their toddlers", fathers' engagement patterns with their toddler (when toddlers are around 2 years old) and their longitudinal relationship with children's literacy and mathematics performance in preschool are examined. In each section, the LCA (latent class model) is presented first followed by descriptive statistics and OLS (ordinary least squares) regression analysis results.

LCA is a useful method for identifying characteristics of different class membership based on covariates (Collins & Lanza, 2010). Observed categorical variables were used to create latent classes for father engagement patterns. A baseline model was developed and evaluated by examining likelihood ratio statistics. The following parameters are presented: the item-response probabilities (ρ's) and the latent class prevalences (γ's) (Collins & Lanza, 2010, p. 154).

First, gender-separated LCA model comparison results and selection criteria are discussed for models with two through six classes. This step of the analysis describes the number of latent father classes underlying the data. The best model was chosen based on G^2 statistic (likelihood-ratio), Bayesian Information Criterion (Schwarz, 1978), and Akaike's Information Criterion (Schwarz, 1978); when one of these criteria starts to increase from the model with n class to the model with n+1 class, the previous model indicates the best fit. Then, father classes and their item response probabilities for each item included in the analysis are presented.

Descriptive sections include percentages, means, frequencies, standard deviations and mean comparisons. In the first stage, the sample characteristics and paternal involvement data are presented for American fathers. Next, the results of fathering latent classes on children's

cognitive skills using OLS regression are presented. Initial models only included assessment age in preschool, age-adjusted previous mental score, father engagement patterns and the outcome of interest. Full model included controlling variables.

Fathers and Their Infants

Descriptive

Descriptive statistics for fathers' engagement in caregiving, literacy and play activities are presented in Table 4 -1. For caregiving activities, fathers' responses ranged from 1 (more than once a day) and 6 (not at all). Fathers' engagement in literacy activities were reverse coded and their response ranged from 1 (not at all) to 4 (everyday). Additionally, responses for engagement in play activities ranged from 1 (more than once day) to 5 (not at all).

Table 4 - 1

9-Month Father Engagement Indicators (N=5,700†)

		Mean	Std. Err.	Range
Caregiving	Changing diaper	2.06	0.02	1-6
	Preparing food	2.09	0.03	1-6
	Feeding bottle	1.97	0.02	1-6
	Putting sleep	2.36	0.02	1-6
	Washing child	3.51	0.03	1-6
	Dressing child	2.70	0.02	1-6
Literacy	Reading book	2.06	0.02	1-4
	Telling stories	2.08	0.02	1-4
Play	Play peekaboo	2.21	0.02	1-5
	Tickling child	1.22	0.01	1-5
	Play outside	3.22	0.02	1-5

† *Sample sizes were rounded to nearest 50 as required by NCES*

The percentages of fathers' engagement patterns based on activities and child's gender are presented in table 4 – 2. Fathers seemed to favor three activities the most: changing diaper, preparing meals, and feeding the child. More than half of the fathers (52.62%) included in this analysis changed their children's diaper more than once a day, 49.14% prepared meals more than once a day, and 51.23% fed the child more than once a day. The percentage of fathers who did not perform these activities were as follows respectively: 2.76, 2.6 and 1.44. Fathers seemed favor the following caregiving activities slightly less than first three caregiving activities. About 32.55% put the child to bed, 9.41% bathe child and 19.95% dressed the child at least more than once a day. A small percentage of fathers did not engage in putting the child to bed (1.65%) and dressing child (2.12%). Fathers' non-involvement in bathing their child was relatively high at 9.13%. This may be due to less frequent daily occurrence of this activity. Generally, fathers engagement more than once a day was slightly higher for their sons, as opposed daughters.

Table 4 - 2

9-Month Caregiving Activities

		More than once a day	About once a day	A few times a week	A few times a month	Rarely	Not at all
Change Diaper	Male	54.52	19.51	14.12	4.85	4.54	2.46
	Female	50.6	19.67	16.67	5.04	4.94	3.07
	Total	52.62	19.59	15.36	4.95	4.73	2.76
Prepare Meals	Male	50.6	20.31	16.84	5.46	4.2	2.59
	Female	47.58	21.44	18.32	5.74	4.3	2.62
	Total	49.14	20.86	17.56	5.6	4.25	2.6

Table 4 – 2 (continued)

		More than once a day	About once a day	A few times a week	A few times a month	Rarely	Not at all
Feed Child	Male	52.68	22.8	15.12	5.4	2.64	1.37
	Female	49.7	24.92	16.7	4.65	2.53	1.52
	Total	51.23	23.83	15.88	5.03	2.58	1.44
Put Sleep	Male	33.22	31.86	22.14	6.61	4.75	1.42
	Female	31.84	30.63	23.61	6.62	5.41	1.88
	Total	32.55	31.26	22.86	6.61	5.07	1.65
Bathe Child	Male	9.63	16.63	32.63	18.11	14.94	8.06
	Female	9.18	13.63	31.38	18.91	16.63	10.27
	Total	9.41	15.18	32.03	18.49	15.76	9.13
Dress Child	Male	21.28	28.39	33.83	9.17	5.28	2.06
	Female	18.55	26.68	35.72	10.85	6.01	2.18
	Total	19.95	27.56	34.75	9.99	5.64	2.12

Descriptive statistics for fathers' engagement in literacy activities are shown in Table 4 - 3. Fathers' every day literacy activity engagement with their children were somewhat limited compared to caregiving and play activities. With the exception of bathing child, more than half of the fathers engaged in the other caregiving activities every day. However, only about 8.41% of fathers read books to their children every day while about 10.96% told stories every day. The number of fathers who told stories to their children every day were slightly more than fathers who read books. Majority of fathers read books (45%) and told stories (41.95%) at least once or twice a week. The percentage of fathers who did not read (28.89%) or told stories (30.85%) were relatively high. In general, fathers with daughters seemed to read more often to their daughters than did the fathers with sons.

Table 4 - 3

9-Month Literacy Activities

		Not at all	Once or twice a week	3 to 6 times a week	Everyday
Read Book	Male	30.37	44.79	16.54	8.3
	Female	27.32	45.23	18.92	8.53
	Total	28.89	45	17.69	8.41
Tell Stories	Male	31.73	41.95	15.65	10.67
	Female	29.93	41.57	17.24	11.27
	Total	30.85	41.76	16.42	10.96

Fathers' engagement percentages in play activities are shown in table 4 – 4. The results for play activities were somewhat mixed. The majority of fathers seemed to engage their children about once a day (27.74%) and more than once a day (36.19%) through playing peekaboo, and fathers' engagement frequency was not different for boys and girls. Additionally, 2.41% simply avoided engaging their child through this activity. On the other hand, a relatively high percentage (83.24) of fathers engaged in tickling their child more than once a day, while about 0.29% did not perform this activity at all. Tickling the child was the most performed daily activity among all play activities and fathers' engagement showed very similar patterns for boys and girls. The last play activity, taking child outside for a walk or play, was the least daily performed activity. Only about 10.27% father took their child outside to walk and play more than once a day while 5.91% did not do this activity at all. Additionally, 35.62% of fathers performed this activity at least a few times a week and the frequency percentage for boys and girls were similar. Fathers' engagement activity patterns in play were distributed more equally for boys and girls than were fathers' engagement in literacy and caregiving activities.

Table 4 - 4

9-Month Play Activities

		More than once a day	About once a day	A few times a week	A few times a month	Rarely	Not at all
Play Peekaboo	Male	36.18	27.96	23.54	5.83	4.01	2.48
	Female	36.2	27.51	23.91	6.6	3.47	2.32
	Total	36.19	27.74	23.72	6.2	3.75	2.41
Tickle Child	Male	83.6	11.18	3.73	0.82	0.38	0.28
	Female	82.86	11.81	3.96	0.81	0.27	0.3
	Total	83.24	11.49	3.84	0.81	0.33	0.29
Outside Walk / Play	Male	10.72	15.13	35.62	21.82	11.29	5.42
	Female	9.8	14.55	35.32	22.86	11.04	6.43
	Total	10.27	14.85	35.47	22.33	11.17	5.91

The following section consists of two main parts: LCA for engagement patterns with their infants and OLS regression analysis results for father engagement patterns with their infants on preschool literacy and mathematics performance.

Father Engagement Patterns

LCA step. Three dimensions of father involvement: (1) engagement in caregiving, (2) engagement in play and (3) engagement in literacy activities, were considered in LCA to create father engagement latent classes. A total of 11 observed variables were used in 9-month analysis and 12 observed variables were used in 2-year analysis. Caregiving dimension of father involvement consisted of six indicator variables. Engagement in caregiving activities in 9-month were assessed with the following items:

1. Change your child's diaper?
2. Prepare meals or bottles for your child? (9-month only)
3. Feed your child or give your child a bottle? (9-month only)
4. Put your child to sleep?

5. Wash or bathe your child?
6. Dress your child?
7. Assist child with eating (2-year only)
8. Help child brush teeth (2-year only)

Fathers were required to indicate the frequency of these activities in a self-administered resident father survey. A dichotomous variable indicating high involvement was created for each item. Changing diaper, preparing meals or bottles, and feeding the child were marked as high involvement when father answered as "more than once a day." Putting the child to sleep and dressing the child at least once or more every day were marked as high involvement. Washing the child at least "few times a week" or more was considered as high involvement. Considering the nature and frequency of infants' caregiving activities, these classifications were deemed appropriate for high involvement category.

Fathers' engagement in play and literacy activities was assessed through several questions and five items were used as measures. Fathers answered the following questions based on the frequency of the activities.

1. Read books to your child
2. Tell stories to your child
3. Play peek-a-boo with your child (9-month only)
4. Take your child outside for a walk or to play in the yard, a park, or a playground
5. Gives a ride on shoulder (2-year only)
6. Play chasing games (2-year only)
7. Play inside games (2-year only)

The first two items, reading books and telling stories, were marked as high involvement when participants answered "every day" and low involvement otherwise. Item 3 and item 4 were marked as high involvement when fathers performed these activities more than once a day. Taking the child outside for a walk or to play was marked as high involvement in fathers who answered at least "a few times a week."

In order to determine existing latent classes, 11 observed variables indicating fathers' actual engagement were used in LCA. In the first step, six caregiving items, three play activity items, and two literacy items were selected and recoded as dichotomous variables to examine patterns of overall engagement. The best model was chosen based on the G^2 statistic (likelihood-ratio), Bayesian Information Criterion (BIC), and Akaike's Information Criterion (AIC). LCA estimates two sets of parameters: class membership probabilities (γ's) and item-response probabilities (ρ's). Class membership probabilities were used to identify which latent class each subject most likely belongs to and the identification is based on item-response probabilities. In the next step, separate analyses were run for boys and girls. There were significant differences in item response probabilities by gender, so a decision was made to run separate LCA for girls and boys.

Fathering profiles for girls at 9-months. The 9-Month LCA sample for girls consisted of 3,000 [1] biological resident fathers. More than half of the fathers (60.7 %) were White, 8.21 % were Black, and 12.43 % were Asian and 16.97% were Hispanic.

Table 4 - 5 shows the comparison of model with two through six classes based on G^2 statistic, AIC, and BIC values. The model with five latent class had the lowest G^2, AIC and BIC

1 *Sample sizes were rounded to nearest 50 as required by NCES*

caregiving, play, and literacy activities. BIC values started to increase in the model with six latent class model.

Table 4 - 5

Model Comparison for Infant Girls

Number of Classes	Degrees of Freedom	Likelihood Ratio G2	AIC	BIC
2	2024.00	3372.64	3418.64	3556.91
3	2012.00	2643.96	2713.96	2924.37
4	2000.00	2139.39	2233.39	2515.94
5	**1988.00**	**2014.04**	**2132.04**	**2486.73**
6	1976.00	1937.04	2079.04	2505.87

Class size (γ' s) and item-response probabilities (ρ' s) for each latent class for the model with five classes are shown in table 4 - 6. The first class of fathers included 22.84% of the participants and these fathers had high probabilities of involving in four caregiving activities, the highest probabilities of reading books and telling stories, and likely to take child for outside play and tickle the child. This class of fathers performed some of the caregiving and play activities and value literacy activities more than any other group. This group of fathers was named as "daily playful caregivers" (DPC).

