Unequal at the Starting Line: How Early Learning Experiences and School Capital Influence Stratification in The United States

Deleena Patton

A dissertation

submitted in partial fulfillment of the

requirements of the degree of

Doctor of Philosophy

University of Washington

2014

Reading Committee:

Charles Hirschman, Chair

Stewart Tolnay

Jerald Herting

Program Authorized to Offer Degree:

Sociology

University of Washington

Abstract

Unequal at the Starting Line: How Early Learning Experiences and School Capital Influence Stratification in The United States

Deleena Patton

Chair of the Supervisory Committee:

Charles Hirschman

Sociology

While the impact of early childhood education on kindergarten readiness is well established, the relationship of such experiences to later life outcomes is not well understood. This dissertation uses longitudinal survey data to examine which children gain access to early childhood experiences, and of what type and intensity, and whether these experiences have long term effects on test scores and educational attainment. Further, this dissertation theorizes and tests a mechanism, referred to as “school capital,” through which long term benefits of early childhood educational experiences may operate.

Dedication

To my students, whose curiosity and wisdom inspired this work. May we all continue to seek justice and equity in our world.

Acknowledgements

I must first express gratitude to my graduate advisor, Charles Hirschman, for guiding me, challenging me, and investing so much into my growth as a researcher.

I would also like to thank Stewart Tolnay and Jerald Herting for offering their mentorship and serving on my dissertation committee.

Finally, I would like to acknowledge my family and friends who have been with me every step of this journey and who have helped me, in ways both large and small, to achieve this goal.

Table of Contents

Introduction

"In states that make it a priority to educate our youngest children…studies show students grow up more likely to read and do math at grade level, graduate high school, hold a job, form more stable families of their own. We know this works. So let's do what works and make sure none of our children start the race of life already behind."

President Barack Obama

State of the Union, February 12, 2013

As policymakers look for ways to solve some of the most pressing issues the United States faces—stagnation in educational attainment, lagging economic productivity, increasing prison populations—one policy provision has been brought up time and again as a possible solution: early childhood education. In his State of the Union Address from 2013, President Barack Obama proclaimed in regards to early childhood education, "We know this works." In fact, the president's most recent budget pushes to create a universal preschool system for all 4-year-olds. Local governments have already begun to take up the charge of educating its youngest

citizens, with cities like Tulsa, Oklahoma and San Antonio, Texas offering universal pre-kindergarten and cities like Seattle, Washington, Detroit, Michigan, and even New York City looking to design and implement similar universal programs. Many states fund preschool programs for low income children to fill gaps left by a Head Start system that can only accommodate one out of every three low income-eligible children (Garces, Thomas, and Currie 2002). While Head Start enrollments have increased since 2000, as a percentage of poor children, the rates of enrollment have declined (Child Trends).[1]

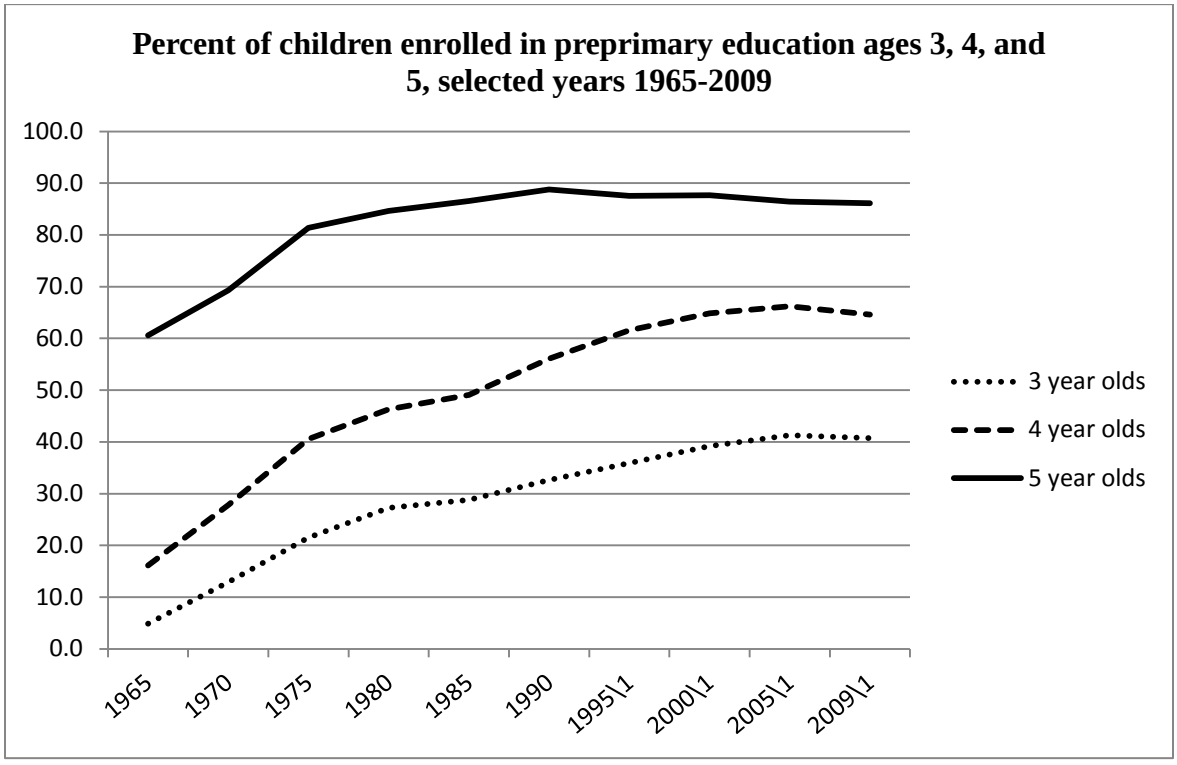
At the same time, massive demographic and family shifts have changed the early childhood experiences of recent generations of children. During the last half-century, American women joined the workforce at unprecedented levels. Increased numbers of employed women also meant the subset of women with young children began searching in higher numbers for care outside of the home. From 1960 to 2011, the labor market participation of married mothers of young children tripled from 20% to 62% (Bureau of Labor Statistics). For children ages 3 to 5, this demographic shift meant increasing exposure to alternative childcare arrangements, including a substantial increase in early educational experiences like preschool. As of 2011, around 64 percent of all three- through five-year-olds who were not already enrolled in kindergarten were exposed to early educational environments, as compared to only 27 percent of children in the same age group in 1965 (National Center for Education Statistics).

Currently, the most popular type of childcare for children ages 3 to 5 who are not yet enrolled in kindergarten is center based care (National Center for Education Statistics). Center based care includes day care centers, preschools, pre-kindergartens, and Head Start programs. Around 60 percent of all four- and five-year-olds who are not already enrolled in kindergarten are exposed to these early educational environments. Current levels of participation represent a

[1] http://www.childtrends.org/?indicators=head-start

steep increase from only 50 years ago, as illustrated in Figure 1 which displays the percentage of 3, 4, and 5 year olds who enroll in preprimary schooling from 1965 to 2009. Mounting evidence indicates that these programs, when they are of high quality, boost cognitive skills and school readiness of participating children (e.g. Gormley 2008; Gormley et al 2005; Magnuson et al 2004; Magnuson et al 2007).

Figure 1: Percent of the population ages 3, 4, and 5 enrolled in school[2]



However, access to these enriching experiences has not been equal across racial/ethnic groups. For example, while black children are more likely to attend preschool than white children, they are also more likely to receive lower quality care (Magnuson & Waldfogel 2005).

[2] Source, U.S. Department of Education, National Center for Education Statistics, Preprimary Enrollment, 1965, 1970, and 1975. U.S. Department of Commerce, Census Bureau, Current Population Survey (CPS), October, 1980 through 2009.

Hispanic children, on the other hand, are much less likely to receive early childhood education, while both black and Hispanic children are much more likely than white children to attend Head Start (Magnuson & Waldfogel 2005), a federally funded preschool program for low-income children that was conceived during the policymaking of the Great Society. While on the whole exposure to early childhood education has now become normative, it has been unevenly adopted across racial/ethnic groups, and the quality and intensity of care varies widely across users of different races and social backgrounds.

While many policymakers believe the benefits of early childhood education and are well-known fact, in reality the current research on preschool outcomes is surprisingly narrow. Until recently, most of the frequently-cited literature around the positive long term effects of preschool was centered around high quality, small scale experimental interventions with low income children and children of color, usually conducted by universities or research groups (Magnuson, Ruhm, and Waldfogel 2007; Lowenstein 2011; Garces, Thomas, and Currie 2002). A large body of research and multiple meta-analyses have found that when disadvantaged children are exposed to such high quality interventions, they enjoy long lasting cognitive and social benefits which are maintained into adulthood (Barnett 1995; Currie 2001; Haskins 1989; Currie et al 2002). However, two concerns arise with the generalizability of such studies: (1) most children who attend preschools in the United States are not being exposed to the high-quality, research-based models that have been studied so intensely, and (2) the American children in preschool classrooms are much more diverse than the racially and socioeconomically homogenous children which have been the subject of most long term studies. Further, the preparation and qualifications of the average preschool teacher differs greatly from the teachers used in the most famous experimental studies. Unlike K-12 teachers, preschool teachers do not need to attain a

bachelor's degree or pass state certification exams (Barnett 2003). The effectiveness of generic preschool may be limited by the qualifications and preparation of teachers.

Beyond problems of generalizability, studies of the long term effects of preschool have failed to identify mechanisms by which possible positive cognitive effects and social outcomes are produced. Studies of high quality programs have found positive long term impacts such as increased school attainment (Duncan, Ludwig, and Magnuson 2007; Currie and Thomas 1995; Garces, Thomas, and Currie, 2000), greater earnings (Garces et al 2002), more positive health behaviors, and reduced criminal activity (Reynolds, Temple, Ou, Arteaga, and White 2011). However, what remains unclear from these studies is exactly how these effects operate. Why would children who attend a one year early learning program at the age of four enjoy long lasting benefits in areas ranging from health to employment to school attainment?

With prior research in mind, I undertake original research to begin to answer some of these questions and fill large gaps in the early learning literature. Many policymakers and scholars believe that early education "works." The goal of this dissertation is to add nuance to this assertion, examining what types of early education are associated with positive outcomes, for whom, and why? Chapter 1 presents a comprehensive literature review which examines in detail prior research in the areas of early learning, child development, and the achievement gap to further frame the research questions and what we currently know and do not know. Chapter 2 summarizes the data sources and methodologies used throughout the empirical chapters of the dissertation. Chapter 3, the first of three empirical chapters, examines which children are exposed to early learning environments and how these environments may vary based on ascriptive characteristics of children such as socioeconomic status and race/ethnicity. Chapter 4 investigates which types of early learning experiences are associated with positive cognitive

outcomes during elementary and middle school, whether the effects endure over time and for whom, and examines whether 'noncognitive skills' may explain these effects. Chapter 5 examines whether preschool effects are maintained into adulthood, by examining whether preschool boosts college enrollment and completion. Finally, Chapter 6 summarizes the findings of this dissertation, offers concluding thoughts on the state of the literature around early education, and makes recommendations for further research and policy.

To current policymakers, investing in early education appears to be a simple policy solution. Research has examined high quality experimental programs, and the findings have on the whole been positive. However, predicting what can be expected from such investments requires a clear and nuanced understanding of what types of programs work, for whom and under what conditions, and importantly, why? There still is a long way to go in being able to answer these questions in regards to early education, and it is through research such as this that the picture will be made clearer.

Aims of the study

In this dissertation, I will examine the factors which predict a child's enrollment in different types of care, and how differences in type, intensity, and quality of early childhood education experiences influence cognitive skills, non-cognitive skills, and educational outcomes in the short, medium, and long term. Further, I will examine whether differences in utilization of early childhood education, as well as barriers to access of high quality care, may be contributing to racial/ethnic inequality in educational achievement. This dissertation follows a long line of research which brings together concern about the achievement gap with the literature asserting

that early childhood is a critical period of development which strongly influences later developmental trajectories.

There has been a great deal of research in this area, and I would like to build on it in the following ways. First, I will use a sociological lens to examine child development by bringing together ecological perspectives on development found in child and developmental psychology with sociological understanding of cultural and social capital. I will also examine in detail the role of so-called "non-cognitive skills" which have been a neglected area in sociological research, and may serve as a mediating force between preschool experiences and cognitive development and school success. I argue that "non-cognitive skills" can be viewed with a sociological lens as a specific sort of cultural capital, what I call school capital, that children gain from participation in high quality early childhood education experiences and can be used to signal to their teachers that they are worthy and fit into school culture. This dissertation will begin to move these important skills and dispositions from fuzzy conceptualization as merely "not test scores," to a more roundly defined concept which will further both the study impacts of early childhood and on the general understanding of the nature of "non-cognitive skills."

Second, I would like to examine early childhood education in a more nuanced way. Prior research has found that the differential rate of participation in preschool does not account for the race/ethnic gap in cognitive achievement, though there has been no systematic investigation of the development of non-cognitive skills. However, these studies generally do not take into account differences in program type and intensity. I will use the ECLS-K to further categorize types of early childhood education participation, not only distinguishing between preschool, prekindergarten, Head Start, and daycare, but categorizing these programs by important dimensions to determine under which conditions and for whom programs work. It will be an

empirical question to see whether differences in the types of programs that are accessed by children from different ascriptive groups may be playing into the achievement gap. Further, as noted above, I will also be able to look at whether participation explains gaps in other outcomes which have not been studied extensively, including retention, college enrollment, and college completion.

Research findings

In my analysis I find that though children are attending early childhood education programs at increasing rates, the type of care they gain access to differs tremendously based on family characteristics and background factors. The decision to enroll children in center-based care and distinguishing among the types of care is related closely to maternal education, child-rearing attitudes and behaviors, as well as racial/ethnic group membership. This indicates that preferences for different types of care are influenced by a variety of different background factors. Further, even when children access the same type of care, say preschool, the content and quality of that preschool can differ substantially. Just as with access to care, access to quality care is contingent on a number of salient background factors.

Preschool appears to have long lasting positive effects, while Head Start and daycare appear not to. I find some evidence that the preschool effect flows through improvements in "school capital" and that kindergarten teachers' ratings of such skills can predict cognitive outcomes at the end of middle school. This finding points to the importance of not just the cognitive boosts provided by preschool, but the school capital which allows children to maintain those boosts. Further, preschool's effect can still be found years later when examining college enrollment behavior, though the effect does not continue into college completion. In contrast

with the research literature, I do not find that Head Start increases school readiness or college going outcomes. When examining daycare I find positive effects on initial kindergarten readiness which fade out by 1st grade. Unlike preschool, daycare and Head Start appear not to provide the tools, such as school capital, to leverage those initial gains into long term improvements.

Drilling down into the preschool effect, I find that effects are robust across different ascriptive groups, but that quality of preschool matters. Preschool effects do not differ by race/ethnicity or by mother's education. However, preschools of higher quality have stronger effects, and the best outcomes are found when children attend only for a moderate amount of time. Within a category such as "preschool" a great deal of variation can be found, and that variation is consequential for child outcomes.

These findings offer important nuance to our understanding of the effects of early childhood education, and identify a plausible mechanism through which effects may operate. While further research is needed, this dissertation represents a step forward in understanding both preschool's effects and how children are stratified in our educational system.

Chapter One

Early childhood education policy has been greatly influenced by advances in theories about development and early learning, as well as an understanding of the magnitude of gaps in achievement at the start of kindergarten or even earlier. This chapter will begin with a summary of the conceptual model used throughout this dissertation. Subsequently, the model is explicated through a discussion of the evolution of developmental psychology since the 1960s which has made a theoretical link between childhood environments and later cognitive outcomes, and of neuroscience research, which offers an empirical basis for such claims. Next, I discuss both the landscape of early childhood education and prior research findings about the impact of such programs, and illuminate gaps in this literature. Finally, early learning and its probable connection to the much larger, and sociologically interesting, issue of the achievement gap and educational stratification will be outlined.

A Conceptual Framework: Child development, stratification, and early learning

In my dissertation, I hope to bring together research from multiple perspectives to start to understand more about how early experiences shape our lives, and how exposures to early childhood education due to changing employment patterns and rising availability of such programs, is shaping our youth and influencing stratification and social mobility. Figure 1.1 displays my conceptual framework which is influenced by sociology, social psychology, and developmental psychology. While the connection between early family environments and

achievement has been explored extensively, less work has been done on how early education experiences may intersect with home environments and contribute to racial disparities in important educational outcomes. Further, the question of whether early experiences may operate through school capital, or "non-cognitive skills," have not been fully examined. The proposed research will help to fill a gap in the literature by exploring how experiences in early childhood education may influence later cognitive and non-cognitive skills, as well as adolescent and adult educational outcomes.