The second class of fathers highly valued caregiving activities and play activities, but they had low probabilities of reading books and telling stories. This category consisted of 21.88% of the participants. They were highly likely ($\rho > 0.92$) to perform all caregiving activities and therefore, this group of fathers was named as "primary playful caregivers" (PPC).

The third class of fathers (21.39%) were likely to engage in some caregiving activities (putting child to sleep, washing the child, and dressing the child) and some play activities. This group of fathers was named as "occasional caregivers (OC)". The fourth class of fathers (7.3%) had high probability of engaging their child only in three play activities and were thus named as

"average playful" (AP) fathers. The last group of fathers was the least likely to be involved in any of the activities except for tickling the child, with the least probability ($\rho > 0.59$) among all groups. This group of fathers was named as "low involving" (LI) fathers and it was used as base group in OLS regression analysis.

Table 4 - 6

Item Response Probabilities for Girls at 9-Month

Item	DPC Fathers 22.84%	PPC Fathers 21.88%	OC Fathers 21.39%	AP Fathers 7.3%	LI Fathers 26.76%
Changing Diaper	**0.746**	**0.945**	0.436	0.038	0.062
Preparing Bottles	**0.935**	**0.977**	0.165	0.002	0.029
Feeding the Child	**0.948**	**0.976**	0.132	0.120	0.011
Putting to Sleep	**0.712**	**0.977**	**0.648**	0.378	0.183
Washing the Child	0.441	**0.981**	**0.772**	0.164	0.173
Dressing the Child	0.472	**0.920**	**0.520**	0.008	0.031
Reading Book	0.050	0.177	0.140	0.101	0.000
Telling Stories	0.060	0.237	0.134	0.206	0.005
Playing Peek a Boo	0.399	**0.658**	0.297	**0.579**	0.031
Tickling the Child	**0.940**	**0.934**	**0.910**	**0.892**	**0.593**
Outside Play	**0.512**	**0.952**	**0.755**	**0.541**	0.323

Fathering profiles for boys at 9-months. The 9-month LCA sample for boys consisted of 3,200 [2] biological resident fathers. More than half of fathers (56.4 %) were White, 7.8 % were Black, and 14.5 % were Asian and 15.8 % were Hispanic. Table 4.3 shows the comparison of models with two through six classes based on G^2 statistic, AIC, and BIC values for fathering profiles for boys at 9-months. The model with five latent class, again, had the lowest G^2, AIC, and BIC values meaning that five latent classes described patterns of American fathers'

2 *Sample sizes were rounded to nearest 50 as required by NCES*

engagement in caregiving, play, and literacy activities the best. BIC value started increasing with the model with six latent class.

Table 4 - 7

Model Comparison for Boys at 9-Month

Number of Classes	Degrees of Freedom	Likelihood Ratio G2	AIC	BIC
2	2024.00	3046.86	3092.86	3232.46
3	2012.00	2440.40	2510.40	2722.84
4	2000.00	1881.38	1975.38	2260.65
5	**1988.00**	**1690.78**	**1808.78**	**2166.89**
6	1976.00	1611.42	1753.42	2184.37

Item response probabilities for the model with five latent classes are shown in Table 4 - 8. The first class of fathers was likely to engage with their sons in almost all caregiving activities, with the exception of dressing them. Additionally, they were likely to tell stories and do some of the play activities. This group of fathers was named as “daily playful caregivers” (DPC) representing 19.52% of all fathers in the analysis. The second class of fathers were somewhat similar to the first group, except they were likely to engage in dressing activities and playing peek a boo, but refrained from telling stories. This group of fathers was named as “primary playful caregiver” (PPC) representing 27.41% of all fathers. The third group of fathers was highly likely to be involved in all 12 activities with the lowest probability of .719 for telling stories. This group of fathers was named as “highly engaged caregiver” (HEC) representing 4.47% percent of all fathers in the analysis. The fourth class of fathers had the least probability of engaging in any activities but tickling the child, with probability of .661. This group was named as “low involving” (LI) fathers representing 28.47% of all fathers in the analysis. The last group of fathers was likely to occasionally engage in two caregiving activities and two play

activities. This group of fathers was named as “occasional caregiver (OC)” representing 20.12% of all fathers in the analysis. A brief summary of all father classes is shown in Table 4 - 9.

Table 4 - 8

Item Response Probabilities for Boys at 9-Month

	DPC Fathers % 19.52	PPC Fathers % 27.41	HEC Fathers % 4.47	LI Fathers % 28.47	OC Fathers % 20.12
Changing Diaper	**0.746**	**0.942**	**0.927**	0.079	0.338
Preparing Bottles	**0.916**	**0.941**	**0.851**	0.032	0.072
Feeding the Child	**0.810**	**0.989**	**0.970**	0.020	0.138
Putting to Sleep	**0.669**	**0.962**	**0.874**	0.198	**0.656**
Washing the Child	**0.526**	**0.942**	**0.875**	0.176	**0.710**
Dressing the Child	0.394	**0.958**	**0.929**	0.035	0.477
Reading Book	0.020	0.028	**0.856**	0.012	0.118
Telling Stories	0.056	0.086	**0.729**	0.040	0.109
Playing Peek a Boo	0.268	**0.619**	**0.719**	0.097	0.358
Tickling the Child	**0.882**	**0.979**	**0.926**	**0.661**	**0.857**
Outside Play	**0.528**	**0.843**	**0.937**	0.387	**0.812**

Table 4 - 9

Overview of Father Classes

Father Classes	Characteristics
Daily Playful Caregiver (DPC):	■ Involve in most caregiving activities ■ Play with the child sometimes but avoid literacy activities
Primary Playful Caregiver (PPC):	■ Perform all caregiving activities ■ Play with the child but avoid literacy

Table 4 - 9 (continued)

Father Classes	Characteristics
Occasional Caregiver (OC):	■ Performs less-occurring caregiving activities ■ Tickle the child and take the child for outside play. ■ Avoid literacy activities
Average Playful (AP): Girls Only	■ No caregiving activities ■ No literacy activities ■ Perform all play activities
Low Involving (LI):	■ Likely to avoid all caregiving, play, and literacy activities ■ Only little play
Highly Engaged Caregiver (HEC):	■ Perform all caregiving activities ■ Substantial play with the child ■ Only class of fathers who likely perform literacy activities

9-Month Father Profiles on Preschool Literacy and Mathematics

Descriptive statistics. The preschool analytic sample consisted of 4,850 children including 2,350 (51 %) female; 2,650 (69 %) White; 350 (6 %) Black; 600 (13 %) Asian; and 750 (13%) Hispanic children[3]. Table 4 – 10 shows descriptive statistics for SES, regions, and family characteristics. Mean literacy and mathematics score by child characteristics and father classes for girls and boys are also shown in Table 4 - 11.

The mean assessment age in preschool was 52.24 months ranging from 44 to 65.3 months old. The analytic sample included children with special needs (2%). Additionally, age-adjusted

3 *Sample sizes were rounded to nearest 50 as required by NCES*

Table 4 - 10

Descriptive Statistics for 9-Month Analysis (N=4,850 †)

Variables	Mean	Std. Dev.	Minimum	Maximum
Dependent Variables				
Reading score	3.22	0.37	2.46	4.39
Mathematics score	30.96	9.48	9.89	65.74
Control Variables				
Child's gender	0.51	0.50	0.00	1.00
Assessment age in preschool	52.24	3.98	44.00	65.30
9-month special education status	0.98	0.13	0.00	1.00
Age-adjusted 9-month mental score	0.01	0.99	-8.96	2.93
Race/Ethnicity				
White	0.69	0.46	0.00	1.00
Multirace	0.04	0.19	0.00	1.00
Asian	0.03	0.16	0.00	1.00
Hispanic	0.19	0.39	0.00	1.00
Black	0.06	0.23	0.00	1.00
Other	0.01	0.07	0.00	1.00
Region				
Northeast	0.17	0.38	0.00	1.00
Midwest	0.26	0.44	0.00	1.00
South	0.35	0.48	0.00	1.00
West	0.22	0.41	0.00	1.00
SES				
First quintile	0.09	0.28	0.00	1.00
Second quintile	0.15	0.36	0.00	1.00
Third quintile	0.19	0.39	0.00	1.00
Fourth quintile	0.27	0.44	0.00	1.00
Fifth quintile	0.30	0.46	0.00	1.00
Relationship happiness	0.02	0.13	0.00	1.00
Mother involvement index	3.45	1.44	0.00	6.00
Children under 18 in household	2.03	1.10	1.00	11.00
Mother work status				
35 hours or more	0.32	0.47	0.00	1.00
Less than 35 hours	0.23	0.42	0.00	1.00
Looking for work	0.05	0.21	0.00	1.00
Not in the labor force	0.40	0.49	0.00	1.00
Fathers' age	31.93	6.34	17.00	73.00

Note. † Sample sizes were rounded to nearest 50 as required by NCES

Table 4 - 11

Preschool Literacy and Mathematics Score by Child Characteristics and 9-Month Father Classes

	Literacy			Mathematics		
	Mean	SD	Sample size	Mean	SD	Sample size
Gender						
Female	3.26	0.38	2350 †	31.64	9.68	2350 †
Male	3.20	0.39	2450 †	30.36	10.21	2450 †
Race/Ethnicity						
White	3.25	0.36	2650 †	31.16	9.31	2650 †
Black	3.15	0.40	350 †	28.21	9.52	350 †
Asian	3.45	0.39	600 †	38.12	10.06	600 †
Hispanic	3.03	0.37	750 †	27.16	9.24	750 †
Other	3.02	0.34	150 †	25.33	9.49	150 †
SES						
First quintile	2.91	0.31	400 †	24.02	8.57	400 †
Second quintile	3.04	0.35	750 †	26.44	9.03	750 †
Third quintile	3.13	0.34	950 †	28.53	8.56	950 †
Fourth quintile	3.25	0.35	1150 †	31.54	9.09	1150 †
Fifth quintile	3.43	0.35	1550 †	36.09	9.53	1550 †
Boys						
DPC Fathers	3.19	0.39	500 †	29.91	10.27	500 †
PPC Fathers	3.13	0.38	700 †	28.56	9.96	700 †
HEC Fathers	3.21	0.41	100 †	29.68	10.22	100 †
AP Fathers	3.21	0.39	750 †	31.42	10.43	750 †
LI Fathers	3.24	0.39	550 †	31.48	10.15	550 †
Girls						
DPC Fathers	3.23	0.39	600 †	31.21	9.65	600 †
PPC Fathers	3.22	0.36	550 †	30.44	9.70	550 †
OC Fathers	3.30	0.38	550 †	32.31	9.66	550 †
LI Fathers	3.20	0.41	200 †	30.76	9.67	200 †
AP Fathers	3.28	0.37	700 †	32.23	9.99	700 †

Note. † Sample sizes were rounded to nearest 50 as required by NCES

9-month mental score had a mean of 0.01 and ranged from -8.76 to 2.93. The mean scores for SES quintiles from first through fifth were as follows: 9%, 15%, 19%, 27%, and 30%. Among fathers, 2% responded "no" to relationship happiness. The composite mother involvement index variable had a mean of 3.45 ranging from 0 to 6. An average household had 2.03 children under 18 years old, and it ranged from 1 to 11. Forty percent of mothers were not in the labor force, 5% were looking for work, 23 % were working less than 35 hours a week and 32% were working 35 hours or more. Fathers had an average age of 31.93 years old ranging from 17 to 73 years old.