This model draws from the status attainment model (Blau and Duncan 1967; Sewell, Hauer, and Ohlendorf 1970), where parent's educational attainment and occupation are ascribed to their children, but expands upon the traditional model by examining the process by which this ascription happens. Bronfenbrenner's (1995) ecological systems theory of child development is represented in the far left hand side of the model, where ascriptive characteristics from Blau and Duncan (1967) are theorized to influence early environments in which children develop, from the pre-natal period through the preschool years. Genes are illustrated surrounding these environments, because genes constrain what neural connections can be made within an environment. The reverse is also true, where without a stimulating environment, genes may not be expressed. Genes can be seen as "potential" where each individual child has his or her own level which is inherited from his or her parents. Potential, if it is not completely inherited, is at least on balance thought to be highly influenced by heritability. At the same time, we as sociologists can never observe potential directly, and as will be shown in my discussion of developmental psychology and neuroscience, "potential" becomes a difficult concept when we look at how children's brains really develop. The conceptual model is meant to show this interplay and the important role that environments and genes play.

The ascriptive and environmental factors then influence the extent to which parents chose to (or are able to) send their children to early childhood education. This may happen in a number of ways, including necessity—for example single parents or families with two working parents may make different care choices than those without such constrains; investment—for example parents who want to give their children an academic "leg up;" or social networks—parents who may be influenced by the decisions of other families with school age children that they know and communicate with frequently. Though this dissertation does not go into depth about how parents make these decisions, meaning I am in unable to "get inside the head" of parents to understand what their decisions are based on, suffice it to say that there are differences across race and class. Since I argue that differences in environment are central to understanding differences in outcomes, and since the genetic "potential" mentioned earlier is not assumed to vary across groups (only within them) understanding how different ascriptive groups are exposed to different early environments, insofar as parents select different care options in the year before kindergarten, is a key understanding.

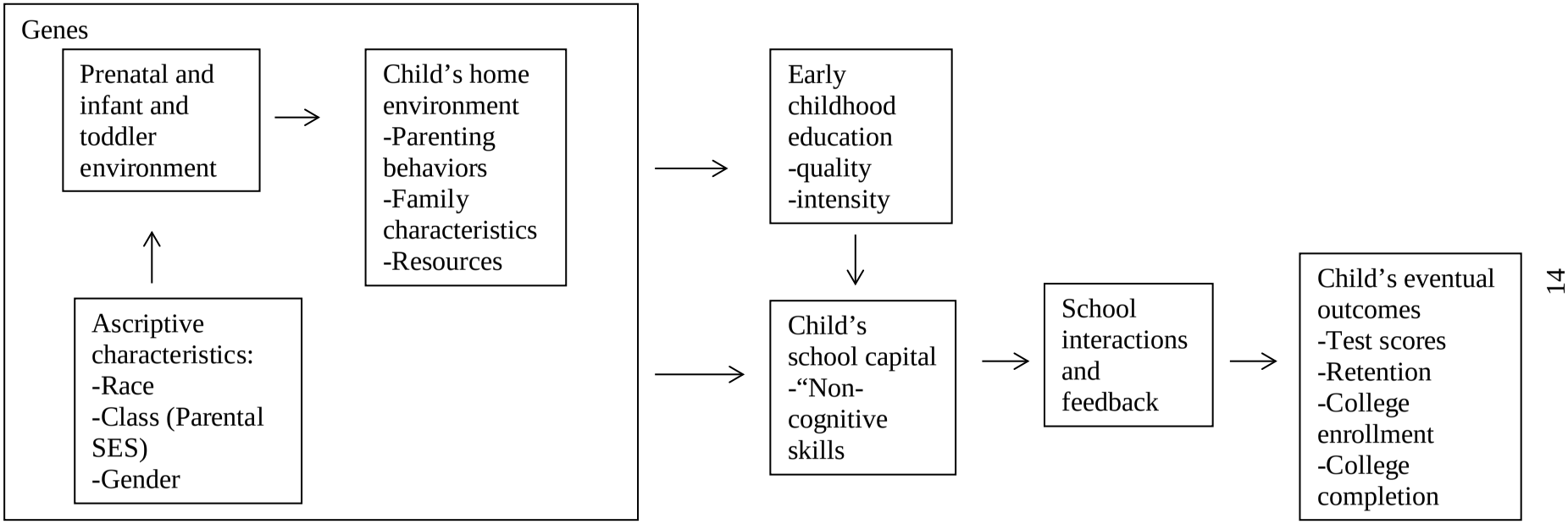
A child's "school capital" or their ability to fit in and approach school in the way desired by their teachers is my own addition to this framework. School capital is theorized to be influenced both by children's families and early home environments, but also by experience, specifically by the quantity and quality of early childhood education. School capital is theorized to be qualitatively different from, but to interact with, noncognitive skills learned in the home. The skills and dispositions that are part of "school capital," which will be discussed more later in this chapter, include those that are specific to a school context, including comfort in a classroom, raising one's hand, and waiting one's turn to speak. While these behaviors may seem small and unimportant, I argue they both prepare students to gain more learning from schooling and they

signal to teachers that the child is “good” and worthy of educational investment. School capital is both a boost in and of itself and a signal to others.

The conceptual model also makes distinctions within and among broad categories of early childhood education. Early childhood education must not be treated as a monolith in analyses, but must be separated by program type and by measures of quality and intensity. The strength of such relationships may be influenced by the type, quality, and intensity of program and it is through keeping this in mind that we begin to uncover what programs work, under what conditions, and for whom.

Benefits of early childhood education are then theorized to flow through the accumulation of school capital, possibly completely mediating the relationship between preschool participation and cognitive and other long term outcomes. Further, school capital is theorized to work through making a child’s transition to school easier, interactions with teachers more positive, and feedback more plentiful. Bronfenbrenner’s ecological systems theory of child development is influential for this conceptual model, as it theorizes that development is an interactive and reciprocal process among the individual, others, and the environment. School capital is likely to lead to more positive interactions with both the environment of school and the other individuals, in this case teachers.

Figure 1.1: Conceptual model of the influence of genes, early experiences, and early childhood education on educational trajectories and long term outcomes



This conceptual model represents an advancement in the study of how stratification and ascription occurs, but also in how early childhood education is thought of, through embedding such experiences in a strong theoretical context. Policies and programs such as early childhood education do not happen in isolation from children's lives, experiences, environments, and development. Instead, enrollment in such programs, and the effects of programs, varies by the same sociological factors that influence stratification more generally. Therefore, this framework and the dissertation more broadly is one attempt to bring together sociology, which recognizes the importance of shared experiences of cohorts of individuals across the life course (e.g. Elder 1999) but has yet not delved deeply into childhood itself; developmental psychology, which tends to attribute structural factors to the individual; and policy research, which can often be atheoretical. It is at the confluence of such streams of ideas that new and interesting knowledge may be uncovered.

Theories of development and early learning

Research from psychology, education, and sociology has profoundly impacted how we think about human development over the life course. In the first half of the 20th century, scholars largely believed that human intelligence is innate, that development is simply predetermined by age, and that one's environment could not have measurable effects on individual intelligence (Consortium for Longitudinal Studies 1983). Further, scholars tended not to distinguish intelligence, understood to be an innate characteristic, and observed achievement. In the 1960s, however, scholars began to assert that intelligence is not a fixed genetic capacity, but that it is responsive to environmental influences (Hunt 1961; The Consortium for Longitudinal Studies 1983) and began to distinguish innate intelligence from achievement, which can be constrained

by external factors. Studies of children who were severely deprived of environmental and emotional stimulation showed that intellectual and motor development was, in fact, affected by experience and environment (Consortium for Longitudinal Studies 1983). This research was incredibly influential upon the study of development, forcing scholars to recognize intelligence as plastic and modifiable through environmental influences.

Related work in developmental psychology asserted that early childhood was a qualitatively different and critical period of life, where influences of environment were most consequential. Developmental psychologists such as Piaget pioneered the idea that advanced learning must build on earlier learning, and implied that an enriching environment could encourage cognitive development (Piaget 1952). Bloom (1964) went on to argue that environmental factors are most influential during periods of rapid development, especially early childhood. The early years of brain development can be seen as providing a critical foundation for future intellectual and emotional functioning (Karoly et al. 1998). This theoretical work encouraged greater interest in the environments in which children develop, and was the impetus behind large scale implementation of early childhood education programs during the 1960s (CLS 1983).

For example, Head Start a current program of the United States Department of Health and Human Services was first implemented in 1964 during President Lyndon Johnson's Great Society campaign. Inspired by empirical psychological research and theoretical advances which challenged the idea that intelligence was primarily hereditary, Head Start was meant to improve both the school readiness and social development of disadvantaged students (Ramey and Ramey 1998). Further, the birth of Head Start also came a little over 10 years after the Supreme Court's Board vs. Brown decision, during policy climate where federal early intervention was also

possible (Ramey and Ramey 1998). Head Start began at the confluence of the War on Poverty, which allowed for much greater flow of resources from the federal government to social welfare programs, the equal rights sentiment of the 1960s, and an increasing theoretical understanding of development and how children learn coming from the academy (Schonkoff and Meisels 1990).

A program like Head Start would simply not have been possible without the theoretical shifts taking place during the 1950s and 1960s, allowing for the role of early environments in either allowing for or constraining cognitive and social development. The call for Head Start came both from a goal of prevention of mental retardation and a goal of fighting intergenerational poverty (Schonkoff and Meisels 1990). Armed with the theoretical claim and empirical support that neurodevelopmental plasticity declined with age, Head Start was designed to intervene early and is considered a two-generation intervention, involving both parents and preschool children. In fact, because of insufficiently nuanced understandings of developmental theory, the expectations and hopes associated with a program like Head Start might be characterized as naïve (Ziegler and Muenchow 1994).

Recent theoretical developments have continued to refine our understanding of how human development takes place within environmental contexts, and thus how the environment is inextricably linked to individual development. Developmental theory stresses individual-context interactions, and it is these interactions, with others and with one's environment, that form the basis for behavior and development (Lerner 1996). Put another way, development takes place in the complicated ecology of human life and the interactions between individual, others, and context are reciprocal, leading to development and change at multiple levels in the ecological system, including individual development (Bronfenbrenner 1995). Especially in the early years, development takes place through "processes of progressively more complex reciprocal

interaction between an active human and persons, objects and symbols in their immediate environment (Bronfenbrenner 1995)." Further, for interactions to deeply affect individuals they must happen on a regular basis and over an extended period of time (Bronfenbrenner 1995). The interaction processes begin as life begins; infants' sensory systems are attuned to stimuli that bombard them upon birth, offering opportunities for learning (Keil 2006) and the development of the brain continues through young adulthood (Nelson et al 2006).

Developmental theory has focused on three key understandings. First, relative plasticity exists across the life span, though the brain is more plastic during periods of rapid development (Lerner 1996). The concept of relative plasticity allows for the existence of constraints on plasticity brought about by early developmental outcomes and by the current contextual conditions (Lerner 1996). The second key understanding is that individuals operate within multiple levels of contextual organization and that these various levels are part of an "inextricably fused developmental system (Lerner 1996)." This means that development can not be separated from environmental factors, since developmental must always take place within a context. Finally, developmental theory asserts that development happens within a larger historical context, so temporality is infused at all levels of the system (Lerner 1996; Elder 1992). Just as Elder (1992) in *Children of the Great Depression* noted the importance of the cohort to which one is born, developmental theory also points out the importance of temporality.

Underlying all of developmental theory is the recognition of the impact of genes. The influence of interactional processes varies based on biological characteristics of the person, but also on the immediate and diffuse environment in which the interactions take place (Bronfenbrenner 1995). Neuroscience illuminates the fact that genes specify the neural structure of the brain, but that since many aspects of individual experience are not predictable across

generations, as an evolutionary adaptation, the brain is set up to rely on experience to customize its connections (Nelson et al 2006). As in the theoretical conceptions put forward by psychologists such as Bronfenbrenner, scholars of neuroscience agree that experience shapes our development, specifically through shaping our neural connections, all while operating within biological and contextual constraints (Nelson et al 2006). Theory suggests that the impact of experience is not constant throughout life, but that early experience has a particularly strong impact (Nelson et al 2006).

To understand why the impact of experience is not constant throughout life, one must only understand the basics of the development of the human brain. Neuroscientific research tells us that brain development proceeds as an orderly process. Brain development begins with neurogenesis, or the birth of undifferentiated brain cells during the second and third trimester, and continues through stages of migration, where cells move to their final location, and differentiation, where both genes and environmental cues (experience) determines what a brain cell will specialize as (Perry 2002). The process continues with apoptosis, where unused neurons die off, again due to both genes and the environment, arborization, where the dendrites (fiber-like projections from a neuron that provide the connection between neurons) are sent out from neuron, and synaptogenesis, where axons and synapses, which allow for neurotransmission, are created (Perry 2002). Finally, synaptic sculpting allows for often used neural connections to strengthen, and rarely used ones to dissolve, and myelination, which allows for more efficient transmission between neurons where activity is highest (Perry 2002). While the creation and migration of brain cells mostly takes place in utero or infancy and through activation of genes, most of the rest of the process of creating a neural structure happens based on experience.

Neuroscience confirms psychologists' understanding of the importance of critical periods. Research on the brain has revealed that neural pathways in the brain are sculpted and pruned based on experience, and that the timing of experience matters immensely. Each brain area develops on a very specific timetable such that the neurodevelopmental processes outlined above will take place during different stages in different areas of the brain (Perry 2002). Since different parts of the brain are going through the latter steps of the neurodevelopmental process at different times, and since the connections and pruning depends on experience, neuroscientific research gives the structural reasons for the psychological observation of critical periods in development. For example, social-emotional development depends on early life nurturing, and if absent during the first three years of life, positive nurturing experiences later in life will not be able to overcome the organization of the brain that has already taken place (Perry 2002). Other examples include the critical periods for natural language acquisition which ends by 6 years of age, and for visual cortex which continues through 7 years of age (Mundkur 2005). While the brain is indeed plastic over the life course, "experience may alter the behavior of an adult [but] experience literally provides the organizing framework for an infant and child (Perry 2002)."

Therefore, theory and brain research both agree that preschooling experiences are likely to influence school readiness and later outcomes because development is constrained both by prior levels of development and by the bounds of current context. It is as if context becomes a part of the individual since it is central to determining, at each successive moment, the interactions that are available to develop brain connections. In theory, once these contexts are embedded in an individual's development, and constraints are put around further development, even positive changes in environment and rich interaction are unable to remove those earlier constraints. Further, because of the process of brain development, certain areas of the brain are

more susceptible to environmental stimulation during critical developmental periods. Neuroscience research suggests that the first five years of life are incredibly important for cognitive, emotional, social, and physical development (Karoly & Gonzalez). Deprivation in the early years of life is likely to lead to impaired IQ and other negative outcomes (Currie 2001). Developmental theories and empirical support for these theories have led scholars to argue that it is most efficient to invest in skills of young children, since skills at older ages are less likely to be altered (Cunha and Heckman 2009).

Types of early childhood education

Early childhood education can be thought of as a subset of early childhood care. Early childhood care can be categorized into three main types: parental care, informal care, and center based care or preschool (Magnuson and Waldfogel 2005). This dissertation is specifically concerned with the third type: that of center based care or preschool. The center-based care and preschool category is substantively interesting because of the research findings that children who participate may enter school better prepared to learn. These findings will be discussed in greater detail in the next section.

Even within the category of early childhood education (i.e. preschool programs) there is great diversity, and making sense of that diversity is one aim of this dissertation. The majority of children who attend early childhood education do so in private programs which charge a fee for attendance (Magnuson and Waldfogel 2005). For low-income parents, these fees may be paid through child care subsidies or financial assistance, such as the child and dependent care tax credit or the dependent care assistance plan (Magnuson and Waldfogel 2005). Within this type of program the quantity of program exposure varies greatly. Some preschools are full-day and

operate during the entire year, which others are only part of the day and/or only during the K-12 school year (Magnuson and Waldfogel 2005).

It is important to note that the federal government has no regulatory authority in regards to preschool programs. Further, state regulations are variable in terms of both their requirements and their enforcement (Magnuson and Waldfogel 2005). Structural indicators of quality of such care include child-to-adult ratios, class sizes, and teacher education. Studies have found that for private preschool programs, the variation on these structural indicators is quite high (Smolenky and Gootman, 2003), but that on average most private programs could be characterized as mediocre in their structural indicators (Magnuson and Waldfogel 2005). Quality is also measured observationally through noting the warmth and responsiveness of teacher-child interactions and quality of activities. Studies of this dimension of quality only found developmentally appropriate care in 24 percent of centers, while care was rated poor in about 10 percent (Helburn 1995).