Overall, girls outperformed boys in both literacy and mathematics, and had a mean score of 3.26 and 3.64 respectively, while boys had mean scores of 3.20 and 30.36, respectively. Asian children had the highest mean score in literacy (3.45) and mathematics (38.12) followed by White, Black, Hispanic children and children in other race group. Children in the lowest SES quintile had the lowest mean scores and each increase in SES quintile resulted in higher mean scores in both literacy and mathematics score. The mean score for literacy and mathematics quintiles 1 through 5 were as follows: 2.91, 3.04, 3.13, 3.25 and 3.43, and 24.02, 26.44, 28.53, 31.54 and 36.09 respectively.

The mean scores based on father class were somewhat similar. Boys with PP fathers had the lowest mean score for literacy (3.13) and mathematics (28.56) while boys with LI fathers had the highest mean score in literacy (3.24) and mathematics (31.48). Girls' mean scores for literacy and mathematics ranged from 3.20 to 3.28 and 30.44 to 32.31, respectively. Girls with LI fathers had the lowest literacy mean score (3.20) and girls with PP fathers had the lowest mathematics mean score (30.44).

Ordinary Least Squares Regression

Literacy. Table 4 - 12 shows the results of regression analysis for the influence of father profiles on girls' and boys' literacy scores. In the first model, father profiles were regressed on girls' literacy scores without control variables and then, the analysis proceeded with the second model that included control variables. In the third model, father profiles were regressed on boys' literacy score and father profiles on boys' literacy score with control variables included. Father profiles with lowest involvement patterns (LI fathers) were used as the reference class in all four models. Due to the differences in the nature of father profiles in 9-month, the results were presented based on gender and made a comparison between boys and girls in the following section.

In Model 1, the effects of father profiles on girls' literacy score were examined controlling only for age adjusted 9-month mental score and assessment age when literacy test was administered. The results indicated that the initial model explained 8.1% of the variance (R^2=0.08, F(6,84)=26.53, p<.01). With the LI fathers as the reference group, DC father class was significantly related to the child's literacy performance at 9-months. Interestingly, three father classes had negative effects on girls' literacy score in preschool years. Girls with DC fathers scored 9% less than girls with LI fathers and girls with AP fathers also scored 6.5% less than those with LI fathers. OC and PP fathers were not significantly related to the outcome. Both age adjusted 9-month mental score and assessment age in preschool data wave were significantly related to literacy score.

In the next model, control variables; age-adjusted 9-month mental score, child's age at preschool assessment, child's race, special education at 9-months, family characteristics and father characteristics; were included. The initial model explained 33% of the variance (R^2=0.33,

Table 4 - 12

Regression Results for 9-Month on Preschool Literacy

	Literacy – Girls Model 1				Literacy – Boys Model 2			
Variables	B	se	b	Se	B	Se	b	Se
DPC fathers	-0.082*	0.03	-0.06*	0.03	0.03	0.05	0.07	0.04
PPC fathers	-0.07	0.04	-0.03	0.03	-0.06*	0.03	-0.01	0.03
OC fathers	-0.02	0.03	-0.03	0.03				
HEC fathers					0.06	0.05	0.07	0.04
AP fathers	-0.08*	0.04	-0.07*	0.04	0.03	0.03	0.03	0.04
Child								
Previous Score	0.04**	0.01	0.022*	0.01	0.04***	0.01	0.02**	0.01
Assessment age	0.02***	0.00	0.03***	0.00	0.02***	0.00	0.03***	0.00
Special ed. (YES)			0.07	0.12			0.04	0.05
Multirace			0.04	0.05			-0.02	0.05
Asian			0.09**	0.03			0.08	0.04
Hispanic			-0.12	0.06			-0.11***	0.03
Black			0.03	0.04			0.10*	0.04
Other			-0.07	0.04			-0.11	0.11
Family								
Region – Midwest			-0.04	0.03			-0.05	0.03
Region – South			-0.03	0.03			-0.07*	0.03
Region – West			-0.09**	0.03			-0.06*	0.03
SES 2			0.11**	0.03			0.08	0.04
SES 3			0.21***	0.04			0.17***	0.04
SES 4			0.28***	0.05			0.26***	0.04
SES 5			0.39***	0.04			0.40***	0.04
Rel happiness (NO)			-0.01	0.07			-0.06	0.06
Mother inv. Index			0.02***	0.01			0.03**	0.01
Children under 18			-0.06***	0.01			-0.05***	0.01
Mother work status								
Less than 35 hrs			0.01	0.02			0.05	0.04
Looking for work			0.00	0.05			0.00	0.04
Not in the labor force			0.03	0.02			0.03	0.03
Father's age			0.01***	0.00			0.00	0.00
_cons	2.08***	0.24	1.36***	0.14	1.906***	0.18	1.43***	0.16
r2	0.08		0.33		0.08		0.34	
N	2350.00†		2350.00 †		2450.00 †		2450.00 †	
F	26.53		41.86		20.52		40.35	

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

Note. † Sample sizes were rounded to nearest 50 as required by NCES

F(26,64)=41.86, p<.01) Two of the father classes, DC and AP, were still significantly related to girls' literacy scores. Girls with DC fathers scored 6.3% less and those with AP fathers scored 5.5% less than those in the reference group. The remaining two father groups were not significantly related to the outcome. Among child characteristics, special education status was not significant but assessment age in preschool and age adjusted 9-month score were significantly related to girls' literacy scores. There were some differences among race groups; Asian girls scored 4.2% higher than those girls in the reference group. Additionally, girls in the West region scored 10% lower compared to the reference group. Socioeconomic status of the family was significantly related to the girl's literacy score; each increase in SES level was significantly and gradually related to the outcome. Relationship happiness was not significantly related to girl's literacy score. Mother involvement index was significant and girls whose mothers were involved more, scored better. The number of children under 18-years old in the household was also related to the outcome and as the number of children increased, the girls' literacy score was affected negatively. Mothers' work status was not significantly related to girls' literacy score in 9-month. Lastly, girls with older fathers scored better on literacy assessment.

In Model 2, father profiles were, first, regressed on boys' literacy scores with assessment age in preschool and age-adjusted 9-month mental score and then, proceeded with the model in which children, family, and father characteristics for literacy score were included. The same convention was followed with Model 2. Again, fathers with lowest involvement pattern (LI fathers) were assigned as the reference group in all four models. In the initial model, 8% of variance was explained (R^2=0.08, F(6,84)=41.86, p<.01). Boys with PP fathers scored about 0.07% less than the reference group. Remaining father groups were not significantly related to boys' literacy score in preschool. Age adjusted 9-month mental score was significant and it

meant boys who had higher previous scores performed better on preschool literacy assessment. Children's age during the assessment in preschool also contributed to their literacy score; older children simply performed better.

In the model with father profiles, child characteristics, family characteristics, and father characteristics included, PPC fathers were no more related to the outcome. In this model 34% of the variance was explained (R^2=0.33, F(26,64)=41.86, p<.01)As expected, age-adjusted previous score and assessment age in preschool were positively related to boys' literacy score in preschool. Special education status was not related to the outcome. Black boys scored 6.2% more, and Hispanic boys scored 11% less than those White boys in the reference group. A close examination of family characteristics in Model 2 revealed that relationship happiness at 9-months was not related to boys' literacy score in preschool. Boys in South and West regions scored 8.4% and 6.7% less than those in the reference group. SES findings were the similar as in the previous model; each level of increase in SES quintile was associated with better literacy scores in a gradual fashion with the exception of the second SES quintile. Mother index, as it was with girls' literacy and mathematics model, was also related to boy's success in literacy; higher mother involvement yielded better literacy scores for boys. The number of children under 18 years old in the household was again significant and as the number of children increased in the house, boys' literacy score suffered. Mothers work status was significantly related to boys' literacy performance. Father's age, interestingly, was not related to children's literacy score in preschool assessment.

Using the adjusted Wald test, father classes were also compared to each other. In the girl literacy models, none of the father classes were significantly different than each other. In the literacy model for boy, DC and PP fathers were significantly different each other. In the next

part, regression results of 9-month father profiles on boys' and girls' mathematics score in preschool are discussed.

Mathematics. Table 4 – 13 displays regression analysis results for girls' father profiles on mathematics score including only adjusted 9-month mental score and assessment in preschool. This model explained 12% variance (R^2=0.12, F(6,84)=26.94, p<.01). Girls with DP fathers scored 2.17 points less and girls with PP fathers scored 2.74 points less on mathematics assessment compared to those in the reference group with LI fathers. OC fathers and AP fathers were not significantly related to girls' mathematics score. Age adjusted 9-month mental score and assessment age in preschool were significantly and positively related to girls' mathematics score in preschool.

The full model included child characteristics, family characteristics, and father characteristics and explained 30% variance (R^2=0.30, F(26,64)=42.54, p<.01)Unlike the results from the regression analysis for literacy score, two father classes, DP and PP fathers, were significantly related to girls' mathematics score. Girls with DP fathers and girls with PP fathers scored 1.67 points and 1.9 points less respectively than those in the reference group. OC fathers and AP fathers were not related to the outcome. Girls with better age-adjusted previous mental scores had better mathematics scores in preschool. Also, age at assessment was significantly and positively related to the outcome, simply stated: older girls scored higher. Special education status in 9-month was not related to girls' mathematics score in preschool. Asian girls were significantly different from the reference group. Asian girls scored 2.6 more than White girls in the reference group.

There were some regional differences among girls' performance; the Northeast region was assigned as the reference group and girls in the remaining three groups, Midwest, South and

Table 4 - 13

Regression Results for 9-Month on Preschool Mathematics

	Girls				Boys			
	Model 3				Model 4			
Variables	b	Se	B	Se	B	Se	B	Se
DPC fathers	-2.17***	0.59	-1.67**	0.52	-0.444	0.84	0.38	0.75
PPC fathers	-2.74***	0.62	-1.89**	0.6	-1.86*	0.83	-0.59	0.64
OC fathers	-0.88	0.87	-1.11	0.66				
HEC fathers					-0.55	1.49	-0.08	1.31
AP fathers	-1.309	0.86	-1.02	0.77	0.48	0.9	0.47	0.83
Child								
Previous Score	0.97**	0.33	0.62**	0.22	1.07***	0.25	0.71**	0.22
Assessment age	0.72***	0.1	0.85***	0.05	0.75***	0.1	0.84***	0.07
Special ed. (YES)			2.42	2.45			0.41	1.62
Multirace			-0.32	1.14			-1.65	0.99
Asian			2.78***	0.72			2.55*	1.03
Hispanic			-2.00	1.26			-1.65*	0.67
Black			0.54	1.12			0.59	1.03
Other			-1.91	1.27			-3.81	2.56
Family								
Region – Midwest			-1.61	0.89			-0.36	0.66
Region – South			-1.30	0.77			-0.93	0.67
Region – West			-1.57*	0.75			-0.45	0.7
SES 2			1.84	1.17			1.48	1.22
SES 3			4.08**	1.46			4.10***	1.02
SES 4			5.88***	1.37			6.78***	1.06
SES 5			8.71***	1.2			9.99***	1.39
Rel happiness (NO)			-0.67	3.35			-0.21	1.19
Mother inv. index			0.45*	0.18			0.39	0.21
Children under 18			-1.16***	0.23			-0.81***	0.17
Mother work status								
Less than 35 hrs			-0.19	0.6			0.70	1
Looking for work			-0.73	1.11			-0.63	1
Not in the labor force			0.02	0.56			0.08	0.63
Father's age			0.09*	0.05			0.04	0.03
_cons	-5.02	5.45	-19.83***	3.01	-8.40	5.06	-20.05***	4.22
r2	0.118		0.305		0.111		0.312	
N	2350 †		2350 †		2450 †		2450 †	
F	26.937		42.538		18.602		38.768	

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

† Sample sizes were rounded to nearest 50 as required by NCES

West, scored 1.7, 1.4 and 1.66 points less than those in Northeast region respectively. SES level, again, was significantly related to girls' mathematics score and there was a significant score increase associated with quintiles. The coefficient for relationship happiness was also not related to the outcome in this model. Mother involvement at 9-months was related to better mathematics scores for girls in preschool years, while the number of children under 18 years old in the household had a negative effect on girls' mathematics score. Interestingly, the mothers' work status at 9-months was not related to better mathematics score for girls in preschool. Lastly, as fathers' age increased, their daughters seemed to get better scores on the mathematics assessment in preschool years.

In Model 4, father profiles were regressed on boys' mathematics score only controlling for age-adjusted 9-month mental score and assessment age in preschool wave, and about 11% variance was explained (R^2=0.11, F(6,84)=18.60, p<.01). Consistent with findings in the previous reading model, PP fathers had a negative influence on boy's mathematics score, and these boys scored 1.86 points less than those in the reference class with LI fathers. Higher age-adjusted mental score and maturity both signified higher scores in preschool mathematics assessment.

In Model 4, once control variables were in the model, 31% of variance was explained (R^2=0.31, F(26,64)=38.77, p<.01). Father class PP lost its significance and they were no more related to the outcome. Age-adjusted 9-month mental score and assessment age in preschool were both significantly and positively related to the outcome, as in Model 3. Special education status was not related to the outcome consistent with previous models for both girls and boys. There were some differences among race groups. Asian boys scored 2.56 points more, while Hispanic boys scored 1.76 points less than White boys in the reference group. Additionally there

were not any significant differences between Black and White boys. Unlike previous models, there were no regional differences among boys' mathematics score at 0.5 significance level in the full model. Second SES quintile was not related to the outcome, which was inconsistent with previous models. However, remaining quintiles signified a gradual score increase on boys' mathematics score in preschool. Consistent with previous models, parents' relationship happiness did not impose any effects on the outcome. Mother involvement index again signaled a positive impact on boys' performance and the inverse relationship of number of children under 18 years old in the household persisted. Although fathers' maturity was a significant player for girls and their performance on reading and mathematics, it was not significant for boys' performance on mathematics in preschool, consistent with the boys' reading model. The adjusted Wald test did not reveal any differences among father classes in 9-month mathematics model for girls and boys.

Fathers and Their Toddlers

Descriptive

Descriptive statistics for fathers' 2-year engagement in care giving, literacy and play activities are shown in table 4 -14. Fathers' responses to caregiving, literacy and play activities ranged from 1 (more than once a day) to 6 (not at all), 1 (not at all) to 4 (everyday) and 1 (more than once a day) to 5 (not at all) respectively.

Table 4 - 14

Descriptive Statistics for 2-Year Caregiving, Play and Literacy Activities (N=4300†)

		Mean	Std. Err.	Range
Caregiving	Changing diaper	2.06	0.03	1-6
	Preparing food	2.34	0.02	1-6
	Feeding bottle	3.27	0.03	1-6

Table 4 - 14 (continued)

		Mean	Std. Err.	Range
	Putting sleep	2.54	0.02	1-6
	Washing child	2.67	0.03	1-6
	Dressing child	3.19	0.03	1-6
Literacy	Reading book	2.46	0.02	1-4
	Telling stories	2.23	0.02	1-4
Play	Chasing games	2.34	0.02	1-5
	Shoulder games	2.75	0.03	1-5
	Inside game	2.06	0.02	1-5
	Outside play	2.86	0.02	1-5

The percentage frequency of fathers' engagement in caregiving activities are shown in table 4 – 15. Fathers' engaged their children the most through changing diaper and about 48.33% performed this activity more than once a day while 22.48% of fathers performed this activity at least once a day. On the other hand, 2.38% did not perform this activity at all. Fathers who had sons performed this activity slightly more than fathers who had daughters. Bathing the child and helping the child brush his or her teeth more than once a day were the least performed activities with 7.91% and 9.66% respectively, and about 5.58% and 8.63% of fathers respectively did not engage their child in these activities. Fathers, again, performed this activity slightly more frequently if they had a son. Putting a child to bed, dressing the child, and assisting the child to eat were performed at least once a day or more with 23.56%, 22.14% and 20.58% respectively while smaller percentage of father did not perform these activities (1.35%, 1.27%, and 2.78%

respectively). In general, for the majority of caregiving activities, fathers seemed to engage slightly more often if they had a son than did fathers who had daughters.

Table 4 - 15

Percentage Frequency of 2-Year Caregiving Activities

		More than once a day	About once a day	A few times a week	A few times a month	Rarely	Not at all
Changing Diaper	MALE	49.59	23.65	17.01	3.95	3.95	1.84
	FEMALE	46.98	21.24	18.36	5.85	4.62	2.95
	Total	48.33	22.48	17.66	4.87	4.28	2.38
Put Sleep	MALE	23.54	44.72	22.31	5.35	2.9	1.19
	FEMALE	19.84	43.02	25.91	5.96	3.74	1.53
	Total	21.75	43.9	24.05	5.64	3.31	1.35
Bathe Child	MALE	8.22	22.05	38.99	16.19	10.17	4.38
	FEMALE	7.59	18.18	35.62	17.96	13.8	6.86
	Total	7.91	20.17	37.36	17.05	11.92	5.58
Dress Child	MALE	22.14	32.96	33.71	7.46	2.67	1.06
	FEMALE	19.1	29.64	36.22	9.11	4.43	1.5
	Total	20.67	31.35	34.92	8.26	3.52	1.27
Assist Eating	MALE	21.6	32.87	27.06	6.88	9.04	2.54
	FEMALE	19.51	31.24	28.79	7.78	9.65	3.03
	Total	20.58	32.08	27.9	7.32	9.34	2.78

The percentages for fathers' engagement in literacy activities are presented in table 4 – 16. About 11.15% of fathers did not read to their children and 19.75% did not tell stories to their children while 15.18% and 11.93% performed these activities everyday respectively. The majority of fathers read to their children once or twice a week (46.27%) and tell stories to their

children once or twice a week (46.82%). In general, fathers engaged in literacy activities slightly more often with their sons than with their daughters.

Table 4 - 16

Percentage Frequency of 2-Year Literacy Activities

		Not at all	Once or twice a week	3 to 6 times a week	Everyday
Read to Child	MALE	12.14	47.17	25.78	14.92
	FEMALE	10.1	45.31	29.14	15.45
	Total	11.15	46.27	27.4	15.18
Tell Child Stories	MALE	20	47.19	21.42	11.39
	FEMALE	19.48	46.42	21.59	12.5
	Total	19.75	46.82	21.5	11.93

Descriptive statistics for fathers' engagement in 2-year play activities are shown in table 4 – 17. A small percentage of fathers avoided chasing games (1.7), shoulder games (2.71), playing indoor games (0.55), and taking the child outside (0.97) while 26.43%, 17.62%, 37.63%, and 12.5% respectively performed these activities more than once a day. More than half of the fathers engaged their children through play activities at least a few times a week. Fathers with sons generally seemed to engage in play activities more often than did fathers with daughters.

Table 4 - 17

Percentage Frequency of 2-Year Play Activities

		More than once a day	About once a day	A few times a week	A few times a month	Rarely	Not at all
Chasing Games	MALE	28.82	29.98	30.76	6.33	2.45	1.67
	FEMALE	23.88	30.19	32.95	8.13	3.12	1.74
	Total	26.43	30.08	31.82	7.2	2.77	1.7
Should Games	MALE	19.02	25.82	35.55	11.99	4.88	2.73
	FEMALE	16.13	23.29	36.34	14.9	6.65	2.69
	Total	17.62	24.6	35.93	13.4	5.74	2.71

Table 4 - 17 (continued)

		More than once a day	About once a day	A few times a week	A few times a month	Rarely	Not at all
Indoor Games	MALE	40.44	32.77	21.45	4.02	0.89	0.44
	FEMALE	34.64	31.48	25.47	6.04	1.71	0.66
	Total	37.63	32.14	23.39	5	1.28	0.55
Outside play	MALE	13.9	22.38	42.34	16.45	3.92	1.02
	FEMALE	11.01	19.77	43.48	19.81	5.02	0.91
	Total	12.5	21.12	42.89	18.08	4.45	0.97

2-Year Father Engagement Patterns

LCA step. 2-year fathering profiles for boys and girls were similar in terms of item response probabilities. Thus, a decision was made to combine the interpretation for both gender. Table 4 - 18 shows the comparison of models with two through six classes for girls and boys respectively. For girls, the model with five latent class, again, had the lowest G^2, AIC, and BIC values meaning that five latent classes described patterns of American fathers' engagement in caregiving, play, and literacy activities the best. BIC value started increasing with six latent class model. A total of 2,730 fathers were used in the analysis. For boys, the model with five latent

Table 4 - 18

LCA Model Comparison for 2-Year

Number of Classes	Degrees of Freedom	Likelihood Ratio G2	AIC	BIC
2	8141.00	7688.57	7788.57	8120.84
3	8115.00	7039.03	7191.03	7696.08
4	8089.00	6208.59	6412.59	7090.43
5	**8063.00**	**5441.08**	**5697.08**	**6547.69**
6	8037.00	5290.06	5598.06	6621.45
7	8011.00	5134.92	5494.92	6691.09

class, again, had the lowest G^2 (2620.67), AIC (2748.67), and BIC (3132.09) values meaning that five latent classes described patterns of American fathers' engagement in caregiving, play, and literacy activities the best. BIC value started increasing with the model with six latent class.

Item response probabilities are shown in Table 4-19. The first class of fathers consisted of 17.03% for boys and 20.75% for girls of all fathers in the analysis. Fathers in this group were highly likely to engage in play activities and their probability of engagement in caregiving and literacy activities were low. The only difference between girls and boys were that fathers in this class had slightly more probability of putting the child to sleep for girls (0.529 vs 0.444). This group of fathers was named as "occasional playful" (OP) fathers. The second class of fathers were likely to engage in all 12 caregiving, play, and literacy activities and named as "highly engaged" (HE) fathers representing 10.62% and 10.97% for girls and boys respectively.

Table 4 - 19

Item Response Probabilities for 2-Year

	OC Boys	OC Girls	HE Boys	HE Girls	PP Boys	PP Girls	DC Boys	DC Girls	LI Boys	LI Girls
Reading books	0.10	0.12	**0.73**	**0.94**	0.08	0.04	0.10	0.11	0.04	0.03
Telling stories	0.06	0.10	**0.69**	**0.70**	0.03	0.07	0.03	0.05	0.02	0.02
Chasing games	**0.74**	**0.82**	**0.85**	**0.72**	**0.84**	**0.87**	0.26	0.32	0.24	0.21
Carry on shoulder	**0.56**	**0.59**	**0.60**	**0.56**	**0.81**	**0.76**	0.06	0.21	0.09	0.06
Inside game	**0.86**	**0.90**	**1.00**	**0.99**	**0.96**	**0.98**	**0.60**	0.49	0.22	0.18
Play outside	**0.80**	**0.78**	**0.97**	**0.96**	**0.95**	**0.94**	**0.74**	**0.73**	**0.53**	**0.51**
Changing diaper	**0.55**	**0.54**	**0.93**	**0.98**	**0.94**	**0.96**	**0.93**	**0.87**	0.25	0.21
Putting sleep	**0.53**	0.44	**0.86**	**0.94**	**0.93**	**0.91**	**0.80**	**0.75**	0.18	0.21
Washing the child	0.47	0.42	**0.89**	**0.89**	**0.97**	**0.94**	**0.73**	**0.75**	0.39	0.22
Dressing the child	0.22	0.22	**0.82**	**0.79**	**0.90**	**0.92**	**0.67**	**0.58**	0.05	0.02
Assist eating	0.31	0.41	**0.82**	**0.82**	**0.80**	**0.77**	**0.62**	**0.56**	0.15	0.14
Help brush teeth	0.13	0.13	**0.72**	**0.69**	**0.71**	**0.65**	0.45	0.45	0.04	0.01

The third class of fathers had high likelihood of engaging their children in both play and caregiving activities but they were likely to avoid literacy activities. This group was named as "primary playful" (PP) representing 23.22% for girls and 30.91% for boys of the fathers in the analysis. The fourth class of fathers included typical caregivers who avoided the majority of play activities and all literacy activities. They are likely to perform all caregiving activities but helping child brush teeth. The only significant difference between boys and girls was that fathers in this group were slightly more likely to play inside games with boys and girls (0.595 vs 0.487). This class of fathers was named as "daily caregiver" (DC) representing 24.65% (girls) and 18.52% (boys) of all fathers. The last class of fathers had low probabilities of engaging in any activities but taking child play outside. Fathers in this class were named as "low involving" (LI) fathers representing about 24.47% (girls) and 18.86% (boys) of all fathers in the analysis. A short summary of father classes are shown in table 4 - 20.