A much smaller percentage of children participate in publically funded preschool experiences. These programs primarily include Head Start and state, district, or city funded prekindergarten. Head Start is the largest and oldest publically funded early childhood education program, which began in 1965 as part of Lyndon Johnson's policy initiative known as the War on Poverty. The target population for this program is children ages 3 and 4 who are below the poverty threshold or who have been diagnosed with disabilities (Magnuson and Waldfogel 2005). Head Start is implemented through federal grants provided to local agencies that offer early education, as well as health, nutrition, and other family services (Magnuson and Waldfogel 2005). While Head Start is able to serve over half of eligible children, this represents only 10 percent of children in the 3- to 4-year-old age group. Thus, while Head Start represents an interesting program intervention, it does not serve a majority of children overall in the United

States. To remain open, Head Start centers are reviewed at least once every three years, and must meet twenty-four federal performance guidelines (Magnuson and Waldfogel 2005). While studies have found that Head Start centers are equivalent to private centers on process quality and structural quality (Zill et al 2003), only one-third of Head Start teachers hold four year college degrees (Magnuson and Waldfogel 2005).

Prekindergarten programs represent a more recent player in the early childhood education market (Magnuson and Waldfogel 2005). These programs generally target the year prior to kindergarten entry and are district, state, or city funded. Prekindergartens across the country vary a great deal in structure; some are funded through state grants, some are funded through district Title I funds, and they may be housed and operated within public schools, or schools may subcontract with other agencies to provide such services (Magnuson and Waldfogel 2005). In contrast with Head Start, prekindergartens generally do not generally provide health and nutrition assistance, or the parent involvement tactics. Prekindergartens are generally targeted to low-income children. However, there are also a number of notable universal prekindergarten programs. As of 2002, an estimated 14 percent of four-year-olds around the U.S. were enrolled in school-based prekindergarten. Because of tighter oversight and regulation, prekindergarten programs have been found to provide moderate to high quality care (Magnuson and Waldfogel 2005). However, because of the variation of regulations, funding streams, and locations of prekindergarten, it is difficult to treat such programs as a single entity, as one can with Head Start.

Effects of early childhood education

Early childhood programs have been found to have direct impacts on kindergarten readiness. However, as becomes clear from the discussion above, what one means when one talks about early childhood education can vary dramatically. Therefore, understanding the limitations of prior research requires a systematic understanding of where such positive impacts have been found. The most compelling evidence for the importance of early childhood education comes from experimental studies of high quality preschool programs such as Perry/High Scope and the Abecedarian Project. These programs consisted of intensive interventions which were research based (Garces, Thomas, and Currie 2002). It is incredibly important to note that none of the publically funded preschool programs, and likely only a tiny percentage of private preschool programs would approach the structural and process quality of these interventions. Students who attended the Perry/High Scope or the Abecedarian Project preschools showed higher test scores at the beginning of school (Garces, Thomas, and Currie 2002; Currie 2001), their test scores increasing by 0.3 to 0.5 standard deviations due to program participation relative to matched children who did not participate (Magnuson et al 2004). The study of Perry/High Scope included 123 African Americans who were born in poverty between 1958 and 1962 in Ypsilanti, Michigan (Belfield et al 2006), while the Abecedarian Project included 111 low income infants, 98% of whom were African American, from North Carolina born between 1972 and 1977 (Campbell et al 2012). Perry intervened when children were 3 and 4 years of age, while Abecedarian Project began working with four-month-old infants (Heckman 2006). While these experimental interventions prove that intensive, high quality intervention can have great effects on school readiness, most children who attend early childhood education do not attend such high quality programs (Barnett and Belfield 2006). Further, the sample used is both racially and

socioeconomically homogeneous, as well as geographically and temporally limited. Thus, it is important to study generic preschool programs and their average impacts on participants as well as racial/ethnic differences in outcomes.

A few recent studies have used nationally representative data to determine what if any effects average preschool programs have on school readiness. Magnuson et al. (2004) find that children who attend center based preschool programs in the year prior to kindergarten have higher scores on reading and math skills at kindergarten entry than those who did not attend such programs. The study also found that the positive effect associated with center based preschool persisted to the end of 1st grade, and that preschool attendees were also less likely to be held back in kindergarten using a robust set of control variables at the child, family, school, and neighborhood level (Magnuson et al. 2004).[3] Various specific programs, such as state sponsored pre-kindergarten and Head Start, have also been found to have positive short term effects. For example, Magnuson et al (2007), find that pre-kindergarten programs are associated with better math and reading scores at the start of school and Gormley et al. (2008) use a regression discontinuity design finding that Oklahoma's universal pre-kindergarten program improves cognitive development. Regression discontinuity designs represent a step forward in methodologies meant to control for selection. Magnuson and colleagues studies (2007, 2005, and 2004) use a robust set of controls but may still suffer from omitted variable bias. Gormley et al (2008) are able to leverage the birthday cutoff to essentially conduct a quasi-experimental

[3] Control variables include child age, gender, birth weight, whether the child was born premature, child weight and height, race/ethnicity, number of children in household, number of adults in the household, family structure, residential mobility, rural residency, region of the country, number of grandparents living, grandfather and grandmother's education, father and mother's education, language spoken in home, mother's age, father's employment status, use of WIC, household income-to-needs ratio, parent's educational expectations, parent's assessment of importance of academic skills before kindergarten, whether parent's chose their current housing to access the current school, frequency of learning activities at home, number of children books in the home, various measures of parental involvement, reports of parent child relationship, as well as a robust set of school and neighborhood characteristics.

design. Gormley et al (2008) compares children who had a birthday both before and after the age cutoff to enter prekindergarten, and finds that compared to children only days younger who were unable to access the program, children who met the age cutoff experienced significantly greater cognitive development. Head Start has also been found to lead to short term gains in educational achievement and success (Haskins 1989; Currie 2001; Barnett 1995). In the case of short term effects of preschool, studies have found positive effects on kindergarten readiness for program types ranging from private to publically funded, and using experimental, observational, and quasi-experimental designs. Therefore, the literature has reached consensus around short term boosts in performance associated with participation in various types of early childhood education programs.

However, consensus on whether to expect positive longer term outcomes has not been satisfactorily reached by the research community. Most of the research on the longer term effects of preschool (into late elementary and secondary school) rely on experimental studies of high quality programs, such as Perry/High Scope, or various impact studies of Head Start. Commonly, these studies find that the cognitive gains fade over time, especially for Head Start (Haskins 1989; Currie et al 2002; Barnett 1995). Currie and Thomas (1995) point out that the fade out of the Head Start effect in particular is likely due to differences in school environments attended by those in the program. In Head Start recruitment, the most disadvantaged are often given priority. Therefore, even among the disadvantaged population eligible for Head Start, the students who attend are the most at risk and go on to enroll at worse schools than their non-attending, but eligible, counterparts and empirical research has supported this claim (Currie & Thomas 1995). The supposed fade out of effects may actually be the result of poor instruction and learning during later schooling experiences. Even so, randomized experiments such as the Abecedarian

Project preschools see the cognitive gains reduced, though not eliminated, over time (Barnett 1995; Currie 2001). As these studies used random assignment, the later school experiences of children should be roughly equal across the experimental and control groups, suggesting that the cognitive advantages of preschool may dissipate over time.

However, generalizing from such research is still problematic, as these studies draw inferences about the long term effects of early childhood education from analysis of a socioeconomically and racially homogenous, not to mention region-bound and time-bound population (Magnuson, Ruhm, and Waldfogel 2007; Lowenstein 2011). The Perry/High Scope and Abecedarian Project populations combined only add up to a total of 234 children from a very specific time and locational context. The common thread between the experimental and Head Start studies is that these interventions served low-income and/or racial minority students exclusively (Garces, Thomas, and Currie 2002). Since scholars know that low income and minority children gain less from year to year, and attend worse school environments, perhaps any longer term effect of programs on cognitive skills is suppressed. The positive effects of preschool may be more difficult to find among low-income minority children, so examining a more balanced sample may be important, especially when trying to trace effects into adolescence and beyond. Perhaps because of the telescoping process of both learning and brain development, more advantaged children might benefit more from early childhood education again calling for a representative sample of children. Further, perhaps even as more children are exposed to stimulating early childhood education environments, they are still sorted among environments in such a way that the advantaged gain access to the highest quality opportunities. Perry/High Scope and the Abecedarian Project gave the neediest children access to the highest quality environments available at the time. However, when similar children obtain care in a market, or

are targeted for interventions, the quality they receive is likely not to resemble those programs. Therefore, the current research literature contains a large gap in understanding long term effects of average programs, of different types of programs, and of programs across children from different ascriptive groups. To ameliorate this problem, the proposed study will examine longer term cognitive outcomes for a nationally representative sample of children, attending programs they selected in an open market.

Even fewer studies have given scholars a glimpse into the extremely long term effects of preschool on adult outcomes, such as college attendance and graduation. Again, most evidence comes from experimental studies of low income children. Intensive high quality early education programs have been found to impact long-term outcomes and positively influence the life chances of poor children (Duncan, Ludwig, and Magnuson 2007), including positive effects on outcomes such as cognitive development, grade promotion, and social development (e.g. Belfield & Levin 2007). However, numerous researchers recognize that the standard programs that most children are exposed to may not have the same impacts as high quality experimental programs aimed at a homogenous population (Duncan, Ludwig, and Magnuson 2007; Lowenstein 2011). Experimental programs such as Perry/High Scope are generally of higher quality and contain more intensive academic and social interventions than the average program, and tend to target low-income children specifically. Due to the field's focus on the impacts of such unique programming, little is known about the longest term effects of programs as they are currently implemented across the United States or how differential access may be influencing gaps in later educational attainment.

Brain development, noncognitive skills, and "school capital"

Another area of little research is how early learning programs are expected to influence later life outcomes. The path through which early childhood education influences cognitive outcomes is clearer: greater preparation on academic tasks, such as early numeracy and literacy, directly impact kindergarten readiness and sets a child on an academic trajectory (Garces, Thomas, and Currie 2002; Currie 2001). However, Perry Preschool and Abecedarian Project participants have been found to complete more years of schooling and have better health and employment outcomes than a matched control group (Barnett and Mass 2011; Barnett and Ackerman 2007; Campbell et al 2002). The mechanisms through which a one year experience in early childhood leads to such improved long term outcomes, even when that experience is of extremely high quality, remain unclear in this research.

It is plausible that the long term benefits of these experiences flow through what are termed non-cognitive skills, such as task persistence, attentiveness, and curiosity to take on challenges (Hair et al 2006). Studies show that non-cognitive skills are highly predictive of later life outcomes, indicating more study of the early development and influence of these types of skills, especially across race/ethnicity, is warranted. Entwisle et al. (2005) suggest that non-cognitive skills have a great impact on academic and social outcomes, and that it is likely these skills develop before school begins as individual "personal resources." They argue that non-cognitive skills, such as enthusiasm and work habits, have largely been developed by the time children get to kindergarten, and dispositional resources help to enhance or undercut their own development (Entiwisle et al. 2005). Further, others have theorized that Head Start's effect on non-cognitive skills may explain the program's long term impact after cognitive effects have faded out (Woodhead 1988). Children who enter the early grades with a temperament and

disposition conducive to learning experience faster development (Hart et al 2003) and are judged more highly by their teachers (Entwisle and Hayduk 1982; Entwisle et al. 1986). Further, Alexander et al. (1993) find that first grade teacher's ratings of children's interest, participation, and attention span correlated directly with reading and math test scores in second and fourth grades.

Noncognitive gaps, just as with academic achievement gaps are observed early. Recent studies find that at the beginning of kindergarten, low-income, African American, and Hispanic children, as well as boys, have lower ratings of their work habits and are rated as more disruptive than their white, middle class, and female peers (Lee & Burkam; Farkas 2003). By the ages of 4 to 6, gaps in noncognitive skills can be found (Carneiro et al 2003; Cunha and Heckman 2009). The pattern of cumulative disadvantage also holds for noncognitive skill; greater gaps are seen in middle and high school, and these gaps are incredibly consequential for educational attainment and labor market outcomes (Farkas 2003). In fact, Heckman and colleagues (2006) find that for many important outcomes, such as educational attainment and wages, cognitive and noncognitive skills are equally important.

Heckman and Rubenstein (2001) point out that common knowledge, as well as empirical research, suggest that non-cognitive skills such as perseverance are important for success in life, but that academic discussions focus almost exclusively on cognitive skills. They also point out that non-cognitive skills are highly valuable to employers once adolescents and young adults enter the labor market, though unlike Entwisle et al. (2005), who argue that these dispositional resources are set by the early grades, they argue that these skills appear to be more malleable at later ages (Heckman and Rubenstein 2001). Analysis of non-cognitive skills is an important extension of current research on academic achievement gaps, due to the salience of non-

cognitive skills for both academic and employment success. While researchers have begun to understand the important impact of non-cognitive skills, they have yet to integrate their knowledge into the study of the achievement gap.

Part of the problem plaguing studies of non-cognitive skills is that they are under-conceptualized and increasingly broadly defined. As such, researchers have not convincingly integrated non-cognitive skills into their theoretical frameworks nor have they come to consensus on what traits and behaviors make up noncognitive skills and which do not. Seemingly every trait besides test scores and IQ can be termed a noncognitive skill: including task persistence, social emotional skills, attentiveness, positive attitude, optimism, curiosity, creativity, trustworthiness, integrity, conscientiousness and the list goes on and on. From psychological traits and dispositions, to self-regulation skills, to values and outlooks on life, it seems in the current state of the literature anything (except test scores or IQ) can fall under the noncognitive skill umbrella. This is troubling, because with vague language such as this, researchers may be talking past each other, both citing non-cognitive skills as important predictors, but not meaning the same thing. Traits from this domain are incredibly important for children's development, but conceptual clarity is needed to determine which of these skills (if any) serve as a mechanism through which preschool influences adolescent and adult outcomes.

In this dissertation, I focus on a limited set of non-cognitive skills as a type of cultural capital, which I call school capital (see Bourdieu 1984). Unlike many researchers who have approached the study of non-cognitive skills from a psychological or economic perspective, I theorize that school capital (non-cognitive skills) are in fact not personal dispositions which are distributed across populations as an individual difference. Instead, school capital is a personal resource which is transferred to children and adolescents through socialization and interactions

with their environment. Early childhood programs are set up to intentionally cultivate these behaviors and abilities. At the same time similar behaviors may be cultivated in the home environment. However, school capital includes a range of skills and dispositions which are explicitly school related including behaviors such as longer attention span, regulating one's own needs without the help of adult, and raising one's hand and waiting for one's turn to talk. While home environment and family influences may overlap somewhat with "school capital" they are not one in the same unless parents replicate the school environment and school expectations in the home.

School capital, as I conceptualize it, is closely related to the concept of "executive function." Executive function is the individual's ability to control his or her thoughts and behavior (Blakemore and Choudhury 2006). The main components of executive function are attentional flexibility, working memory, and inhibitory control (McClelland and Cameron 2012). Examples of attentional flexibility include focusing on a task in spite of distractions and being able to shift attention as necessary, such as when transitioning from one activity to another. Examples of the utilization of working memory include keeping information in mind while processing other information, such as remembering multi-step instructions or recalling school rules while absorbed in another activity. Finally, inhibitory control is the ability to control one's immediate impulses, including behaviors such as raising one's hand and waiting for an answer instead of blurting out or getting out of your seat to find the teacher (McClelland and Cameron 2012). Neuroscientific research connects the development of executive function, the ability to regulate one's thoughts and actions, to the development of the frontal lobe (Blakemore and Choudhury 2006).

Since executive function is directly related to the development of the architecture of the frontal lobe, it is also linked directly to brain development and thus executive function is governed by sensitive periods. As outlined in the section in this chapter on development and the brain, sensitive periods are a period of time during the course of development during which environmental stimulation has the greatest effects on a particular brain structure and function (Thomas and Knowland 2009). Research indicates that the development of the frontal lobe, and executive function skills in particular, happens most rapidly during early childhood (McLellan and Cameron 2012; Zelazo and Carlson 2012). While the development of the neural networks in the prefrontal cortex continue into adulthood, the most rapid growth (i.e. the sensitive period) has been found to lie in the preschool years, with the functional plasticity declining thereafter (Zelazo and Carlson 2012). Executive functioning ratings in preschool have been found to significantly predict academic achievement in early elementary school, even after cognitive ability is taken into account (Clark, Pritchard, and Woodward 2010) and executive function abilities are more strongly associated with school readiness than either IQ or initial reading and mathematics achievement (Diamond, Barnett, Thomas, and Munro 2007).