Table 4 - 20

Summary of Father Classes

Father Classes	Characteristics
Occasional Playful (OP):	■ No literacy activities ■ Considerable play ■ Little caregiving activities
Highly Engaged (HE):	■ Extensive literacy activity ■ Involvement in all caregiving activities ■ Perform all play activities
Primary Playful (PP):	■ Performs all caregiving activities ■ Highly playful ■ No literacy activities
Daily Caregivers (DC):	■ Majority of caregiving activities ■ No literacy activities ■ Little play

Table 4 - 20 (continued)

Father Classes	Characteristics
Low Involver (LI):	■ No caregiving activities ■ No literacy activities ■ Very Little Play

2-Year Father Profiles on Preschool Literacy and Mathematics

Descriptive statistics. The analytic sample for 2-year father profiles consisted of 4,400 children including 2,200 (49 %) females; 2,400 (54.78 %) White; 300 (6.53 %) Black; 500 (11.58 %) Asian; and 700 (16.17 %) Hispanic children [4]. Table 4 - 21 shows descriptive statistic for SES, regions, and family characteristics. Additionally, mean literacy and mathematics score by child characteristics, SES quintiles, and 2-year father classes are displayed in Table 4 - 22.

Preschool literacy and mathematics scores had mean scores of 3.22 and 2.46 ranging from 2.46 to 4.39 and 9.89 to 65.74, respectively. The average assessment age was 52.26 months and it ranged from 3.97 to 44 months old. The mean score of age-adjusted 2-year mental score was 0.21 ranging from -3.69 to 3.38. The analytic sample included children with special needs (2 %). As SES quintiles increased, the mean score for each quintile increased. The mean literacy and mathematics scores for first quintile were 2.94 and 24.70, respectively, while the mean score for children in the fifth quintile were 3.44 and 36.31, respectively. A small proportion of fathers (2 %) reported unhappy relationship status. Mother involvement index in 2-year had a mean score of 3.78 and it ranged from 0 to 6. In 2-year data, the average number of children under 18 years old in the household was 2.14 and 10 children was the maximum. About 32% of mothers

4 *Sample sizes were rounded to nearest 50 as required by NCES*

Table 4 - 21

Descriptive Statistics for 2-Year Variables (N=4,450 †)

Variables	Mean	Std. Dev.	Minimum	Maximum
Dependent Variables				
Reading score	3.22	0.37	2.46	4.39
Mathematics Score	30.97	9.59	9.89	65.74
Control Variables				
Child's gender	0.51	0.50	0.00	1.00
Assessment age in preschool	52.26	3.97	44.00	65.30
9-Month special education status	0.98	0.14	0.00	1.00
Age-adjusted 2-year mental score	0.21	0.95	-3.69	3.38
Race/Ethnicity				
White	0.68	0.47	0.00	1.00
Multirace	0.03	0.18	0.00	1.00
Asian	0.03	0.16	0.00	1.00
Hispanic	0.20	0.40	0.00	1.00
Black	0.06	0.24	0.00	1.00
Other	0.01	0.07	0.00	1.00
Region				
NorthEast	0.16	0.36	0.00	1.00
Midwest	0.26	0.44	0.00	1.00
South	0.36	0.48	0.00	1.00
West	0.23	0.42	0.00	1.00
SES				
First quintile	0.09	0.28	0.00	1.00
Second quintile	0.15	0.36	0.00	1.00
Third quintile	0.20	0.40	0.00	1.00
Fourth quintile	0.26	0.44	0.00	1.00
Fifth quintile	0.30	0.46	0.00	1.00
Relationship happiness	0.02	0.14	0.00	1.00
Mother involvement index	3.78	1.45	0.00	6.00
Children under 18 in household	2.14	1.09	1.00	10.00
Mother work status				
35 Hours or more	0.32	0.47	0.00	1.00
Less than 35 ours	0.23	0.42	0.00	1.00
Looking for work	0.04	0.20	0.00	1.00
Not in the labor force	0.40	0.49	0.00	1.00
Fathers' age	33.26	6.30	18.00	76.00

Note. † Sample sizes were rounded to nearest 50 as required by NCES

Table 4 - 22

Preschool Literacy and Mathematics Score by Child Characteristics and 2-Year Father Classes

	Literacy			Mathematics		
	Mean	SD	Sample Size	Mean	SD	Sample Size
Female	3.26	0.38	2200 †	31.85	9.65	2200 †
Male	3.20	0.39	2250 †	30.60	10.15	2250 †
White	3.25	0.35	2400 †	31.43	9.25	2400 †
Black	3.12	0.39	300 †	27.34	9.48	300 †
Asian	3.46	0.37	500 †	38.62	9.70	500 †
Hispanic	3.04	0.38	700 †	27.37	9.37	700 †
Other	3.03	0.33	100 †	26.33	9.01	100 †
SES						
First quintile	2.94	0.32	400 †	24.70	8.74	400 †
Second quintile	3.04	0.34	650 †	26.58	9.02	650 †
Third quintile	3.13	0.35	850 †	28.67	8.67	850 †
Fourth quintile	3.25	0.34	1100 †	31.54	8.95	1100 †
Fifth quintile	3.44	0.35	1450 †	36.31	9.44	1450 †
Boys						
OP fathers	3.23	0.38	550 †	31.20	10.22	550 †
HE fathers	3.28	0.40	300 †	31.56	9.89	300 †
PP fathers	3.12	0.37	800 †	28.76	9.69	800 †
DC fathers	3.22	0.39	500 †	31.26	10.43	500 †
LI fathers	3.22	0.39	500 †	31.07	10.92	500 †
Girls						
OP fathers	3.27	0.38	400 †	31.90	9.50	400 †
HE fathers	3.39	0.35	250 †	33.79	9.78	250 †
PP fathers	3.16	0.38	550 †	29.41	9.41	550 †
DC fathers	3.28	0.38	600 †	32.35	9.46	600 †
LI fathers	3.25	0.37	600 †	31.90	10.06	600 †

Note. † Sample sizes were rounded to nearest 50 as required by NCES

worked 35 hours or more, 23 % worked less than 35 hours, 4 % were looking for work, and 40% were not in the labor force. Fathers' average age was 33.26 ranging from 18 to 76 years old. Girls' preschool literacy mean score was 3.26, while boys had a mean score of 3.20. For mathematics, girls' had an average of 31.8 and boys' mean score was 30.60. Children in the other ethnicity group had the lowest mean scores in literacy (0.33) and mathematics (26.33) while Asian children had the highest mathematics mean score (38.62) and Black children had the highest literacy score (0.39). Each increase in SES quintile resulted in higher mathematics mean score (24.7, 26.58, 28.67, 31.54, and 36.31 respectively) but this finding did not hold for literacy score (0.32, 0.34, 0.35, 0.34, and 0.35 respectively).

Boys and girls with HE fathers had the highest mean scores in literacy, 3.39 and 3.28, respectively. The mean scores for children with PP fathers were the lowest (3.12 for boys and 3.16 for girls). Boys with OP, DC, and LI had similar means scores (3.23, 3.22, and 3.22, respectively). Girls with OP, DC, and LI fathers also averaged to 3.27, 3.28, and 3.25, respectively. For mathematics mean scores, both boys and girls with PP fathers had the lowest mean score of 28.76 and 29.41, respectively. Boy and girls with HE fathers had the highest preschool mathematics mean score: 31.56 and 33.9, respectively. The mean mathematics scores for boys and girls ranged from 28.76 to 31.56 and 29.41 to 33.79, respectively.

Ordinary least squares regression

Regression models for preschool literacy and mathematics were first run only with following variables: father profiles, age-adjusted previous mental score in 2-year, and assessment age in preschool. In the full models, I regressed child, family, and father characteristics together on literacy and mathematics scale score. In the following section, I interpreted reading models and compared girls to boys followed by mathematics models in a similar way.

Literacy. The results of regression models are shown in table 4 - 23. Initial models explained 26% of the variance for girls (R^2=0.26, F(6,84)=65.84, p<.01) and 23% of the variance for boys model (R^2=0.23, F(6,84)=64.25, p<.01). In the initial models, HE fathers had a positive effect on boys' literacy scores; boys with HE fathers scored 9.2% more compare to boys' with LI fathers in the reference group. Girls with PP fathers suffered in their literacy performance and scored 8.8% less than the reference group. Age-adjusted 2-year mental score and assessment age in preschool were both related to girls' and boys' performance which meant higher scores on previous assessments and their maturity contributed to their literacy score.

Models with all controls included explained 42 % of the variance for girls (R^2=0.42, F(26,64)=70.18, p<.01) and 38 % for boys (R^2=0.38, F(26,64)=34.74, p<.01). The models showed similar results for girls and boys. None of the father classes were significantly related to boys' and girls' literacy score. As expected, age-adjusted 2-year mental score and assessment age in preschool data wave were both significant and predicted higher scores for girls and boys. Special education status did not have effect on literacy score for boys and girls. Multiracial children, children in the other race category, and Black boys were not related to literacy scores in both models. However, Black girls, Asian girls, and Asian boys were different from White girls and White boys, and they scored 6.5%, 7.1 % and 5.1 % better than those in the reference group, respectively. Hispanic boys were at a disadvantage, scoring 6.7% less than those in the reference group.

Boys in South and West regions scored less compared to boys in Northeast region, while girls in the West region scored less compared to girls in the Northeast region reference group. Findings for SES quintiles were consistent with the previous model and each increase in quintile

Table 4 - 23

Regression Results for 2-Year Father Classes on Preschool Reading

	Girls				Boys			
	Model 5				Model 6			
Variables	b	Se	b	Se	B	se	B	Se
OP fathers	0.00	0.03	-0.02	0.02	0.05	0.06	0.04	0.05
HE fathers	0.08	0.04	0.02	0.03	0.12*	0.05	0.05	0.03
PP fathers	-0.07**	0.02	-0.05	0.03	-0.04	0.03	-0.02	0.03
DC fathers	0.01	0.03	-0.01	0.03	0.03	0.06	0.00	0.05
Child								
Previous Score	0.17***	0.01	0.12***	0.01	0.14***	0.02	0.10***	0.02
Assessment age	0.03***	0.01	0.03***	0.00	0.03***	0.00	0.03***	0.00
Special ed. (YES)			0.04	0.09			-0.01	0.06
Multirace			0.02	0.05			0.02	0.07
Asian			0.16***	0.03			0.12***	0.03
Hispanic			-0.08	0.04			-0.06*	0.03
Black			0.11**	0.03			0.05	0.04
Other			-0.04	0.03			-0.10	0.14
Family								
Region – Midwest			-0.02	0.02			-0.05	0.03
Region – South			-0.02	0.03			-0.06	0.03
Region – West			-0.09**	0.03			-0.08**	0.03
SES 2			0.10*	0.04			0.08	0.06
SES 3			0.24***	0.06			0.15**	0.04
SES 4			0.26***	0.06			0.26***	0.06
SES 5			0.37***	0.04			0.37***	0.05
Rel. happiness (NO)			-0.07	0.05			-0.04	0.07
Mother inv. index			0.01	0.01			0.02**	0.01
Children under 18			-0.04***	0.01			-0.02*	0.01
Mother work status								
Less than 35 hrs			-0.01	0.02			0.05	0.02
Looking for work			0.00	0.04			0.00	0.05
Not in the labor force			0.02	0.02			0.03	0.02
Father's age			0.00	0.00			0.00	0.00
_cons	1.89***	0.26	1.37***	0.15	1.76***	0.14	1.38***	0.16
r2	0.26		0.42		0.23		0.39	
N	2200†		2200†		2250†		2250†	
F	65.84		70.17		64.25		34.75	

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

† Sample sizes were rounded to nearest 50 as required by NCES

was related to a gradual increase in literacy score for both boys and girls with only exception of the second quintile for boys. Boys' performance in the second SES quintile did not significantly different than those in the first SES quintile reference group. Parents' relationship happiness again was not significantly related to literacy score of girls and boys. Mother involvement index yielded some interesting results for boys and girls because it did not contribute to girls' literacy score but it contributed to boys' literacy score in preschool.