The concept of executive function is related to those behaviors and skills that are rewarded in an academic context, or what I term “school capital.” Indeed, attentional flexibility, working memory, and inhibitory control could be alternatively referred to as, paying attention, following directions and rules, and inhibiting “bad behavior,” respectively. What teacher would not want students who can, on kindergarten entry, avoid distractions and stay on tasks for long periods of time; follow simple directions, such as hang up your backpack and coat, turn in your homework, and sit down at your desk quietly; and take turns, sit quietly and wait for the teachers help, and raise a hand instead of blurting out an answer? While these skills can be seen as

making learning more efficient or reinforcing and student's motivation to learn more due to early success (Knudsen, et al 2006), they also signal to school teachers a student's "teachability." Labeling theory (see Rist 1977; Becker 1974) states that individual's self identity is highly influenced by the labels and categories that others label them with, and the interactions with individuals who hold those views of them, leading to self-fulfilling prophecies. Through school capital, or those behaviors associated with the neuropsychological concept of executive function, children signal to their teachers the type of student they are, and subsequently, teachers label those students, differentially invest their time and energy in teaching them, and lead to the reinforcement (or alternatively, disengagement from) the student's perception of themselves as a learner.

What makes school capital distinct from executive function is that school capital is a domain specific set of skills and behaviors which are governed executive function itself. For students to be successful in school, specifically, students must be able to function and learn in the classroom environment (Blair 2002; Blair and Diamond 2008, McLellan and Cameron 2012). For young children especially, school is demanding. Children must transition from their preschool environment to a structured kindergarten environment that demands a great deal of their skills at self-regulation (McClellan and Cameron 2012). Further, the "rules of the game" are often unclear or do not make sense from a child's perspective. For example, in the home children do not wait to be given permission to use their restroom, raise their hand when they have a question of their caretaker, or have to sit and pay attention while being distracted by the presence of twenty other children. Therefore, while children may display executive function at home, in home specific ways, such as remembering to complete basic chores or concentrate on a single activity, the demands and expectations of school require domain specific behaviors that are

related to global executive function, but are specific to the school environment. Therefore, to distinguish between "school capital" or school-specific behaviors, and global executive function, I plan to use multiple measures, including teacher ratings of children's behaviors, children's ratings of their behaviors, and student's own assessments of themselves. This way I hope to assess the extent to which early learning's long term effects may flow through mechanisms outside of the cognitive domain.

School capital, in the simplest words, is made up of those peculiar and particular behaviors expected by school teachers throughout the United States. They are likely to be differentially transferred to children across these various groups, because the cultural value placed on such behaviors may differ across groups, and access to learning such behaviors outside of the home (such as through early learning) are inequitably distributed. Further, as a form of cultural capital, school capital can be used either consciously or subconsciously to signal to those of the dominant school culture that one "fits in." Children who show up in the early grades displaying school capital—they are able to sit still, pay attention, raise their hands—signal to their teachers and other school personnel that they are "good students" and are likely to receive positive responses from their teachers and more attention, leading to a positive feedback loop for those children possessing high levels of school capital. However, it is important to note that just as with cultural capital, in the strict sense the behaviors of school capital are not necessarily superior to other behaviors, but are simply differentially rewarded in educational institutions. Therefore, in addition to early cognitive skills determining the success of the transition to school, cultural resources of school capital are also likely to determine the course of a child's education. In this conceptualization, school capital becomes a central factor in determining a child's later trajectory.

The achievement gap

The conceptual model underpinning this work is one which models the stratification of individuals in American society. As such, early learning is put in the context of understanding how advantage and disadvantage is transferred from parent to child and from generation to generation. Therefore, early learning must be brought into the conversation on why gaps in academic achievement, as well as social mobility and life chances, are observed. This connection to the mechanisms by which individuals are stratified in our society makes this dissertation more than just an assessment of a program or policy, but a study of sociological importance.

Starting with the Coleman Report more than forty years ago, numerous studies have examined racial differences in academic achievement test scores. Using data from students in the 1st through 12th grades, the Coleman Report found large differences in academic achievement between blacks and whites and between the rich and poor at every grade level, and discovered that these differences widened as children advanced through their education (Coleman et al. 1966). Today, more than 45 years after desegregation and other attempts to equalize the educational experience of all children, stark differences in achievement still remain between members of traditionally advantaged and disadvantaged racial/ethnic groups. The Coleman Report, along with the Supreme Court's Brown vs. Board decision in the decade prior, brought into public consciousness and into the policy domain, an interest in educational equity.

Inequalities in academic achievement are present before children ever enter school for their first day of kindergarten. According to a study of recent longitudinal data by Lee and Burkam (2002), black and Hispanic children start kindergarten scoring 21% and 19% lower than whites, respectively, on cognitive skills. Asian children, however, appear to enter kindergarten

performing as well or better than their white peers (Magnuson & Duncan, 2005). Research indicates that cognitive disparities are also present in the first years of life. Using a nationally representative sample of children born in 2001, researchers have found that statistically significant developmental disparities are present between whites and racial/ethnic minorities as early as 9 months of age (Halle et al 2009). Researchers also found that disparities existed across domains, including cognitive development, social-emotional development, as well as general health, and became more pronounced by 24 months of age (Halle et al 2009). Developmental inequalities begin staggeringly early in life. Evidence indicates that racial and ethnic achievement gaps among school age children narrowed substantially in the 1970s and 1980s, but improvements slowed down in the 1990s (Lee 2002).

A portion of the racial/ethnic readiness gap can be explained by differences in socioeconomic status and family environments that influence young children during their formative early years. Early learning environments differ profoundly across race and class, and the result is large differences in test scores at the start of school (Duncan, Ludwig, and Magnuson 2007). For example, highly educated parents provide home learning environments that lead to academic success, through such activities as reading regularly with their children (Rothstein, 2004). Further, parents who have higher incomes are able to buy goods and services for their children, such as nutrition, healthcare, and academic enrichment activities (Duncan & Brooks-Gunn, 1997). More substantial incomes also can be protective against stress and depression, two factors that can lead to more harsh and authoritative parenting and are associated with decreased academic success for children (McLoyd, 1998). Scholars have found that differences between racial/ethnic groups in cognitive skills at the beginning of school can often be explained by covariates which capture socioeconomic status and family background (Fryer

and Levitt, 2004). Social class has been the dominant explanation for differences at the beginning of school, but once children enter the school building, other factors complicate such simple assessments.

Unfortunately, gaps in achievement are not ameliorated once children enter school. In fact, academic gaps between racial/ethnic groups stay the same or in many cases grow over time. Using the National Assessment of Educational Progress (NAEP) scores from 2000, Phillips and Chin (2004) found that black eighth graders are significantly farther behind whites academically than when they were fourth graders. Hispanic children, who now comprise a larger share of minority children than black children, are also behind academically, but the Hispanic-white gap is slightly smaller and appears to remain constant as children age (Phillips and Chin 2004). Some studies suggest that Asian-Americans outscore whites, especially at higher grades (Clotfelter, Ladd, and Vigdor 2009), while others suggest that Asian-American children lose their advantage as their exposure to school continues (Fryer and Levitt 2004).

Widening gaps after entering school throw into question the policy of intervening early, without ensuring quality for children as they move into and through our highly segregated and incredibly unequal school system. As the earlier discussion of neuroplasticity makes clear, synaptic connections and neural structure rely on the continued experience and use of such connections. Pathways in the brain which are not used simply dissolve while those which are only rarely used do not benefit from the increased neural connectivity brought about by myelinization. Neuroplasticity means that brains are more sensitive to environmental stimulation early in life, but also means that without continued stimulation early dense brain connections can be lost.

Early academic failure is associated with a host of negative later life outcomes. Children who score poorly on achievement tests in kindergarten are more likely to become teen parents, engage in crime, and struggle to find employment as adults (Duncan, Ludwig, and Magnuson, 2007). Early achievement also has obvious connections to later education outcomes. Much of the variation in educational attainment can be explained by performance in school as early as first grade because children find themselves on educational trajectories, often at the start of their education, and these trajectories are largely stable over time (Entwisle et al. 2005). Test scores and personal resources measured in first grade predict years of schooling completed and educational attainment at age 22 just as well as similar measures from adolescence (Entwisle et al 2005) suggesting educational trajectories are often set early in life. Further, hourly wages are becoming increasingly sensitive to cognitive test scores of individuals (O'Neill 1990), and with achievement gaps set so early in life, and remaining stable over time, children who fail early can expect to earn less during their lifetimes.

A systematic study of differences in school readiness, both in relation to cognitive and non-cognitive skills (school capital), and growth in gaps over time, must include the role of early childhood education. Additionally, an understanding of how parental advantage is passed down to children, essentially how stratification operates, is largely dependent on understanding children's environments and experiences, and how these interact with institutions and structures that constrain their lives. It is well established that socioeconomic status and family resources play a role in achievement gaps and stratification. However, increasing numbers of children are cared for outside of the home, often in education focused centers of varying quality and intensity. Early childhood education environments may not only lead to gaps in cognitive skills, but also may differentially prepare children to demonstrate their school capital, leading to very different

interactional processes between children of different racial and ethnic groups. These educational experiences may affect the achievement gap in one of three ways: (1) preschool may maintain existing gaps, with preschool simply substituting for traditional home environments and offering the same level of developmental stimulation, (2) preschool could widen the gap if the gap in quality of childcare between advantaged and disadvantaged parents is larger than the gap in the quality of home environments, or (3) preschool may narrow the gaps if disadvantaged parents are able to access high quality care through programs like Head Start.

Why a study such as this is needed

As my conceptual model lays out, I believe that one important mechanism through which educational stratification occurs is early environments, and that early childhood education represents a specific policy meant to modify and improve such environments. As this chapter lays out, prior research has come to a consensus that early childhood education boosts cognitive skills of students entering kindergarten, relative to peers who are exposed to no preschool. While children who did not attend preschool still interacted with an environment, the assumption is that this environment did not prepare them cognitively to the extent that preschool does. This finding is robust to many different types of research methods including experiments, observational studies, and quasi-experimental designs. Further, these findings are supported by an understanding of developmental psychology and brain science.

The research literature assumes that cognitive advantage brought about by preschool attendance may be maintained as children age and explain later life course outcomes, but the research supporting this assertion is not robust. The Perry/High Scope and Abecedarian Project programs are associated with positive long term outcomes, but as previously stated these

programs were small, time-bound experiments using the highest quality interventions available. There are as of yet few studies which attempt to trace outcomes into late elementary, secondary, or adult outcomes using anything other than experimental methods. Further, the theoretical assumption that such cognitive boosts should remain is not necessarily consistent with developmental psychology and brain science research. Human brains are plastic, ever evolving and changing. This does not just mean new connections are added, but that old ones can wither and die. Thus, early childhood education must be understood while understanding that continued environmental stimulation is necessary to maintain any cognitive results. Thus, understanding later school environments is incredibly important.

Finally prior research has so far not been able to answer the question of when such short and long term outcomes occur, for whom, and why. Partially this is because so few long term studies use data coming from programs other than Perry/High Scope and Abecedarian Project experiments. Therefore, differences in program quality and intensity, and such measures' relationship to the outcomes can not be assessed. These programs also used small numbers of racial minority and/or extremely disadvantaged children. Therefore, both program quality and participant type has been held constant in these experiments. They represent only proof of concept: that intensive intervention creates long lasting boosts in children's cognitive and life course outcomes. They are silent on whether the programs that a majority of children actually attend have such long term effects. Lastly, these long term experimental studies do not suggest any plausible mechanisms through which advantages that are found operate. The why and how are left unanswered. Therefore, this study comes at an opportune time, when the interest in early childhood interventions is high, and more information is needed.

Chapter Two

This chapter details the data sources for analysis in this dissertation, and gives an overview of statistical methods used. Basic descriptives on key variables of interest can also be found in this chapter. More detailed information about data and methods specific to a particular analysis will be found in the data and methods sections of each empirical chapter.

Data sources

Data for this dissertation come from two sources. The first source is a longitudinal dataset made publically available by the National Center for Education Statistics named the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K). The ECLS-K is a longitudinal study of a nationally representative sample of approximately 20,000 children who entered kindergarten in 1998. The study focuses on children's early school experiences and follows them through elementary school and into middle school. Waves of data were collected in the fall and spring of kindergarten, and spring of 1^{st}, 3^{rd}, 5^{th}, and 8^{th} grade. The dataset also includes detailed information from parent, teacher, and administrator surveys about the children, families, and schools. Further, parents provide information on the child's educational activities in

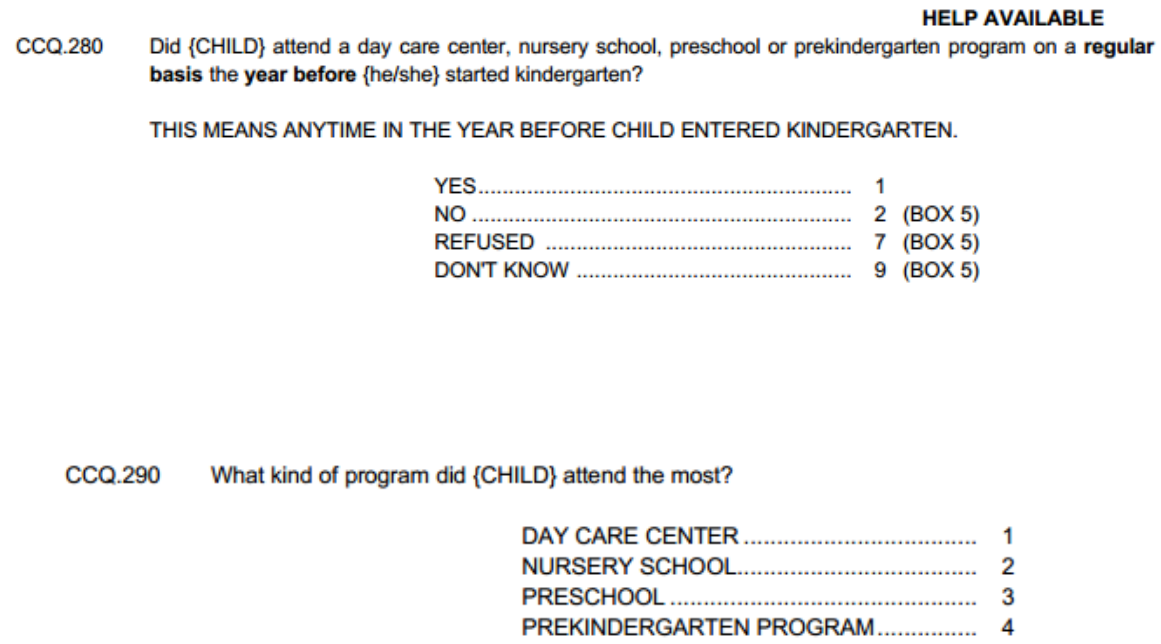
the year before they started kindergarten, allowing for longitudinal studies of how those experiences influence later life outcomes.

The second source of data is the University of Washington Beyond High School Research Project (UW-BHS). UW-BHS is a longitudinal study that focuses on the educational attainment and early life course outcomes of young adults. The study focuses on the transition from high school to college, thus it contains information about post-secondary enrollment and graduation in addition to socioeconomic and family indicators, high school experiences and behaviors. Unlike the ECLS-K, the UW-BHS is regional in nature, drawing the sample from a large metropolitan area on the West Coast. The UW-BHS includes retrospective reports of students' experiences prior to first grade, which allows for comparisons of long term outcomes across types of early childhood education. The survey was fielded in the spring of the students' senior years (between 2000 and 2005), enrollment data come from a one year follow up survey, and completion data comes from the National Student Clearinghouse.

ECLS-K: Outcome variables

Early childhood education program type serves as both a predictor variable, when examining children's subsequent educational enrollment and achievement, and as an outcome variable dependent on family background and other ascriptive characteristics. Program types are coded into three distinct categories: preschool, Head Start, and day care. Parents are surveyed in fall of their child's kindergarten year about whether the child was cared for outside of the home in a center-based setting including day care centers, nursery schools, preschools, or prekindergarten. If parents indicated that their child did attend a program, they are then asked to report what type of care the child attended most.

Figure 2.1: Early childhood education items in the ECLS-K



HELP AVAILABLE

CCQ.280 Did {CHILD} attend a day care center, nursery school, preschool or prekindergarten program on a **regular basis** the **year before** {he/she} started kindergarten?

THIS MEANS ANYTIME IN THE YEAR BEFORE CHILD ENTERED KINDERGARTEN.