Additionally, as the number of children in the household increased, boys and girls had poorer scores. Having a full-time, working mother was not significantly different than mothers working part-time, mothers looking for work, or stay-home mothers for girls. Fathers' age was related to girls' literacy score in preschool but it was not related to boys' performance. Girls with older fathers scored higher on literacy assessment. The adjusted Wald test revealed that for boys, HE and PP fathers were significantly different. For girls, there no significant differences among father classes but HE and PP fathers were close to being significant (F=3.09, p=0.0821).

Mathematics. OLS regression results for 2-year father profiles on children's literacy and mathematics performance are shown in Table 4 - 24. In the initial models (Models 7 & 8) without child, family, and father characteristics, 27% of the variance for girls (R^2=0.27, F(6,64)=72.6, p<.01) and 11% of the variance for boys (R^2=0.11, F(6,84)=18.6, p<.01) were explained. PP class father was significant, and it had a detrimental effect on boys' and girls' mathematics scores in preschool assessment. Remaining father classes were not significantly related to girls' and boys' performance. Age-adjusted 2-year score and assessment age were both significant and had similar contributions as in the previous models.

Full models with controls revealed similar results to that of literacy model results, and 39% of the variance for girls (R^2=0.39, F(26,64)=54.82, p<.01) and 31% of the variance for boys

Table 4 - 24

Regression Results for 9-Month on Preschool Mathematics

	Girls				Boys			
	Model 5				Model 6			
Variables	B	se	B	se	b	se	B	Se
OP fathers	-0.37	0.65	-0.65	0.71	0.52	0.92	0.37	0.79
HE fathers	-0.10	1.04	-1.08	0.76	2.32	1.44	0.78	1.25
PP fathers	-2.12*	0.85	-1.59**	0.55	-0.71	0.71	-0.28	0.77
DC fathers	-0.60	0.64	-1.08	0.67	0.37	1.14	-0.16	1.02
Child								
Previous Score	4.16***	0.27	3.00***	0.37	3.822***	0.26	2.75***	0.25
Assessment age	0.79***	0.09	0.86***	0.06	0.872***	0.06	0.95***	0.07
Special ed. (YES)			0.34	1.90			-0.24	2.29
Multirace			-0.95	0.91			-0.32	1.31
Asian			4.62***	0.62			3.59***	0.77
Hispanic			-1.69	0.86			-0.69	0.63
Black			1.30	1.10			0.07	1.18
Other			-0.61	0.93			-2.96	2.45
Family								
Region – Midwest			-1.17	0.93			-0.29	0.88
Region – South			-1.14	0.84			-0.49	0.76
Region – West			-1.50	1.05			-0.83	0.63
SES 2			2.03*	0.89			1.38	1.05
SES 3			4.35***	0.97			3.99***	0.88
SES 4			5.34***	1.06			6.37***	0.94
SES 5			8.13***	1.05			9.32***	0.95
Rel happiness (NO)			-2.34	1.48			0.15	1.34
Mother inv. index			-0.24	0.19			0.39*	0.15
Children under 18			-1.0***	0.21			-0.38	0.24
Mother work status								
Less than 35 hrs			-0.28	0.60			0.76	0.65
Looking for work			-0.37	1.18			0.07	1.38
Not in the labor force			0.26	0.65			0.74	0.71
Father's age			0.10	0.06			0.01	0.04
_cons	-10.57*	5.01	-18.32***	3.21	-15.57***	3.61	-25.60***	4.04
r2	0.27		0.39		0.27		0.40	
N	2200ŧ		2200ŧ		2250ŧ		2250ŧ	
F	72.57		54.82		60.84		37.10	

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

ŧ Sample sizes were rounded to nearest 50 as required by NCES

(R^2=0.31, F(26,64)=38.77, p<.01) were explained. The only significant father class was PP, and this group of fathers had a negative effect on girls' mathematics score in preschool. Previous scores and assessment age remained significant for both boys and girls. Higher previous scores predicted a higher literacy score in preschool, and in the West region scored 10% less than the girls in the Northeast reference group. For girls, each SES quintile systematically and gradually resulted in higher scores but for boys, second SES quintile was not significantly different than the first SES quintile in the reference group. Remaining SES levels predicted better scores for boys in a gradual manner. Relationship happiness remained insignificant for both girls and boys. Interestingly, mother involvement index was not related to girls' mathematics score but it contributed to boys' performance. Asian girls and boys performed 6.9% and 5.1% better, respectively, than White boys and girls in the reference group. Additionally, Hispanic girls scored 9.3% less than White girls in the reference group. The number of children in the household was had a detrimental effect on girls' performance consistent with previous models but it did not have any significant effect on boys' performance. This was interesting because the negative effect was prevalent in both 9-month models and in 2-year literacy model. Girls with older fathers performed better but this effect did not hold for boys. Adjusted Wald test did not reveal any significant differences among father classes.

Summary

Father Classes

The LCA confirmed differences in fathers' actual engagement based on child's gender in their infancy. Fathers with the highest likelihood of engaging their infant children had generally negative effect on girls' literacy and mathematics scale score in preschool. On the other hand, one class of fathers who engaged in average caregiving and play activities had positive effects on

boys' literacy performance. The LCA results for father-toddler engagement patterns were more consistent across genders. Initial gender-separated analysis showed only minor differences in item response probabilities meaning the disparity of fathers' engagement patterns based on gender mostly disappear when their children are around 2 years old.

There were five distinct father classes and the results did not yield gender-exclusive father engagement patterns for infant data. One group of fathers was least likely to engage their children through caregiving, play and literacy activities. Another group avoided the majority of caregiving activities while they were highly likely to play with their children. Some fathers acted like primary caregivers, highly involved in caregiving activities and play activities, while others were moderately engaged in the combination of caregiving and play activities. For toddler data, Fathers' engagement in caregiving, play, and literacy activities was not related to toddler sons' mathematics or literacy in preschool. However, one class of fathers, who were highly engaged in caregiving and play activities with their toddler daughter, had detrimental effects on girls' mathematics score in preschool. The rest of the father classes did not significantly predict either outcome.

Father Classes as a Predictor of Cognitive Development

Fathers' engagement with their toddlers had far less negative effects on children's cognitive development when compared to their engagement with their infants. None of the father-infant classes seemed to have effects on boys' literacy and mathematics performance in preschool after control variables were included and this was a surprising finding. However, girls with DC fathers scored less in literacy assessment than those with LI fathers. Girls' mathematics performance suffered when they had DC and PP fathers. One would expect otherwise because DC and PP fathers were highly engaged fathers who perform all caregiving and play activities

with high item response probabilities, but no literacy activities. Although not significant, another father class, HE fathers, showed similar engagement patterns and the only difference between HE fathers and PP fathers was that HE fathers also engaged in daily literacy activities on top of all caregiving and play activities. Again, for girls with PP fathers, this may signify the lack of mothers' involvement when girls are around 2 years old.

The effect of Related Factors

Age-adjusted previous mental score in 9-month-olds and 2-year-olds predicted better score for children's literacy and mathematics achievement in preschool. Older children scored higher throughout all of the models included in this study. Special education status at 9-months was not a significant predictor of children's later mathematics and literacy performance in preschool.

Overall, Asian girls and Asian boys consistently outperformed their peers. Additionally, Hispanic boys were at a disadvantage in both 9-month models and the 2-year literacy model, however, this effect disappeared for Hispanic boys in the 2-year mathematics model. Black boys had advantage compared to White boys in the reference group in the 9-month literacy model and Black girls scored higher than White girls in the reference group in the 2-year literacy model. Additionally there were regional differences. Boy and girls in Northeast region generally had better scores that those in the remaining regions.

SES quintiles were consistently significant and had effects on children's literacy and mathematics scores in all models. Increase in the SES level was associated with a better score in literacy and mathematics assessments with only one exception for boys. Boys' mathematics performance within the second SES quintiles was not significantly different than boys who are in the first SES quintile in both 9-month and 2-year models.

Mother involvement index with infants predicted better mathematics and literacy scores regardless of the child's gender. For 2-year analysis, the results started showing some differences. Mothers' engagement with toddlers significantly predicted better mathematics and reading performance for boys. However, this effect was not observed for girls' performance in both subjects. The number of children in the household had a detrimental effect on girls' literacy and mathematics performance in both 9-month and 2-year models. This find also hold true for boys with one exception. The number of children in the house in the 2-year model did not predict boys' mathematics scores in preschool. Children's with fathers who reported unhappy relationships was not significantly different than the reference group who reported otherwise. Lastly, girls with older, more mature fathers scored better than those with younger fathers on average.

CHAPTER 5

DISCUSSION

This chapter presents a brief summary of the study, including the nature of the study, the research problem, research questions, sample selection, and research methods. Then, a summary of findings is presented for both literacy and mathematics achievement scores based on fathers' engagement patterns with their infant and toddler children. Next, the contributions of control variables, SES, gender and race/ethnicity, included in the study and their relationship to the outcome variables are discussed. Implications for policy and practice, study limitations, and recommendations for future research follow. Finally, conclusions of the study are presented.

Father involvement studies have flourished in the last three decades (Dienhart, 1998; Doherty, Kouneski, & Erickson, 1998; Lamb, 1997). A drastic increase in the public interest was due to a shift in the roles of fathers. Shifting from the traditional "breadwinner" role, fathers had become more involved in engaging in child-related activities and sharing of responsibilities (Carlson & Magnuson, 2011). This shift gained researchers' attention from many different fields of study. Researchers consistently found that paternal involvement could be beneficial, and in some families, supportive fathers could be more effective and beneficial to the development of children than that of mothers (NICHD Early Child Care Research Network [ECCRN], 2004; Tamis-LeMonda, Shannon, Cabrera, & Lamb, 2004). However, fathers' contributions may come in many different ways, and the scope of this study is limited to fathers' actual engagement and interaction with their young children.

Fathers' direct engagement and interaction with their children may contribute to children's cognitive development starting at early ages (Martin, Ryan, & Brooks-Gunn, 2010; McBride, Rane, & Bae, 2001). Although the majority of fatherhood studies generally support the

fathers' contribution in early childhood, a small number of studies claim that children's cognitive development may suffer when their fathers are highly engaged. Some researchers claim that fathers' high engagement and involvement in child-rearing activities have positive effects on young children's intellectual development (Clarke-Stewart, 1978: Rowe, Coker, & Pan, 2004,) and it is believed that children learn through interactions with adults. On the other hand, others (Pan, 2004) argue that children gain more when they have highly involved mother and fathers' who provide support for mothers in various ways. They base their arguments on the importance of the emotional attachment between a mother and a child, and claim that when fathers' provide indirect support, mothers are able to maximize their time and effort with their children (Cummings & O'Reilly, 1997; Lamb, 1997; Pleck & Masciadrelli, 2004). Another argument is that fathers and mothers are equally important for their children, and children benefit most when parents complement each other in terms of sharing child-rearing activities and responsibilities.