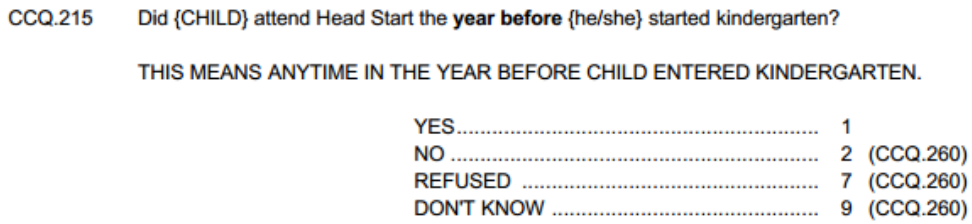
YES	1	
NO	2	(BOX 5)
REFUSED	7	(BOX 5)
DON'T KNOW	9	(BOX 5)

CCQ.290 What kind of program did {CHILD} attend the most?

DAY CARE CENTER	1
NURSERY SCHOOL	2
PRESCHOOL	3
PREKINDERGARTEN PROGRAM	4

A separate section of the interview inquired about Head Start attendance. The question about Head Start is reproduced below.

Figure 2.2: Early childhood education items in the ECLS-K



CCQ.215 Did {CHILD} attend Head Start the **year before** {he/she} started kindergarten?

THIS MEANS ANYTIME IN THE YEAR BEFORE CHILD ENTERED KINDERGARTEN.

YES	1	
NO	2	(CCQ.260)
REFUSED	7	(CCQ.260)
DON'T KNOW	9	(CCQ.260)

Early childhood education was coded in the following way. If the parent indicated that the child attended Head Start, then the case was coded as Head Start, irrespective of if the parent indicated the child attended another type of program. This is because Head Start has income eligibility requirements, making those that attended qualitatively different from other children in early childhood education programs. Day care is maintained as a discrete category. Finally, preschool, nursery school, and prekindergarten are combined into a single category labeled preschool. This decision was made because prior research has found that parents find it difficult to distinguish reliably among such programs (Magnuson, Ruhm, and Waldfogel, 2007). Table 2.1 displays a tabulation of program participation.

Table 2.1: ECE Type in the ECLS-K

	Number	**Percent**
No care	6284	35%
Preschool	8133	46%
Head Start	1823	10%
Daycare	1536	9%

Besides examining selection into programs, the main outcome variables of interest in this study are achievement test scores and retention in grade. Achievement test scores come from adaptive exams in reading and mathematics which were fielded by NCES during each wave of the study. The exam was adaptive, in that based on answers to a few items children were then offered a test form which matched their cognitive level. In order to track achievement gains

throughout the waves of the study and for scores to be longitudinally comparable, all test-forms from kindergarten to eighth grade must be calibrated on the same scale. In order to carry out this goal, ECLS-K used Item Response Theory (IRT) as detailed in Lord (1980).[4] Average reading and math IRT scale scores across the waves of the study used in this dissertation analysis are summarized in the table below. It is important to note that the testing frameworks and test items selected were based on those defined in National Assessment of Educational Progress (NAEP) and curriculum experts provided additional input on developmental appropriateness of the assessments (NCES 2009). The most directly comparable study is the NAEP 2007, which finds similar standardized subgroup gaps as the ECLS-K, providing evidence of correspondence to national assessments of import.

Table 2.2: Mean reading and math scores in ECLS-K at each wave of the survey

	Reading Mean Score	**Math Mean Score**
Fall Kindergarten	35.4	26.1
Spring 1st Grade	77.8	61.6
Spring 3rd Grade	127.3	99.1
Spring 5th Grade	150.7	124.2
Spring 8th Grade	171.5	142.6

Retention in grade is another important outcome when attempting to understand the impact of preschool. Retention is measured at two periods of time. The first retention measure

[4] For more information on the ECLS-K assessment methods and on Item Response Theory, please consult the technical appendix.

indicates whether the student was retained in kindergarten, and the second retention measure indicates whether the student was retained at any point before eighth grade. Retention patterns for the two categories are displayed in the table below. Note that, due to differential attrition, by eighth grade, the percent retained appears lower than during the kindergarten year. Further, retention in kindergarten may be a distinct process. For example, some parents may elect for an additional year of kindergarten in order to "red-shirt" their children, or make sure they are at the top of the distribution of their class. Therefore, retention during any period through 8th grade is an important additional indicator.

Further, this difference points out the issue of differential attrition. Disadvantaged and low performing children are more likely to be lost to follow up. This pattern would lead to an underestimate of effects, especially those later in the study, as the variation of the sample in important outcomes decreases over time.

Table 2.3: Retention in grade, ECLS-K Sample

	Percent
Retained in kindergarten	16%
Retained before reaching 8th grade[5]	10%

UW-BHS Outcome variables

UW-BHS is a valuable data sources for long term outcomes, including college enrollment and completion. College enrollment data come from a one year follow up survey which attained

[5] This percentage is inclusive of kindergarten retention.

a 92% response rate. Students indicated whether they were enrolled in college at the time of the follow up, one year after their scheduled graduation date. The colleges that respondents reported attending were then cross referenced with the Carnegie Classifications to determine the type of institution. Carnegie classifications are a set of classifications of institutions of higher education in the United States created and maintained by the Carnegie Commission on Higher Education.[6] The analysis reported in this dissertation examines enrollment in four year colleges. The college graduation measure comes from records requested from the National Student Clearinghouse about attainment of a bachelor's degree. The National Student Clearinghouse is an institution which provides verification of enrollment and degree attainment and also offers data for student educational outcomes research. College graduation (i.e. receipt of a bachelor's degree) is measured seven years after the student's scheduled graduation year. The table below presents summary statistics on these long term outcomes.

Table 2.4: College attendance in the UW-BHS sample

	Percent Yes	**Percent No**
Enroll in four year college	43%	57%
Graduate from four year college	31%	69%

Methodology

Both the ECLS-K and UW-BHS consist of individual student level data nested within schools. In the ECLS-K, there are nearly 20,000 children across about 1,000 schools, with an

[6] For more information see: http://classifications.carnegiefoundation.org/

average of 20 children per sampled school. The UW-BHS consists of around 9,000 high school seniors across 12 high schools. Therefore, most regression analyses in this dissertation will use hierarchical linear modeling (HLM) techniques.[7] HLM allows for the impact of contexts to be modeled in regression analyses. All multilevel models in this dissertation will use the simplest form of HLM, a varying-intercept model, where the intercept of the regression line is allowed to vary by the clustering variable, in this case allowing varying intercepts by school. This takes into account that averages on outcome variables of interest may vary across schools, because individual scores on an outcome variable are likely to be highly correlated within a school, or other context. Further, HLM allows for adding variables at the contextual level without biasing the individual level coefficients. This is incredibly important for analysis examining academic outcomes because of the role that schools may play in stratifying students. HLM allows for school contextual variables to be taken into account.

Due to nonrandom missingness in both the ECLS-K and the UW-BHS, imputation was conducted. For each dataset, multiple imputation was run using the ice command in Stata 13 to create twenty datasets which are combined using Rubin's rules (see Rubin 1995). Only independent (predictor) variables were imputed. Thus, each of the variables outlined above in the section on outcome variables were not imputed. This includes early childhood education participation, academic achievement scores, retention, college enrollment, and college graduation. Other variables, including control variables and other covariates, will be discussed in detail their relevant chapters.

[7] Exceptions are multinomial logistic regression analyses in Chapter 3 because Stata does not have a command which handles multilevel multinomial logistic regression. In this case multinomial logistic regressions using robust standard errors clustered by school are used. These models will be noted in the chapter.

Chapter Three

Early learning programs continue to be an important topic, as cities across the United States as well as the federal government consider how policies around preschool access may lead more children to be ready for school. However, much work still needs to be done by the research community to understand preschool as distinct from other forms of childcare, and not as another childcare option. Conceptualizing preschool in this way, as just another option among many for daytime care made necessary because of parental employment, obscures the several distinct reasons that determine why parents decide to enroll their children in preschool. Preschool is qualitatively different from other types of nonparental care, not just in the substance of the programs, but in how parents view its benefits. Preschool programs are also considered distinct by the National Center for Education Statistics, which classifies preprimary education enrollment (nursery school, preschool, and kindergarten), as distinct from daycare.[8] As the term 'preprimary education' suggests, preschool and nursery school programs are considered by the education community and by parents to have a main purpose of being educational—an investment to better prepare children for graded schooling. This is not the case for other forms of nonparental care.

[8] See http://nces.ed.gov/fastfacts/display.asp?id=516

However, sociological research on preschool enrollment has not yet fully admitted this fact. This mistaken assumption, that parental employment, specifically maternal employment, and not other factors are the only ones at play during the preschool enrollment decision making process, leads to an overemphasis on employment and income factors, and less on preference and taste factors.

Literature review

Early studies which dealt with preschool enrollment were primarily concerned with where the children of employed mothers ended up being cared for. Researchers were focused on the recent demographic shift where more and more mothers of preschool aged children sought employment outside of the home. Based on this unfolding pattern, scholars tended to make the assumption that all forms of care were simply instrumental, based on substituting some other form of care for that traditionally provided by mothers. For example, Leibowitz et al (1988) in their article in *Demography* only examine care for preschool children of employed mothers because "those women who supply no labor to the market almost always assume primary responsibility for care of their preschool children." These authors assume that mothers would prefer to care for all preschool aged children, but are forced to put their children into various forms of childcare, including preschool, because of necessity. While the article does examine differences by age of the child, and recognizes that older preschoolers need a stimulating environment to aid in development, they make the assumption that a stimulating daycare environment is simply a substitute for mother's care, and not qualitatively different in any way (Leibowitz et al 1988). Generally, in early studies, preschool was seen as indistinguishable from

other forms of center based care, or care outside of the home more generally. Preschool was seen as just another space to store children while mother and father worked.

Fuller et al (1996) recognized that center based care was qualitatively different from other forms of child care and could benefit children during their early development. They find that center based care enrollment is associated with more educated mothers, older preschool aged children, and with a lack of family childcare alternatives (Fuller et al 1996). They also find ethnic differences, with African American children more likely than either white or Hispanic children to be in center based care (Fuller et al 1996). However, center based care as a category in this study is still too broad and does not distinguish daycare, aimed simply at taking care of children during working hours, and preschool type programs, which are aimed at preprimary education. Even so, the authors do acknowledge that future studies should examine "how parents' thinking about their child's development and socialization, in part bounded by ethnic or cultural membership, influences how they choose child care (Fuller et al 1996)."

Liang et al (2000) are critical of the past tradition of studying child care, which takes a household-economics perspective, relying on maternal employment and income to explain childcare choices. They find net of income, maternal employment, and family structure, parents' child-rearing beliefs and practices are associated strongly with enrollment in center based programs (Liang et al 2000). Specifically, children are more likely to be enrolled in center based care if "the mother defines child rearing as an explicit process that should impart school-related skills—reading to her youngster, frequenting the library, teaching cooperative skills, and speaking English (Liang et al 2000)." They suggest that in addition to the household economic reasons and child rearing attitude, access issues, such as local supply of child care centers and linguistic isolation may also play into enrollment differentials (Liang et al 2000). While they

bring up many cultural and supply factors which should be brought into other studies, these researchers still fail to see preschool as a distinct form of center based care, one which is concerned explicitly with education and preparing children for school.

Peyton et al (2001) conceptualize care decisions in terms of weighing priorities. They categorized reasons for selecting care into those focused on quality, practicality, or a preference for a specific type of care arrangement (Peyton et al 2001). They found mothers who worked fewer hours and were less constrained by income concerns chose care based on quality, in contrast to practical concerns such as hours, location, or cost (Peyton et al 2001). In contrast, mothers with more stress related to parenting were likely to choose care based on practical concerns, and mothers who chose based on practical concerns were least satisfied with care (Peyton et al 2001). This study made explicit that multiple factors other than economic ones influence care decisions.

Kim et al (2009) use latent class analysis in order to discover types of choice priorities that tend to go together, across seven dimensions of childcare priority. Their analysis discovered four classes of parents: those who rank all dimensions as important, those that prioritize practicality, those who do not rank any dimensions as highly important, and those who emphasize learning and quality dimensions (Kim et al 2009). With controls in place, learning focused parents tended to select center based care, while practicality focused parents tended to select home-based relative or non-relative care arrangements (i.e. babysitting) (Kim et al 2009). This study is interesting, in that it takes a parent centered, holistic approach to understanding childcare, and suggests that childcare is not simply instrumental for giving parents the ability to work during the day, but also for contributing to the development of children. However, I believe that studying choices in the year before the start of kindergarten will be able to shed more light

on the specific decisions relating to preschool, and the importance of preprimary schooling to parents, irrespective of employment concerns.

Augustine et al (2009) move past earlier studies by separating out maternal choices in the earlier preschool years from those closer to the beginning of kindergarten. In the year before kindergarten, maternal education was not related to the likelihood of being in center based care relative to familial care arrangements; however, mother's education was associated with the quality of center based care, where more educated mothers gained access to higher quality care, and with fewer hours in care (Augustine et al 2009). Children of highly educated mothers were in more academically focused programs that are likely to aid in their development (Augustine et al 2009). Augustine's study still does little to distinguish preschool from other types of center based care.

Even though studies are beginning to separate type of center based care, even within these categories it is likely that the programs will still vary widely within each category. For example, a church-based preschool may vary greatly from a school based program, although in accepted categorizations these programs are likely to both be labeled 'preschool.' Therefore, researchers have begun trying to measure both program type and indications of quality and intensity of care (see Loeb et al 2007). This represents advancement in this line of study; however, we are just beginning to understand how patterns of racial stratification influence the types of programs—as well as their intensity and quality—that children access in the year before kindergarten. Understanding whether, and how, early learning may be reproducing inequality is incredibly important (Meyers and Jordan 2006).

The research literature has clearly come a long way from early studies that conceptualized childcare simply as a consequence of the changing gendered household

economics in the United States. More recent studies have recognized that parents make decisions about their children's care by weighing a number of important preferences, and that the norms about children's school readiness and early achievement have changed substantially over time (Meyers and Jordan 2006). General parenting norms have been found to be highly correlated with social class, with middle class parents adopting intensive parenting styles and lower class parents allowing for natural growth (Lareau 2003). Such parenting differences have been supported by other qualitative as well as quantitative inquiry (Dornbusch et al 1987; Hoover-Dempsey 2005).

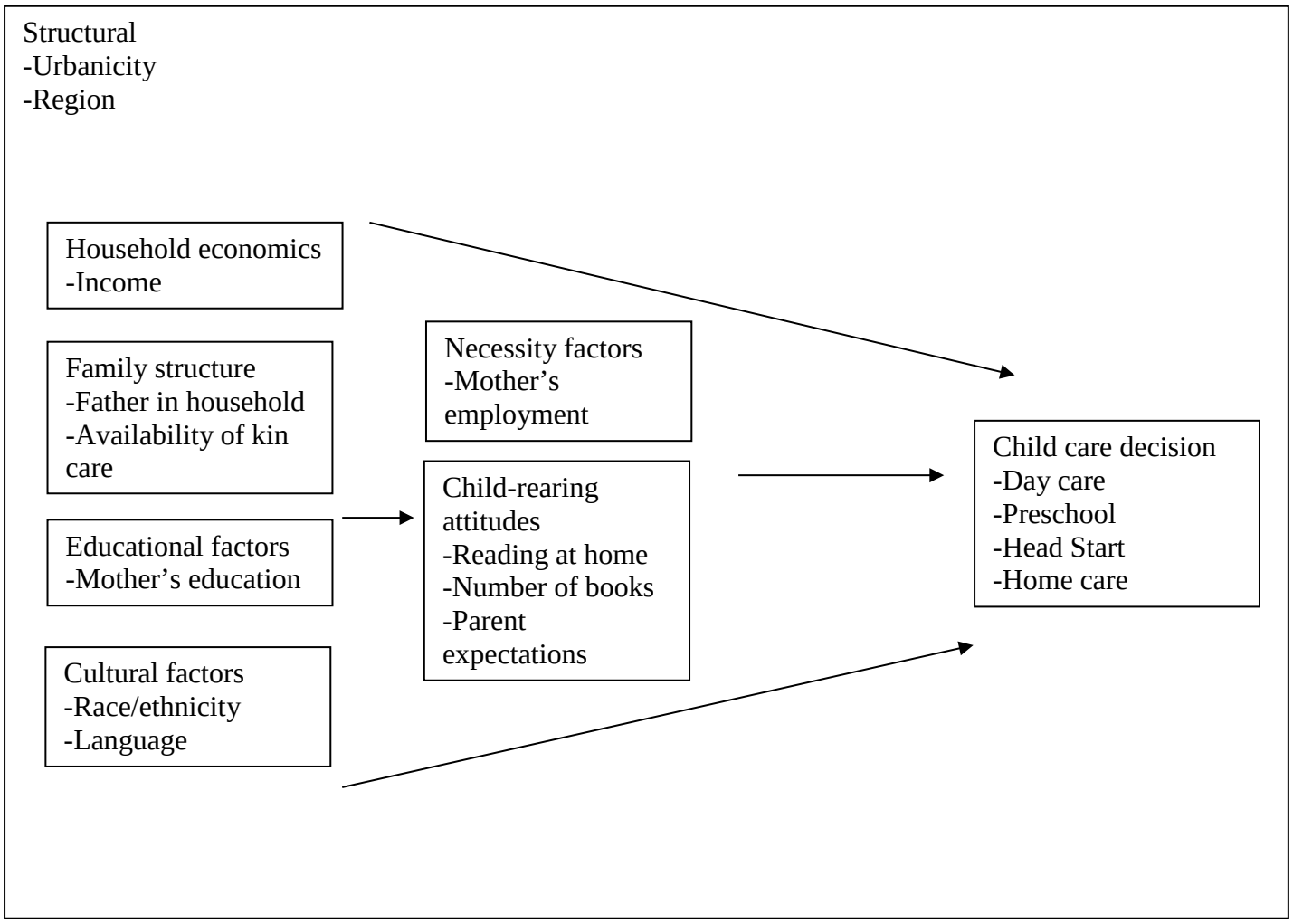
With the growth in care options, the uptake of various types in the year before preschool is likely to be highly correlated with these parenting styles. Recent research has also noted racial and ethnic, and linguistic differences which suggest cultural differences in acceptance of nonparental care (Liang 2000). However, the research literature still tends to assume that care in the year before kindergarten, and care which focuses on academic preparation (i.e. preschooling), is synonymous with all other forms of center-based childcare. This has kept the research literature from understanding the unique influences on parents' childcare decision making in the year before children start school. Further, these studies do not take into account the real differences in preferences based on social class and race/ethnicity for different types of care as found in qualitative literature (see for example Uttal 1997 and Meyers and Jordan 2006).

Finally, important in any discussion of child care utilization is an understanding of availability of care in different locales. For example, data from the 1997 National Survey of American Families indicated that utilization of center-based care varies greatly across states, with over 60% of Mississippi three- and four-year-olds in center based care compared to 31% of California's three- and four-year-olds (Capizzano 2000). Additionally, childcare, broadly defined

as center based care, is less likely to be available in sparsely populated rural areas while large cities can more often provide these resources (Miller and Votruba-Drzal 2013). When care is available in rural areas it is often Head Start or other forms of subsidized care and is thus available exclusively to the poor (Miller and Votruba-Drzal 2013). Studies have found lower enrollments in early childhood education and other forms of childcare in rural areas, as well as regional differences, but it is as of yet unclear if these differences are directly related to the supply of care or to differences in the preference for home care (Atkinson, 1994). Even so, prior literature indicates that the inclusion of regional and urbanicity variables is important to understanding how children of different backgrounds access early childhood education because families' opportunities to use these services may be constrained by their residential location.

Therefore, in order to improve and expand the research literatures understanding of early care, this study will examine the types of care used in the year prior to kindergarten. To stay in line with more recent research, I hypothesize that the following factors will influence the type of care chosen in the year before formal schooling: 1) household economic factors, 2) family structural factors, 3) educational factors, 4) child-rearing attitude factors, and 5) cultural factors. Additionally, structural factors act to expand or limit access to various types of preschool programs (Mulligan et al 2005). The figure below displays the hypothesized interrelationships between factors influencing choice of childcare in the year before kindergarten.

Figure 3.1: Conceptual model of child care decisions in the year before kindergarten



I predict that household economic concerns, educational factors, family structure, and ascriptive factors have direct and indirect influences on childcare decisions. The household economics perspective predicts that those families with higher incomes will seek care outside of the home because these families are able to use their monetary resources to gain access to care (Liebowitz et al 1988) which, with the exception of Head Start and state or city funded pre-K, require substantial fees to attend. Alternatively, those families may choose care because of their conception of and value place on concerted cultivation of children (Lareua 1999). Further, those families with a present father and kin available for childcare will be less likely to choose nonparental care, net of differences in income, because these families have greater options for care, with additional adults able to take care of children (Fuller 1996). More educated mothers will choose higher quality types of care and preschool and will opt out of lower quality forms of care, because they are more able to discern quality and are also more likely to weigh these factors in decision making, as opposed to practical concerns such as location and hours (Peyton et al 2001; Augustine et al 2009).

Further, I predict that some portion of these effects will operate through influencing child-rearing attitudes, which will show an independent effect on childcare choice, such that those parents with more developmental attitudes will choose preschool type care, thought to prepare children for school, in relation to alternatives (Liang et al 2000; Meyers and Jordan 2006). Families with greater incomes and more educated mothers are more likely to possess these child rearing attitudes, such that a portion of the effect of these factors will be explained by the presence of certain childrearing attitudes (Meyers and Jordan 2006). Also intervening is mother's employment outside of the home, which is related to exogenous factors of household economics, education, and family structure. Structural factors such as region of the United States

and degree of urbanicity are associated with supply of care, and therefore will be associated with types of care, net of other factors (Mulligan et al 2005). Finally, if race/ethnic factors remain significant, net of all other factors, this may indicate that there are remaining cultural differences across these communities in the desire for each type of care, though concerns about omitted variable bias must lead to caution when interpreting residual effects.

Data and measures

The Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K) is a nationally representative sample of more than 20,000 American children who entered kindergarten in 1998.[9] The ECLS-K is ideal for the current study because it is the most recent and representative sample of children in schools, it begins data collection during the start of formal schooling at kindergarten entry, and asks a number of the questions necessary to divide early childhood center based care into its various types. As stated in Chapter 1, early childhood education is largely variable between, but also within types of programs. The ECLS-K draws from approximately 1,000 schools, with an average of 20 students in each sampled school. Data collected include information from parents, teachers, and school administrators. For the current analysis, data are taken from two of the parent surveys: fall of kindergarten and spring of kindergarten. Cases with missingness on the dependent variable, early childhood education type, were deleted from the analysis for a total sample of 14,871 cases. The missing cases (about 13% of the sample) are lower than average on income and have less educated mothers. Therefore, the selectivity of the sample means that lower SES children are more likely to have missing data on this variable. As a

[9] The are a small number of students in the sample who were retained in kindergarten and thus were second-time kindergarteners. The results are not sensitive to including or deleting these cases. As of May 2011, 42 states and the District of Columbia required their school districts to offer kindergarten programs, and 15 states and the District of Columbia required children to attend kindergarten (see Digest of Education Statistics 2012, table 197).

consequence, fewer children who may have been in Head Start are included in the sample, and the analyses may underestimate the effects of SES differences.

Measures

The main outcome of interest in this chapter is the type of early childhood education children were enrolled in the year prior—at age 4—to entering kindergarten. The parents of sampled children provided this information in the parent survey administered during the fall of the kindergarten year. The outcome is categorical and is divided into the following categories: no care, preschool, Head Start, and day care. In the year before kindergarten 31% of children were not in any regular care outside the home, 47% were primarily in preschool, 13% were primarily in Head Start, and 9% were primarily in day care. Parents were asked to identify the type of care that they primarily used in the year before kindergarten.[10]

Understanding Who Accesses Early Childhood Education

This chapter's main directive is to understand selection into preschool programs. Therefore, it is incredibly important to examine, as best as possible with the given data, the factors that explain why children are exposed to different types of care. The conceptual framework for this study is drawn from prior literature, and includes childrearing beliefs and mothers employment, in addition to the more traditional economic and household variables. It is incredibly important to minimize the possibility of any effects of preschool being due to different types of parent or families choosing these programs. For example, if parents who are more encouraging of and committed to their child's education choose preschool in the year before kindergarten, omitting this variable in a study of the effects of preschool might misattribute this

[10] Less than 1% of cases identified as being both in preschool and Head Start were coded as Head Start.

effect to preschool, when in fact encouragement increases both preschool going and performance. In Chapter 4 and Chapter 5 in this dissertation, I will examine effects of preschool on later outcomes which makes understanding the selection into this program and minimizing bias critical, because children are not randomly assigned to preschool experiences but instead access these experiences based on important background factors.

Additionally, I am interested in whether children who access similar care, for example a white and black child attending preschool, are receiving the same quality of care. Therefore, I use a small number of indicators or proxies for care quality as outcome variables. First, I include the number of hours per week a child spent in care for preschool, Head Start, and daycare. The number of hours variable comes from the parent survey at the start of kindergarten. Hours per week is an indicator of intensity and quality, with moderate amount of care being the best for children. Next, I calculate a student-teacher ratio using parent reports of number of adult teachers in the classroom and number of children in the classroom. The ECLS-K only used these questions when parents reported their children attended Head Start, so unfortunately the student-teacher ratio measure is only available for Head Start attendees. Lower student to teacher ratios allow for more caretaker child interaction and these ratios have been used extensively as a structural measure of quality. Finally, parents were asked if the early childhood program they used charged a fee, whether or not the parent themselves paid the fee or it was paid another way, such as through a child care subsidy. This question was asked of parents who reported their children were in either preschool or daycare. Charging a fee can be seen as a proxy for quality as well, and empirical research has shown that parent fees are strongly associated with structural and process quality in preschool classrooms (Phillips et al 2011)

Predictor variables of interest: Household economics variables include household income and mother's employment while child was 0 to 5. Unfortunately, the data do not allow for contemporaneous measurement of working patterns of parents in the year before the child enters kindergarten. However, as children age the likelihood of mother's employment increases, meaning that cumulative measures of any work over that period should be highly correlated with working when children are 4 years of age. Over 71% of children's mothers worked while they had preschool aged children, with about 4% missing on this item. The mean family income of the sample is slightly over $53,000; however, the income variable contains a great amount of missingness, at about 25%. Mother's education is included as a family educational variable. Nearly 13% of mothers had less than a high school degree, about one-third had a high school degree, another third have attended some college, while about one-quarter have a college degree. Missingness in mother's education was minimal, at less than 1.5%. It is important to note that the unit of analysis for this study is children who entered kindergarten in 1998. Families who make the decisions in terms of child care, are included proportional to the number of their children. To take this into account, number of siblings is included.

Racial and ethnic variables and language minority status are also controlled. Fourteen percent of the sample is black, 17 percent is Hispanic, 5 percent is Asian, and 58 percent is white.[11] Nearly one-quarter of the sample is of families whose primary language is not English.

Child rearing and developmental attitudes are measured in this analysis by the frequency of reading with children, the number of books in the home, and parental educational expectations for children. Nearly 20 percent rarely or never read books with their children, 35 percent read sometimes, and around 45 percent read every day. The average number of books in the home is

[11] Minorities were oversampled in the ECLSK.

about 75, with a range between 0 and 200 (top-coded at 200). Three-quarters of parents expect their children to attain a bachelor's degree.

Control variables: Family structure is determined by presence of the father and by the availability of kincare. Nearly 20% of children have no father in the home as of fall of kindergarten year, with about 1% of cases being missing. Around 17% of families have access to family members for kin care, but this variable is highly missing, at 25%. Missingness on variables correlates strongly with disadvantaged statuses on other non-missing variables. Therefore, it is important to preserve cases through imputation to maintain the variability of the sample on other factors.

Finally, regional variables are included. Nearly 19 percent of the sample live in the northeast, 32% live in the south, 23% live in the west, and 26% live in the Midwest. Thirty-eight percent live in the urban fringe, 22% live in small towns or rural areas, and 40% live in the central city. In order to preserve cases, I use multiple imputation in Stata 13 to create twenty data sets, and combine these imputed datasets for all analyses. Imputation is accomplished using the "ice" command in Stata, which uses chained equations to create imputed values, using values on non-missing data to create a predicted imputed value. Using twenty data sets adds variability to the imputed value, as the values are not the same across the twenty sets.

Analysis and results

Using multinomial logistic regression with clustered standard errors, I estimate the effects of the predictor variables outlined above on the categorical outcome of what type of care a child received in the year prior to kindergarten: none outside the home, preschool, Head Start, or day care. These regressions are nested in each other such that exogenous variables are added first,

and intervening variables are added in the subsequent models. As I outline in my conceptual framework, family economics and education, as well as family structural and cultural factors are exogenous factors, while mother's employment and child-rearing attitudes are theorized as intervening variables. Mother's employment is endogenous to economic and household structure variables as are child-rearing attitudes. Including the intervening factors in the model may explain the mechanism by which exogenous factors influence child care decisions.

I argue that the year prior to kindergarten is a distinct period for parents when deciding on care for their children; care outside the home is not just necessitated by mothers' employment outside the home, but also has an educational or developmental component. As such, the models examine the following hypotheses.

1. Income, mother's education, the availability of kin care, presence of father, ethnicity, and language will all have effects on the childcare decision, and these effects will remain strong net of mothers' employment. Income should increase the use of care, with the exception of Head Start, while the availability of kin and a father in the home should decrease the use of all types of care. Minority children and children whose families do not speak English should be less likely to use care outside of the home, with the exception of black children. This hypothesis is based on the assertion that, in the year prior to kindergarten, mother's employment is not a necessary condition for entering early childhood education, though it should be highly associated with day care use (a care type highly associated with necessity).
2. Net of the household and structural variables from the first hypothesis, childrearing variables including reading with children, the presence of books in the home, and expectations about children obtaining a bachelor's degree should have independent

positive effects on the decision to enroll in early childhood education (Head Start and preschool), but not on day care. Much of the decision to enroll in early childhood education will be made because families subscribe to certain attitudes about childrearing and educational preparation, as well as cost considerations and availability of care.

3. The region of the United States as well as the urbanicity of the child's residence will have an independent effect on the ability to access early childhood education. The supply of various early childhood options, may act to constrain early education decisions in the year before kindergarten. Supply is likely to vary based on whether the family is living in an urban center or outside the city, and the region of the US.
4. Even among children of different races who access the same types of care, racial/ethnic differences will be found in hours spent in care, student/teacher ratio, and whether the program has a fee, all either measures, or proxy measures, of program quality. Race continues to structure access to resources in the United States, and dominant groups tend to gain access to, and fail to equitably distribute, resources which would be beneficial to less dominant groups.

Which families access which types of care?

The baseline model, displayed in Table 3.1 includes only the exogenous factors outlined in the conceptual model: family income, family structure, mother's education, and cultural factors. Income is strongly related to each type of care relative to no care, but family structure, net of income and all other variables is not related to choice of preschool over only home care. However, the lack of the father in a household is strongly related to Head Start use and day care use. Further, availability of kin for care is not related to the decision to enroll in any of these

options in the year before kindergarten. As predicted, greater levels of education are associated with higher likelihoods of preschool and day care, but decreased likelihood of Head Start.

Model 1 tests the first hypothesis, that additional factors more than just mothers being employed outside of the home are responsible for the decision to seek early childhood education in the year prior to kindergarten. Mother's employment has a significant effect on enrollment in preschool, relative to home care, but the effect is small, increasing the log-odds by 0.2. Contrast this with the effect on enrollment in day care, where mother's employment is associated with an increase in the log-odds of 1.54. Interestingly, mother's employment is not related to the decision to enroll in Head Start, relative to no care. Income is significantly related to ECE choice, net of mother's employment. Controlling for whether the mother worked, each increase of $10,000 in the family income is associated with an increase in the log-odds of preschool enrollment, a decrease in the log-odds of Head Start enrollment, and a small but statistically significant increase in the log-odds of daycare. It is difficult to interpret these findings in the case of Head Start, as only children who are in or near poverty, or those children with diagnosed disabilities are eligible to enroll in Head Start. Therefore, at a certain level of income, the probability of enrolling in Head Start should be near zero.

Mother's education, net of income and employment, is significantly related to care decisions, such that more educated mothers are associated with greater odds of preschool enrollment, decreased odds of Head Start enrollment, and increased odds of day care. Having no father in the household increases the likelihood of choosing Head Start or day care, but is unrelated to the preschool decision. The presence of relatives for kin care is unrelated to the decision to enroll in any of the types of care, again consistent with the idea that ECE in the year before kindergarten is not simply related to necessity.