However, there is a need to find ways to conceptualize the fathers' role in complex family systems, and to examine their effects on children's cognitive development empirically. The number of studies examining the reciprocal relationship between fathers' direct engagement and children's cognitive development in the family context are limited (Lamb, 2010). The availability of large secondary data and a wide range of information about fathers, their roles in the family, and family characteristics, make it feasible to study the effects of fathers' engagement on their children's cognitive development. The current study explored the reciprocal relationship of the father, the child, and the family longitudinally.

In the first chapter, a brief introduction of current literature and description of the nature and goals of this study was provided. The theoretical framework, significance of the study, purpose of the study and research questions were presented. The chapter concluded with

operational definition of terms. Chapter 2, consisted of a literature review of fatherhood studies, and conceptualization of father involvement followed. The literature review was structured around the historical place of fathers in the family as well as current roles. Next, studies of contemporary father involvement and their relevant findings were presented. The chapter concluded with an overview of theoretical approaches to father involvement and their place in children's early development. In the third chapter, the Early Childhood Longitudinal Study Birth Cohort (ECLS-B) was summarized. A detailed summary of the research design, description of data, sampling design, and data collection procedures were presented. Next, the target population and data extraction process were presented. The discussion followed with the details of the research design for the current study, and the research methods selected for measuring fathers' engagement and its relationship to children's later academic achievement. In Chapter 4, LCA (latent class analysis) was used to explore the ways fathers interact and engage with their children when they were around 9 months old and 2 years old and then, the longitudinal effects of these interactions on children's literacy and mathematics scale scores when children were in preschool were examined. The LCA of father engagement for 9-months revealed different father engagement patterns for girls and boys, and thus, separate analyses for girls and boys were conducted. The second LCA for 2-year data revealed similar father engagement patterns, and universal father engagement models for both girls and boys were developed.

A .nationally representative study, ECLS-B, of children who were born in 2001 in the United States, which included information about their families were utilized. ECLS-B serves the purpose of this study well because it includes data about fathers and their involvement through self-administered resident father surveys. In the analyses, factors that are known to effect children's cognitive development including child characteristics (assessment age, previous score,

special education status and race), family characteristics (region, socio-economic status, relationship happiness, mother's involvement, number of children in household less than 18 years old, and mother's work status), and a father characteristic (fathers' age) were controlled. In OLS (ordinary least squares) model with father-infant engagement patterns, two separate regression models for boys and girls were conducted, and findings were discussed. OLS regression model for 2-year father engagement pattern was separately run for girls and boys, and the results were discussed. With the utilization of ECLS-B study, LCA and OLS regression, this study addressed following questions:

Research Question 1: How often do fathers engage their infants and toddlers through child-bearing activities?

Research Question 2: How does fathers' home engagement influence children's cognitive development in early childhood?

Research Question 3: Is there evidence of significant gain in children's cognitive development in early childhood related to levels and quality of fathers' direct engagement after controlling for SES, sex, and race?

Research Question 4: Do children's cognitive development benefit from different patterns of fathers' direct engagement after controlling for maternal involvement, age, gender, race, and SES?

Summary of Findings

In the following section, key findings for father engagement profiles on children's preschool mathematics and literacy performance are discussed with possible explanations. The relationship between 9-month and 2-year father engagement and children's literacy and

mathematics performance and child, family and father characteristics is discussed. Key findings are summarized below:

- About 70% of fathers engaged their infant-children at least once a day through caregiving activities and play activities.
- About 10% of fathers read and told storied to their-infant children every day.
- The majority of fathers engaged their toddlers through caregiving activities and play activities at least once a day.
- About 10% to 15% of fathers engaged in literacy activities every day.
- LCA analysis revealed different fathering profiles for infant-girls and infant-boys.
- One group of fathers, HE, were highly likely to engage in literacy activities with infant-boys.
- None of the father classes were likely to engage in literacy activities with their infant daughters.
- Fathers with the highest likelihood of engaging their infant children had generally negative effect on girls' literacy and mathematics scale score in preschool.
- LCA results for father-toddler engagement patterns were more consistent across genders.
- There were five distinct father classes and the results did not yield gender-exclusive father engagement patterns.
- Fathers' engagement in caregiving, play, and literacy activities was not related to toddler sons' mathematics or literacy in preschool.

- One class of fathers, who were highly engaged in caregiving and play activities with their toddler daughters, had detrimental effects on girls' mathematics score in preschool.
- Fathers' engagements with their toddlers had far less negative effects on children's cognitive development when compared to their level of engagement with their infants.
- Age-adjusted previous mental score in 9-month-olds and 2-year-olds consistently predicted better score for children's literacy and mathematics achievement in preschool regardless of their gender.
- Older children scored higher throughout all of the models included in this study.
- Special education status at 9-months and 2-years did not significantly predict children's later mathematics and literacy performance in preschool.
- Asian girls and Asian boys consistently outperformed their White peers in the reference group.
- Hispanic girls and Hispanic boys were at a disadvantage in both 9-month models and the 2-year literacy model.
- SES quintiles had the most significant impact on children's literacy and mathematics scores in all models. The nature of this relationship was linear and gradual. Each increase in the SES level was associated with a better score in literacy and mathematics assessments. This finding held true for every SES quintile for girls but there was one exception for boys. The findings for boys' mathematics performance within the second SES quintiles was not significantly different than boys in the first

SES quintile reference group in both 9-month and 2-year models. Boys' mathematics performance started to increase from the third SES quintile and on.

- Mothers' early engagement with their children around 9-months predicted better mathematics and literacy scores regardless of the child's gender.
- Mothers' engagement in 2-year-olds significantly predicted better mathematics and reading performance for boys. However, this finding did not hold true for girls' performance in both subjects.
- The number of children in the household was inserted as a continuous variable and it had a detrimental effect on girls' literacy and mathematics performance in both 9-month and 2-year models.
- The number of children in the house in the 2-year model was not a significant predictor of boys' mathematics scores.
- The father-reported unhappy relationship status was not a significant factor in any of the models.
- Findings for the maturity of fathers were rather interesting. Also supported by the literature (Svensson, Abel, Dalman & Magnusson, 2011), girls who had older fathers scored better in literacy and mathematics in both the 9-month and 2-year models.

Fathers and Their Infants

The current study found that differences in fathers' actual engagement based on child's gender when infants are around 9-month old. Fathers' engagement behavior may differ based on child's gender and this is consistent with the findings from other research (Furstenberg & Weiss, 2000). Although the majority of father classes were similar for boys and girls, there were two distinct groups of fathers who exhibited different engagement patterns for boys and girls. None

of the father classes were likely to engage in literacy activities with their infant daughters while one group of fathers was highly likely to perform literacy activities with their infant sons (Amato, 1994). One possible reason for this finding could be that some fathers could place more value on raising their infant-son and therefore engage in more caregiving, play and literacy activities with their sons.

Some fathers were highly engaged in caregiving activities, some only engaged their infants through play activities and others engaged their infants through combination of caregiving, play and literacy activities. Additionally, some fathers engaged in less-occurring caregiving activities and play activities. Analyses also revealed that a group of fathers simply avoided engaging their infants through these activities. The differences in father engagement patterns could be due to cultural differences. For example, a specific culture may value fatherhood more than others do and encourage fathers' engagement as much as possible (Chen, Liu, & Li, 2000). Another possible explanation could be that fathers' beliefs and attitudes toward child-rearing could affect their actual engagement. Clearly, providing a definitive explanation for such findings is beyond the scope of this study, and therefore further research is recommended.

Surprisingly, DPC fathers who had the highest likelihood of engaging their infant children had generally negative effect on girls' literacy and mathematics scale score in preschool. This finding did not hold true for boys. One possible explanation for this effect may be that fathers actually engage their infants significantly more because their mothers were unable to do so for some reason. Considering the importance of infants' emotional attachment to their mothers (Freeman, Newland, & Coyle, 2010), lacking mothers' attention might be taking a toll on their cognitive development throughout early childhood. It is obvious that there are differences in boys' literacy and mathematics performance, and boys' somehow avoid this negative effect in

terms of their mathematics performance in preschool. This may be associated with the differences in the nature of learning reading and mathematics. Young children are quite capable learners and they may be able to construct their own knowledge and mathematical concepts such as quantity and symbols naturally may make sense to them (NAEYC, 2010).

Fathers and Their Toddlers

The results for father-toddler engagement patterns were more consistent across genders. Initial gender-separated analysis showed only minor differences in item response probabilities meaning the disparity of fathers' engagement patterns based on gender mostly disappear when their children are around 2 years old. The results did not yield gender-exclusive father engagement patterns. Perhaps, as young children mature they become more independent of mothers, and they start to strengthen their relationship with their father and this could help fathers engage their toddlers more. Fathers' levels of engagement varied from low to high. One group, LI fathers, was least likely to engage their children through caregiving, play and literacy activities. Another group, OC fathers, avoided the majority of caregiving activities while they were highly likely to play with their children. Some fathers acted like primary caregivers, highly involved in caregiving activities and play activities, while others were moderately engaged in the combination of caregiving and play activities. This could be due to several factors such as socioeconomic and cultural. Fathers from higher socioeconomic levels could have resources that help them increase their availability to their children. Additionally, the availability of the mother could be another determining factor for fathers' engagement with their children (Ely, Gleason, Berko, Narasimhan, & McCabe, 2009).

The results for literacy models were mixed for boys and girls. Fathers' engagement in caregiving, play, and literacy activities was not related to toddler sons' mathematics or literacy in

preschool. However, one class of fathers, who were highly engaged in caregiving and play activities with their toddler daughters, had detrimental effects on girls' mathematics score in preschool. The rest of the father classes did not significantly predict either outcome. Fathers' engagements with their toddlers had far less negative effects on children's cognitive development when compared to their level of engagement with their infants. None of the father classes seemed to relate to boys' literacy and mathematics performance in preschool and this was a surprising finding. This finding suggests that fathers' engagement with their toddlers through caregiving, play and literacy activities do not predict children's mathematics and literacy performance in preschool after controlling for family, child and father characteristics. This contradicts research findings that have been reported in recent years (Lamb, 2010; Paquette, 2004). However, most of the contradicting studies examined the relationship between singled-out factors (e.g. reading to child or having a meal together) and children's cognitive development without a holistic approach that includes multiple factors, as opposed controlling for those factors.

Effects of Child, Family and Fathers Characteristics

Previous score. Age-adjusted previous mental score in 9-month-olds and 2-year-olds consistently predicted better scores for children's literacy and mathematics achievement in preschool regardless of their gender. This was expected and supported by multidisciplinary studies. Previous scores were age-adjusted to counter balance the effect of children's maturity during the assessment.

Assessment age. Young children's chronological age during the assessment was controlled because data were collected whenever convenient regardless of age. Young children learn relatively fast and even weeks may make differences in their assessment performance.

Consistent with the literature, older children scored higher throughout all of the models included in this study.

Special education. Although cognitive disabilities were found to affect and interfere with children's cognitive development (Geary, 1993), special education status at 9-months and 2-years did not significantly predict children's later mathematics and literacy performance in preschool. The special education indicator contains both cognitive and non-cognitive disabilities and in most cases, non-cognitive disabilities do not manifest any detrimental effect on cognitive development (Gottfried, 2013). However, this study had a longitudinal nature and any children with special needs might have been subject to interventions, helping them to overcome the problems associated with their condition.