Table 3.1: Multinomial logistic regression predicting early childhood education type relative to no care (N=14,757)

	Model 0		Model 1		Model 2		Model 3	
Preschool (relative to no center based care)	Coef.		Coef.		Coef.		Coef.	
Mom worked when child was between 0 and 5			0.19	***	0.22	***	0.23	***
Income (in ten thousands)	0.10	***	0.10	***	0.09	***	0.09	***
Mother dropped out of high school	-1.49	***	-1.45	***	-1.23	***	-1.22	***
Mother has a high school degree	-0.93	***	-0.91	***	-0.77	***	-0.75	***
Mother attended some college	-0.47	***	-0.46	***	-0.39	***	-0.39	***
No father in the household (in kindergarten)	0.09		0.08		0.07		0.06	
Relatives are available for kincare	0.04		0.00		0.00		0.00	
Black	-0.03		-0.03		0.06		-0.01	
Hispanic	-0.43	***	-0.42	***	-0.39	***	-0.38	***
Asian	-0.27	*	-0.25	*	-0.19		-0.18	
Native Hawaiian/Pacific Islander	-1.54	***	-1.55	***	-1.49	***	-1.24	***
American Indian/Alaska Native	-0.59	**	-0.58	**	-0.51	**	-0.43	**
More than one race	-0.09		-0.09		-0.09		-0.09	
English is not family's primary language	-0.20	**	-0.18	**	-0.14	*	-0.16	*
Parent's expect child to obtain BA					0.29	***	0.27	***
Parents rarely read to child					-0.09		-0.10	
Parents sometimes read to the child					0.05		0.05	
Number of books in the household					0.27	***	0.28	***
Northeast region							-0.18	*
Southern region							-0.10	
West region							-0.25	**
Urban Fringe							0.01	
Small town and rural							-0.39	***
Constant	0.65	***	0.51	***	0.00		0.22	

Head Start (relative to no center based care)								
Mom worked when child was between 0 and 5			0.02		0.03		0.01	
Income (in ten thousands)	-0.17	***	-0.17	***	-0.16	***	-0.16	***
Mother dropped out of high school	0.52	***	0.52	***	0.45	**	0.47	**
Mother has a high school degree	0.60	***	0.60	***	0.55	***	0.56	***
Mother attended some college	0.53	***	0.53	***	0.50	***	0.51	***
No father in the household (in kindergarten)	0.30	***	0.30	***	0.30	***	0.34	***
Relatives are available for kincare	0.16	*	0.15	*	0.15	*	0.15	*
Black	1.31	***	1.31	***	1.31	***	1.49	***
Hispanic	0.17		0.17		0.17		0.40	***
Asian	0.44	**	0.44	*	0.45	*	0.61	***
Native Hawaiian/Pacific Islander	-0.56	*	-0.56	*	-0.57	*	-0.61	*
American Indian/Alaska Native	1.40	***	1.40	***	1.37	***	1.09	***
More than one race	0.49	**	0.49	**	0.51	**	0.62	***
English is not family's primary language	-0.01		-0.01		0.00		0.05	
Parent's expect child to obtain BA					-0.16	**	-0.12	*
Parents rarely read to child					-0.10		-0.09	
Parents sometimes read to the child					-0.15	*	-0.14	*
Number of books in the household					-0.11		-0.11	
Northeast region							-0.21	
Southern region							-0.31	**
West region							-0.39	**
Urban Fringe							0.05	
Small town and rural							0.54	***
Constant	-1.21	***	-1.23	***	-0.98	***	-1.06	***

Day care (relative to no center based care)								
Mom worked when child was between 0 and 5			1.49	***	1.48	***	1.48	***
Income (in ten thousands)	0.05	***	0.05	***	0.04	**	0.05	***
Mother dropped out of high school	-1.51	***	-1.27	***	-1.23	***	-1.22	***
Mother has a high school degree	-0.76	***	-0.67	***	-0.64	***	-0.63	***
Mother attended some college	-0.33	***	-0.31	**	-0.31	**	-0.29	**
No father in the household (in kindergarten)	0.56	***	0.47	***	0.47	***	0.48	***
Relatives are available for kincare	0.15		-0.07		-0.07		-0.07	
Black	0.33	**	0.32	**	0.29	**	0.26	*
Hispanic	-0.26	*	-0.22		-0.24	*	-0.11	
Asian	-0.27		-0.18		-0.20		-0.06	
Native Hawaiian/Pacific Islander	-3.49	**	-3.54	**	-3.54	**	-3.16	**
American Indian/Alaska Native	-1.24	**	-1.20	**	-1.20	**	-1.16	**
More than one race	0.10		0.09		0.08		0.16	
English is not family's primary language	-0.38	**	-0.29	*	-0.31	**	-0.29	*
Parent's expect child to obtain BA					0.16	*	0.16	*
Parents rarely read to child					0.12		0.10	
Parents sometimes read to the child					0.11		0.11	
Number of books in the household					0.02		0.03	
Northeast region							-0.12	
Southern region							-0.02	
West region							-0.56	***
Urban Fringe							0.02	
Small town and rural							-0.05	
Constant	-1.00	***	-2.25	***	-2.42283	***	-2.33	***
Number of observations	14757		14757		14757		14757	
Number of imputations	20		20		20		20	

Further, racial gaps are found even with the household and family structure variables controlled. Black families are equally as likely to select preschool as white families, but more likely to enroll in Head Start and day care, controlling for the family factors in this model. Hispanic families are less likely to choose preschool than similar white families, though they are equally as likely to select Head Start or day care. There is some evidence that Asian families may be slightly more likely than similar white families to select Head Start. NHOPI families are less likely to choose all three options relative to similar white families. American Indian families are less likely to use preschool or daycare, but much more likely to use Head Start as compared to similar white families. It is unclear at this point in the analysis if these differences are due to differences across these groups in taste for these child care options, or if intervening variables of employment, child rearing attitudes, or structural variables may be at play. Finally, having parents whose primary language is not English decreases children's likelihood of attending preschool or day care.

Model 2 tests that second hypothesis, that parents' attitudes about childrearing and early education matter, net of the household structure and economic variables, and that they should matter mostly for Head Start and preschool, which are explicitly education focused (see Liang et al 2000). Indeed, parents who read more often to their children, expect their children to obtain a bachelor's degree, and those with greater numbers of books in their home are significantly more likely to enroll their child in preschool relative to no care, controlling for income and other family variables. Contrastingly, if parents expect their child to have a bachelor's degree they are significantly less likely to choose Head Start relative to no care, controlling for family background characteristics. Finally, as predicted these educational preparation attitudes have no relationship with the decision to enroll in day care relative to no care.

Day care as an option in the year before preschool appears to function as a necessity, with strong relationships to mother's employment and no relationship to attitudes about educational preparation. However, preschool is much less related to mother's employment and more strongly related to income and to educational preparation attitudes. This indicates a possibility of a "taste" for early education that is associated with greater income, maternal education, and developmental childrearing attitudes. This taste may come from parents' own early experiences, class-based norms on child-rearing, and may not even be consciously held. For example, parents who experienced preschool environments in their youth may be more likely to enroll their children. Or parents who remained at home during their childhood may have strongly held beliefs about the importance of keeping kids at home and nurturing the family environment. On the other hand, preschool may just fall within a middle class parent's conception of concerted cultivation or the desire to determine and plan the child's time to bring about desired outcomes. In contrast, parents who subscribe to a natural growth conception may see preschool as interference into what should be the day to day activities of childhood, that is learning and playing in the home. Finally, a taste for childcare may simply be attained through mimicry, such as through observing what other families with same age children do. It is impossible in this analysis to "get inside the head" of parents choosing child care arrangements.

On the other hand, Head Start is strongly and negatively related to income, which makes sense as it is a means tested service. However, it is unrelated to employment and, controlling for income is negatively related to education and parent's expectation of a bachelor's degree. One interpretation is that net of income those who possess stronger childrearing attitudes, as represented by educational expectations, may have a stigma against Head Start and choose no care instead of the Head Start environment. This type of stigma has been found for ACDF/TANF

and food stamps (Moffit 1983), and has been suggested to be similar for a social program like Head Start (Neidell and Waldfogel 2009).

Model 3 tests the third hypothesis, that supply issues may serve to constrain the ECE choices families can make. Parents in the Northeast and West are significantly less likely to choose preschool relative to no care, as compared to parents in the Midwest and South. Parents in the West are significantly less likely to choose both Head Start and day care relative to parents from all other regions, even with the previous controls in place. Regional differences have been found previously in a number of studies (Stolzenberg and Waite 1984; Blau 1991; Brandon 2000)

Parents in small town and rural areas are much less likely than those in the urban fringe or central cities to choose preschool. As Miller and Votruba-Drzal (2013) state, this may be due to a smaller supply of preschool options in these locales, but my analysis does not allow me to state this definitively, as a competing explanation may be differences in preferences for home care across differing levels of urbanicity. The opposite pattern is found when examining Head Start; families in small towns and rural areas are much more likely to be enrolled in Head Start than economically similar families in the urban fringe and central city. Again, alternatives to Head Start are more readily available in areas that are more populous (Miller and Votruba-Drzal 2013). Finally daycare is unrelated to urbanicity of residence. It does appear that where people live, in addition to their family circumstances and childrearing preferences, structure the type of early childhood education children are exposed to in the year before kindergarten. Additionally, racial and ethnic differences in care remain in the final model, as do differences between native English speaking and other language speakers. Net of household factors, childrearing attitude factors, and geographic factors, differences across race and language groups remain, suggesting

perhaps cultural differences in the acceptance of out of home care. The lower rates of use among Asian and Hispanic families, and among immigrant families is supported by prior research (Brandon 2004; Magnuson, Lahaie, and Waldfogel 2006).

Table 3.2 displays predicted probabilities of ECE type taken from Model 3 in Table 3.1 above (with all covariates in the model). The accompanying figure displays the results graphically. Holding all covariates in the model constant at their means, I vary mother's employment and calculate predicted probabilities. This graphic makes clear where mother's employment matters and where it does not. There is no discernable difference in employed and stay at home mothers in preschool enrollment. Instead, stay at home mothers show a preference for home care and employed mothers have a lower probability of using home care, likely out of necessity. This necessity does not lead employed mothers to choose preschool at any higher rate, but instead to use daycare (the program I tie to necessity directly).

Table 3.2: Predicted probabilities of ECE choice by mother's employment (covariates held constant at their means)

	No Care	Preschool	Head Start	Day Care
Mother employed	0.29	0.48	0.13	0.10
Mother not employed	0.35	0.48	0.15	0.03

Figure 3.2: ECE participation by mother's employment

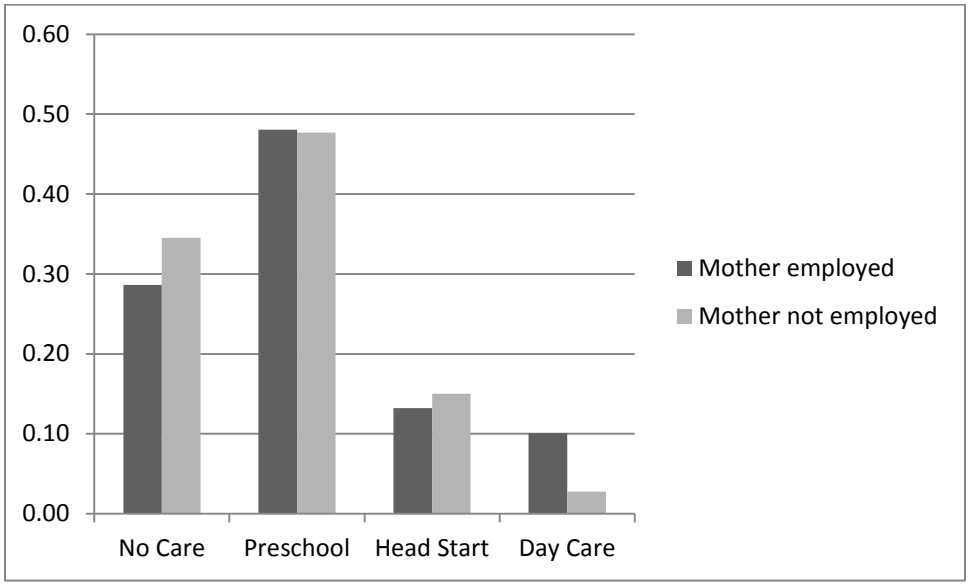


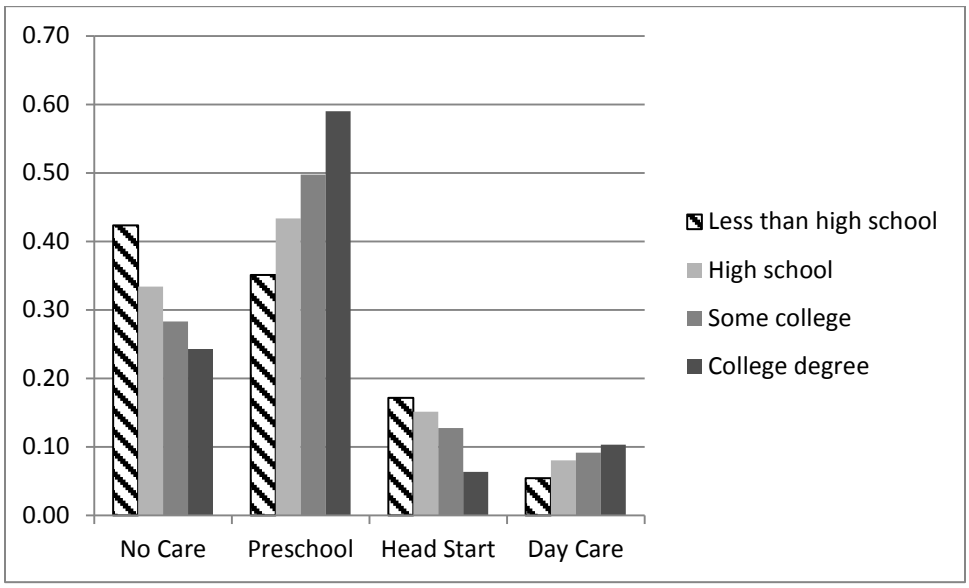
Table 3.3 displays predicted probabilities of ECE type from Model 3 above and the accompanying figure displays the results graphically, this time varying not mother's employment but mother's education. In this display, stark differences appear. There is a strong almost linear relationship between mother's education and probability of choosing various types of care. For example, care in the home drops from a 42% probability among high school dropouts to a 24% probability among mothers with a college degree. In a corresponding fashion, the preference for preschool increases from a 35% probability among high school dropouts, to a 59% probability among mothers with a college degree. Head Start preference appears relatively stable, except for the much lower probability among college degree holders. However, this is difficult to interpret because of income eligibility requirements of Head Start. Therefore, the next section will limit the sample such that the analysis will only examine families living in poverty. Finally, daycare is rarely used as the primary means of care for the year before kindergarten, and this is across educational groups. In essence, the main finding from examining education in particular is that as

women are more educated, they tend to trade home care for preschool. Since plausibly daycare represents a similar care option, the fact that the preference for preschool increases indicates that these mothers do not respond to necessity, but to their own assessments of the importance of investing in the academic success of children through preschool enrollment.

Table 3.3: Predicted probabilities of ECE choice by mother's education (covariates held at their means)

	No Care	Preschool	Head Start	Day Care
Less than high school	0.42	0.35	0.17	0.05
High school	0.33	0.43	0.15	0.08
Some college	0.28	0.50	0.13	0.09
College degree	0.24	0.59	0.06	0.10

Figure 3.3: ECE enrollment across mother's education



Types of care for families in poverty

There are a number of reasons to examine families in poverty by themselves, the most important of which in terms of this analysis is the fact that Head Start is a means-tested program. Families must either be in poverty or the child must have been diagnosed as having a disability

to be eligible for a seat in a Head Start classroom. Therefore, while the prior analyses gave estimates for the effect of increases in income on Head Start attendance, the fact is at a certain point families become ineligible for such a service. In this section, I rerun the final model from the previous analysis, this time limiting the focus to those families that ECLS-K confirmed were below the poverty threshold at kindergarten. Table 3.4 displays the breakdown of early childhood education type among the restricted sample, which differs from the sample as a whole. The poverty sample is more likely to use no care or Head Start than the overall sample, and less likely to use preschool care. Table 3.5 displays the results of a multinomial logistic regression with standard errors clustered by school.