Ethnicity. There were some interesting findings in terms of children's ethnicity. As suggested by many other researchers (Hofferth, 2003), Asian girls and Asian boys consistently outperformed their White peers in the reference group. Additionally, Hispanic girls and Hispanic boys were at a disadvantage in both 9-month models and the 2-year literacy model, but the same findings did not hold true for Hispanic boys in the 2-year mathematics model. In the 9-month literacy model, Black boys had advantage compared to White boys in the reference group. Additionally, Black girls scored higher than White girls in the reference group in the 2-year literacy model. There were no significant differences among children in other, multi-race, and White ethnicity groups.

Region. Girls' mathematics and literacy performance in the West region was lower in comparison to the Northeast region reference group in both 9-month and 2-year models. For boys, this only held true in their literacy performance in 9-month and 2-year models and the results for their mathematics performance were not conclusive. For the Midwest region, the only

difference was in girls' mathematics score in the 9-month model, these girls scored less when compared to girls in the Northeast region. In the 9-month model, girls' mathematics performance and boys' reading performance in the South region were even lower compared to children in the Northeast region. In the 2-year models, the only difference for the South region was boys' mathematics performance and these boys scored less than boys in the Northeast region.

SES (socio-economic status). SES quintiles had the most significant impact on children's literacy and mathematics scores in all models. The nature of this relationship was linear and gradual. Each increase in the SES level was associated with a better score in literacy and mathematics assessments. This finding held true for every SES quintile for girls but there was one exception for boys. The findings for boys' mathematics performance within the second SES quintiles was not significantly different than boys in the first SES quintile reference group in both 9-month and 2-year models. Boys' mathematics performance started to increase from the third SES quintile and on.

Although the relationship between SES and children's cognitive development was beyond the scope of this study, the analysis showed that children from lower SES levels fell behind significantly. Given equal opportunities, children can improve their knowledge and skills which could, in turn, help their academic achievement (NAEYC, 2010). Policies targeting children with limited resources exist, however most policies provide opportunities in schools. Yet, it is well established the majority of brain development occurs before the age of one. It follows that policies for improving children's early home experiences could maximize infants' early experiences, and in turn positively influence cognitive development.

Mother involvement index. Mothers' early engagement with their children around 9-months predicted better mathematics and literacy scores regardless of the child's gender. This

index was used as a composite variable in the analysis, and consisted of limited daily play activities. Infants' emotional attachments to their mothers may explain the positive impact (Flouri & Buchanan, 2004; Tamis-LeMonda, Shannon, Cabrera, & Lamb, 2004). For the 2-year analysis, the results started showing some discrepancies. Mothers' engagement in 2-year-olds significantly predicted better mathematics and reading performance for boys. However, this finding did not hold true for girls' performance in both subjects. These differences between boys and girls are interesting and should be studied further.

Number of children in the household under 18 years old. The number of children in the household was inserted as a continuous variable and it had a detrimental effect on girls' literacy and mathematics performance in both 9-month and 2-year models. A similar effect was also found for boys with one exception. The number of children in the house in the 2-year model was not a significant predictor of boys' mathematics scores in preschool, although it was related in 9-month model. Boys seem to be able to recover from this negative effect over time.

Relationship happiness. Although relationship happiness has been found to predict young children's socio-emotional and cognitive development (Amato, 1994; Burgos, 2003), the father-reported unhappy relationship status was not a significant factor in any of the models. The data have a limited number of cases that reported unhappy relationships, and further gender-separated data analysis made this number even smaller. A larger number of cases with a similar reported status might have yielded different results.

Fathers' age. Findings for the maturity of fathers were rather interesting. Also supported by literature (Svensson, Abel, Dalman & Magnusson, 2011), girls who had older fathers scored better in literacy and mathematics in both the 9-month and 2-year models. These findings did not

hold true for boys in any of the models. There was no relationship between fathers' age and child's performance in literacy and mathematics in preschool.

Limitations and Future Research

The current study benefits from two advancements in research methods. First, utilizing the ECLS-B data contributes to the strength of study because the father data was collected directly from fathers. This procedure eliminates inconsistencies when collecting data from secondary sources (e.g. mothers or significant others) (Pleck & Masciadrelli, 2004). Second, the richness of ECLS-B data allowed this study to include as many factors as possible. This issue was problematic in earlier studies due to the lack of available data. With this advancement, it was possible to examine fathers and children as part of the larger family system.

Studying fathers' roles in young children's cognitive development is a complicated task due to the complex nature of the family system and an array of factors that come into play. The current study was an effort to provide a better understanding of the interaction of factors in this system. Although the availability of nationally representative data and advancements in research methodologies helped with this quest, there are still some limitations to consider. Sample selection for the current study is limited to children with biological-resident fathers in an effort to achieve more generalizable results; and children with non-resident, step-fathers and foster fathers were left out of the analysis. Thus, the results cannot be generalized to the entire population of children who were born in U.S in 2001. Also, children were the main focus of the study and selection of fathers was based on the random selection of the children born in 2001. A study with a random selection of biological-resident fathers would reveal less error-prone results.

Study participation was volunteer-based and this might have affected the data collection. Highly-involved fathers may have responded at a higher rate compared to fathers who are less

interested in father roles. These factors distort the generalization of the current study and introduce bias. Another problem with father data is that the number of non-respondent fathers was relatively high. For example, for 9-month data, almost 40% of fathers did not complete the self-administered father survey. There are also problems with self-reported data. Some fathers may have simply overstated their actual engagement behavior.

The current study lacks the ability to account for children's emotional attachment to their fathers. However, emotional attachment can affect the quality of interaction between a father and a child, and could yield different results for children with different levels of attachment to their fathers (Grossmann et al., 2002). Additionally, children's emotional attachments to their mothers are strong factors that can shape the direction and intensity of cognitive development, especially in 9-month-olds. Accounting for this factor could greatly improve the accuracy of this study.

Although the ECLS-B data include a great variety of information on fathers' engagement and interaction in daily activities, the same data were not available for mothers. Availability of this type of data could help researchers find out the nature of parental buffering and whether fathers and mothers cooperate in terms of the contributions that they make in child-rearing activities. The relationship between fathers' engagement and interaction with children and children's cognitive development is a multidimensional phenomenon. Although father classes seemed to have effects on children's cognitive development, there are other factors that may change the direction and magnitude of this relationship. Additionally, findings show some disparity among different race groups. This may point to differences in fathering practices or perception toward the fatherhood across race groups.

There are several important factors contributing to fathers' actual engagement and interaction with their children. Although it is outside the scope of this study, factors such as

fathers' health, financial contributions, perceived social support, and parent cooperation are known to mediate fathers' actual involvement (Cabrera, Linver & Brooks-Gunn, 2007; Gadsden, Fagan, Ray, & Davis, 2004). A study taking into account such factors could add to the findings reported in the current study.

Children's cognitive development is only one dimension of early experience. Studying the effects of fathers' actual involvement on children's social and emotional development is also necessary, as these dimensions contribute to the healthy development of children throughout their lives. For future studies, I believe more qualitative studies should investigate the nature of emotional attachment between a father and a child. Once there are data available on this issue, researchers should be able to more precisely identify and measure the effects of fathers on their children.

Considering the benefit of early cognitive development on children's later academic achievement, researchers continue to investigate the nature of fatherhood and its connection to the children's development. More studies are needed to study the effects of fatherhood over time. Thus far, there are some studies that have measured this effect in early childhood. Far fewer studies have measured these effects across and individual's lifespan. While such studies could be challenging for researchers they could yield interesting findings. For example, in a recent study, researchers found that fathers' early involvement had effects on children's emotional development and social adjustment in early adulthood (NICHD, 2004; Carpendale & Lewis, 2006). More studies similar to the aforementioned one are needed to determine how these early factors affect later development, and how society benefits from these positive effects.

Advancements in research and data collection methods have helped childhood research flourish in the last three decades. Although large scale studies are more readily available than

ever, there is still a need for larger and more comprehensive studies. Factors affecting young children tend to vary based on a range of variables such as SES, ethnicity, gender, and region. Considering the differences among these subgroups, more studies are needed to identify group-specific patterns. This is only possible with larger and more comprehensive studies. I would hope that advancements in the field and in the literature will make it feasible and justify the great resources required for conducting such studies.

Despite these challenges, the current study offers a broader understanding of factors regarding fathers' engagement patterns in early childhood and how these patterns affect children's early cognitive development. There were some clear differences in the patterns of fathers' engagement with their children. Some fathers engaged their children more than others in a variety of activities. Father classes with higher engagement patterns, especially with 9-month-olds, seemed to have negative impact for girls and boys alike. Fathers' high engagement with 2-year-olds seemed to have no detrimental effect, especially on boys. Although the data on mother involvement are limited in the analysis, it still shows that mothers' high engagements are likely to contribute to children's literacy and mathematics performance levels in preschool. Therefore, initiatives aiming to enhance children's early home experiences should consider potential ways to increase fathers' direct or indirect support to amplify mothers' direct engagement with their children. For example, mothers receiving adequate social support seems to protect children from harmful effects of psychological distress (Giesbrecht, Greald, Poole, Letourneau, Nicole, Campbell, & Kaplan, 2014). Researchers and educators are encouraged to consider investing resources, time, and effort to design studies that may help to improve children's early home experiences in relation to immediate significant others.

It is not clear how fathers approach engagement with their children. It may be possible that some fathers see these activities as necessary and perform these tasks without too much meaningful interaction with their children. Although it is not the focus of the study, there is an implication for mothers as well. Mothers' engagement, without controlling for the effect of emotional attachment, was consistently positively associated with children's academic achievement in preschool. This finding is not a new one, however, it could explain the significance mothers' availability to their children when they are infants. With the current state of fatherhood, fathers may not be able to fill the mothers' roles in some families. Policies should continue to emphasize the importance of mothers' early involvement and should economically support and encourage such involvement.

Conclusion

In conclusion, the current study sheds light on the relationship between fathers' engagement with young children and the effects of these practices on children's later cognitive development in preschool. This issue is an area of concern for parents, educators and policy makers. These findings are relevant for parents and policy makers considering the efforts being undertaken to provide the best early experiences for young children and thereby support their cognitive development. Utilization of ECLS-B data helped this study to examine the specific ways in which fathers interact with their infants and toddlers, and to test whether these patterns of interaction predicted children's later academic achievement. The composite SES variable overshadowed the effects of father classes of engagement and all other variables included in the study. Mothers' early involvement with their infant children is known to contribute children's cognitive development and highly engaged fathers may indicate a lack of mothers' attention. Findings of this study suggest that when fathers assume many roles with their infant children,

they tend to have lower scores on measures of academic achievement and performance when they are in preschool.

APPENDIX A

HUMAN SUBJECT APPROVAL

Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673 · FAX (850) 644-4392

APPROVAL MEMORANDUM

Date: 05/14/2015

To: Oguzcan Cig

Address:

Dept.: EDUCATION

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research
Fathers' Early Engagement: Contributions to Children's Cognitive Development in Preschool

The application that you submitted to this office in regard to the use of human subjects in the research proposal referenced above has been reviewed by the Human Subjects Committee at its meeting on 05/13/2015
Your project was approved by the Committee.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals which may be required.

If you submitted a proposed consent form with your application, the approved stamped consent form is attached to this approval notice. Only the stamped version of the consent form may be used in recruiting research subjects.

If the project has not been completed by 05/11/2016 you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee.

You are advised that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report, in writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is IRB00000446.

Cc: Ithel Jones <ijones@admin.fsu.edu>, Advisor
HSC No. 2015.15530

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BIOGRAPHICAL SKETCH

Oguzcan Cig was born in Adana, Turkey in 1980. He received his undergraduate degree in School Psychology and Counseling from Ataturk University, Erzurum in 2002. While working as a school counselor in a public elementary school, he was awarded a scholarship by the Turkish Ministry of Education to pursue Master's degree in the United States. He earned his M.S. degree in 2006 and Ph.D. degree in 2015 in Early Childhood Education at Florida State University.

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