Table 3.4: Percent of students enrolled in early childhood education

	Poverty Sample	Full Sample
No Care	38	30
Preschool	22	47
Head Start	35	14
Daycare	6	8

Table 3.5: Multinomial logistic regression predicting early childhood education type relative to no care for families in poverty (N=2,862)

Preschool (relative to no center based care)	Coef.	
Mom worked when child was between 0 and 5	0.16	
Income (in ten thousands)	0.01	
Mother dropped out of high school	-1.08	***
Mother has a high school degree	-0.77	**
Mother attended some college	-0.64	*
No father in the household (in kindergarten)	0.12	
Relatives are available for kincare	0.00	
Black	0.15	
Hispanic	-0.48	*
Asian	-0.25	
Native Hawaiian/Pacific Islander	-1.75	***
American Indian/Alaska Native	-0.60	
More than one race	0.10	
English is not family's primary language	0.11	
Parent's expect child to obtain BA	0.31	**
Parents rarely read to child	-0.03	
Parents sometimes read to the child	0.09	
Number of books in the household (per 100)	0.47	***
Northeast region	-0.33	
Southern region	0.04	
West region	0.03	
Urban Fringe	-0.04	
Small town and rural	-0.45	**
Constant	-0.07	
Head Start (relative to no center based care)		
Mom worked when child was between 0 and 5	0.01	
Income (in ten thousands)	-0.04	
Mother dropped out of high school	0.35	
Mother has a high school degree	0.53	
Mother attended some college	0.44	
No father in the household (in kindergarten)	0.22	*
Relatives are available for kincare	0.07	
Black	1.22	***
Hispanic	0.31	
Asian	0.59	*
Native Hawaiian/Pacific Islander	-1.10	*
American Indian/Alaska Native	0.83	**
More than one race	0.62	*
English is not family's primary language	-0.02	
Parent's expect child to obtain BA	0.01	

Parents rarely read to child	0.06	
Parents sometimes read to the child	-0.05	
Number of books in the household (per 100)	0.29	*
Northeast region	-0.38	*
Southern region	-0.35	*
West region	-0.51	**
Urban Fringe	0.01	
Small town and rural	0.63	***
Constant	-1.05	**
Day care (relative to no center based care)		
Mom worked when child was between 0 and 5	1.30	***
Income (in ten thousands)	0.00	
Mother dropped out of high school	-0.87	
Mother has a high school degree	-0.39	
Mother attended some college	-0.13	
No father in the household (in kindergarten)	0.51	**
Relatives are available for kincare	0.12	
Black	0.18	
Hispanic	0.14	
Asian	0.47	
Native Hawaiian/Pacific Islander	-14.15	***
American Indian/Alaska Native	-0.49	
More than one race	0.59	
English is not family's primary language	-0.18	
Parent's expect child to obtain BA	0.07	
Parents rarely read to child	0.10	
Parents sometimes read to the child	0.28	
Number of books in the household (per 100)	0.46	**
Northeast region	0.28	
Southern region	0.59	*
West region	-0.34	
Urban Fringe	-0.02	
Small town and rural	0.05	
Constant	-3.28	***
Number of observations	2862	
Number of imputations	20	

In this model, which limits the sample to families which are below the poverty line, new and interesting patterns emerge. For preschool relative to no care, income and employment are no longer significant predictors. Income has a much narrower range when limited to those in poverty (between $0 and $33,000) and plays little role in the preschool decision. Surprisingly mother's employment appears to be unrelated to the decision to enroll in preschool relative to no care. However, like the income unrestricted model, the effect of mother's education is significant even though all families were in poverty. More educated mothers have a strong preference for preschool relative to no care, and this may be due to their education influencing their child-rearing attitudes outright or possibly through mimicking similarly educated and more affluent peers. A new finding is that the absence of a father is now associated with preschool care, which was not found in the full sample models. As before, Hispanic and Native Hawaiian and Pacific Islander families show a strong negative preference for preschooling relative to no center based care. Among this restricted sample, parenting attitudes and behaviors still matter. Children whose parents believe they will graduate from college and those with more children's books in the home prefer preschool over home care.

Head Start use on the other hand has very few significant predictors outside of ascriptive characteristics. Controlling for family characteristics and regional variation, black children in poverty are significantly more likely to enroll in Head Start relative to no care, as are American Indian and mixed race children. Perhaps this could be explained by the location of Head Start centers in areas where black and American Indian families reside or by differential recruitment into Head Start. Surprisingly, the number of books in the household is positively related to enrollment in Head Start relative to no care. Whereas in the full sample model we saw no strong preference between Head Start and no care based on parenting behaviors and investments, in this

case higher investment (measured by children's books as a proxy) is associated with enrollment in Head Start.

Day care's pattern of use shows the strong role necessity plays in the decision to enroll. If the mother was working or the father was not in the household, the log-odds of enrolling in daycare increase. This finding indicates that daycare is often chosen because of lack of childcare alternatives. Since daycares often offer more hours and year round service, essentially catering to working families' hours, this choice is associated with measures of necessity. Native Hawaiian and Pacific Islander families show a strong preference away from daycare. The coefficient for NHOPI is negative in each comparison, showing a strong across the board preference for care in the home, or other forms of non-center based care (e.g. kincare, babysitting).

Among families in poverty, income becomes less important and racial/ethnic preferences and differences in taste across education appear to rule the day. Preschool is chosen generally by more educated families, and less so by Hispanic and Pacific Islander families. Further, child rearing attitudes, even when controlling for mother's education, are highly associated with the decision to enroll in preschool. Head Start attendance appears to be mostly associated with racial/ethnic differences, with black and Native American families choosing Head Start more than similar families from other backgrounds. Finally, as expected daycare use is borne out of necessity. Mothers who work and families without a father are more likely to use day care.

Table 3.6 displays these results in terms of predicted probabilities across levels of mother's education, and the corresponding figure plots them for easier interpretation and comparison. Again, this display corresponds to the subsample of families which are in poverty. For the lower educated mothers, the main choice seems to be between no care and Head Start, with a relatively low probability of preschool and extremely low probability of day care. This is

more or less true for all mothers who do not have a college degree. However, for mothers who possess college degrees and are living in poverty, it appears the choice they primarily make is between no care and preschool, with very low probabilities of Head Start attendance. This pattern may be due to the rarity of finding mothers with such high levels of education living in poverty. Indeed, children with mothers fitting this description make up less than five percent of the low-income sample. While there may need to be a caveat on interpreting probabilities for college educated mothers in poverty, even among the three other categories, a clear positive trend in preference for preschool and negative trend in preference for care at home is still notable.

Table 3.6: Predicted probabilities of ECE choice by mother's education for the in poverty sample (covariates held at their means)

	No Care	Preschool	Head Start	Day Care
Less than high school	0.41	0.19	0.36	0.05
High school	0.35	0.22	0.37	0.06
Some college	0.34	0.24	0.34	0.07
College degree	0.32	0.32	0.19	0.09

Figure 3.4: ECE enrollment by mother's education, poverty sample

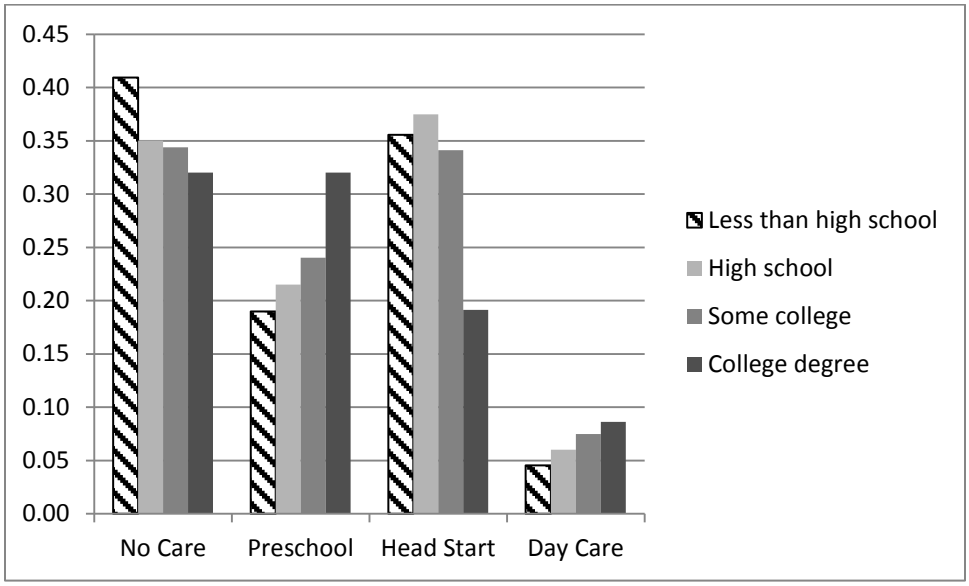


Table 3.7 displays these results in terms of predicted probabilities across the most common ethnic groups, and the corresponding figure plots them for easier interpretation and comparison This comparison is justified because of the robust findings of differences across race/ethnic groups in early childhood educational preferences net of family background controls. Overall, black families living in poverty show distinctive preference patterns as compared to the other largest racial and ethnic groups also living in poverty. Black families choose no care much less often than any other group, and choose Head Start much more often than any other group. White, Hispanic, and Asian families living in poverty show similar levels of preference for no care, but whites seem to prefer preschool over Head Start when electing for care, where Asians and Hispanics choose the opposite (Head Start over preschool).

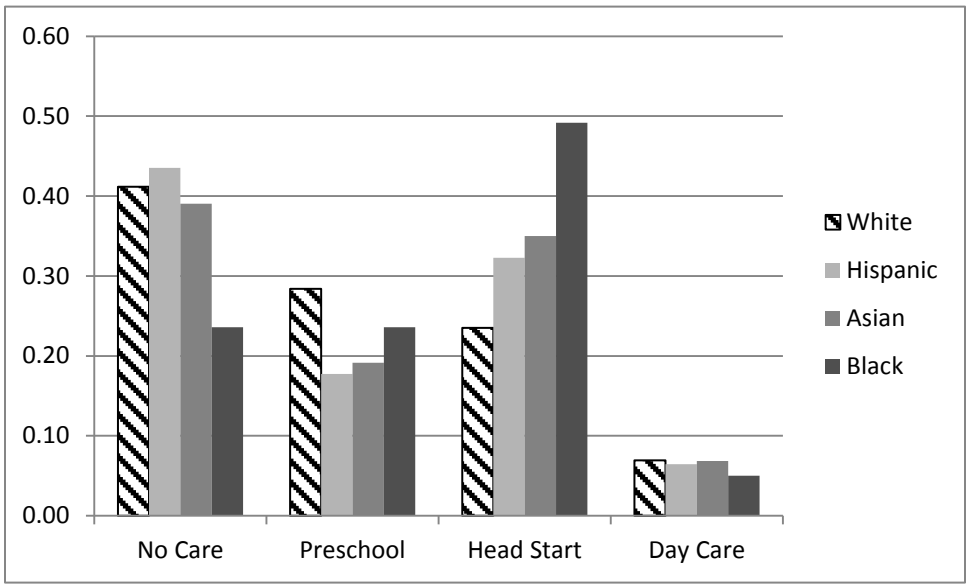
What this analysis can not tell is why these patterns are so disparate. Employment or lack of a father's earnings can not explain these patterns, since both of those covariates are in the model and held constant when calculating the predicted probabilities. However, a number of

explanations come to mind. First, recruitment into Head Start may target black families in particular because of stereotypes about the home care of black families. The outreach methods may differentially target black families. The differences seen here could be partially attributed to "steering." Second, perhaps Head Start centers are more likely to be located in areas that are more easily accessed by black families. While earlier analysis controlled for urbanicity, those controls only got at the divide across areas. Perhaps Head Start centers are located differently within urban, rural, and suburban locales on the level of neighborhoods and this may explain some of the differences. This would indicate not steering, but geographic and residential limitations on access leading to differential outcomes. Finally, and I believe most likely, is that white parents shun Head Start because its stereotypical association with black families, as well as the desire to remain segregated from diverse children, even in early childhood environments. Qualitative research that can uncover the meanings and stereotypes attributed to different types of care, as well as analyses which are able to take the supply of Head Start (as well as alternatives) into account will help to explain these interesting patterns.

Table 3.7: ECE choice by race for the in poverty sample
(covariates held at their means)

	No Care	Preschool	Head Start	Day Care
White	0.41	0.28	0.24	0.07
Hispanic	0.44	0.18	0.32	0.06
Asian	0.39	0.19	0.35	0.07
Black	0.24	0.24	0.49	0.05

Figure 3.5: ECE enrollment across race/ethnicity, poverty sample



Within categories of care do different groups access the same quality of care?

I also predicted that even among children who attended the three main types of care studied here, racial differences in the quality and intensity of care may still be apparent. Sociology is filled with examples of opportunities and resources being differentially accessed by advantaged groups, from housing, to jobs, to education (for example Rury and Saatcioglu 2011; Tilly 2000; and Kelly 2009).This pattern might extend further into care received in the year before preschool.

Table 3.8 tests the hypothesis that even among children of different races who access the same types of care, racial/ethnic differences will be found in hours spent in care, student/teacher ratio, and whether the program has a fee, all either measures or proxy measures of program quality. Black, Asian, and Pacific Islander students all attend preschool for a greater number of hours, as compared to similar white children who attend preschool. Further, all non-white races of children receive greater numbers of hours at Head Start centers than similar white children

who attend Head Start. Interestingly, day care hours do not differ significantly across race. Black students also are in Head Start classes with slightly more children per adult, and black, Hispanic, and American Indian students are much less likely to attend a preschool experience that requires a fee (this is regardless of whether the family paid for the fee themselves, or it was paid by another agency or waiver).

Table 3.8: Predicting access to early education type across race ethnicity controlling for ascription, family characteristics, and geography[12]

	Preschool Hours		Head Start Hours		Day Care Hours	Head Start Ratio		Preschool Fee		Day Care Fee
Black	7.49	***	5.84	***	-0.55	0.62	***	-1.18	***	-0.51
Hispanic	0.87		1.61	*	1.60	-0.34		-0.82	***	-0.03
Asian	2.83	***	1.67		0.99	0.37		-0.26		0.44
NHOPI	5.58	**	6.06	**	10.61	0.65		-0.24		xxxx
AIAN	0.37		5.03	***	1.63	-0.12		-1.14	***	xxxx
Multirace	2.54	**	0.32		0.66	0.05		-0.46	*	0.62

Spending seven and a half more hours in preschool and six more hours in Head Start per week may be an advantage for black students. However, some studies have shown that while kids benefit from a moderate amount of early education, more intense amount of hours may actually be detrimental to development, due longer hours being associated with more externalizing behaviors in children (Leob et al 2005) A lower ratio in classrooms is generally accepted as positively correlated with better schooling outcomes. Even in a program like Head Start which is consistently monitored and funded through the government, black children still appear to end up in classrooms with more students, and likely less teacher attention and

[12] This table controls for household income, mothers work, mothers education, family structure, race/ethnicity, language, parent investment behaviors and attitudes, region, and urbanicity.

interaction. Finally, even among students who are able to access preschool, arguably qualitatively the program most aligned to later educational outcomes, black, Hispanic, and native students are more likely to attend fee-free preschools. With fees taken as a fair proxy of the quality of the program, these children may be accessing lower quality preschool experiences.

Discussion and conclusions

This chapter examined which children access different types of early childhood education in the year before the start of kindergarten and why. The key arguments put forth are that prior research did not adequately recognize that the year before kindergarten is a qualitatively different time period from others for care decisions, that during this time period mother's employment is not a key necessary condition, and that childrearing and educational preparedness attitudes as well as availability in the families' residence also structure care decisions. Further, I argue that preschool, and to some extent Head Start, is qualitatively different from day care and combining all center based care obscures the real differences in the predictors of each type. Finally, I argue that even among a more detailed breakdown of care between preschool, day care, and Head Start, differences in the intensity and quality of care within each category across racial groups is likely to still be observable, and may have consequences for the students' later educational outcomes.

The results support these assertions. While mother's employment is very important for the choice to enroll in daycare, it is unrelated to Head Start, though it is related to the decision to enroll in preschool. In the year before kindergarten, enrollment in some sort of out of home experience is quite common, whether or not the child's mother worked when the child was preschool age (infancy to age 5). While this is a large period of time, and a child's mother may have moved in and out of the workforce during that period, substituting mother's work during

kindergarten year, likely to be highly correlated with employment in the year prior, gives similar results. Furthermore, the availability of kin care is not related to the decision to enroll in any of the early childhood education types, supporting that the necessity of care hypothesis is no longer sound in the year prior to kindergarten.

Why then are mothers who do not work sending their children outside their homes? Other important factors include income and mother's education, regardless of whether she works. Those mothers with higher household incomes and greater education show a greater preference for their children to attend preschool and a slight preference toward day care. More educated mothers show a similar preference for preschool and away from Head Start, even using a sample only of children who meet income eligibility requirements for Head Start, though again mother's education is also positively related to daycare. Women of the same income level are less likely to enroll in Head Start if they are more educated. At the same time women of the same income are more likely to choose preschool (and for some daycare) in the year before kindergarten when they are more highly educated. More educated mothers may have themselves attended preschool as children, or the act of education may impart some preference for and possibly justification for the need for children to enroll in preschool.

Families are also sending children outside the home for early childhood education because of very clear attitudes about the importance of educational preparation and expectations. Mothers who report supporting education in their own behavior—reading with their children, providing books in the home, expecting their child to graduate from college—are much more likely to choose preschool net of household economic and structural factors. They also show a slight aversion to Head Start, where those mothers who expect their child to graduate from college choose no care over Head Start. Moreover, these attitudes are unrelated to the choice of

day care over no care, which supports the assertions that Head Start and preschool are seen as explicitly educational and as such are sought out or avoided based on families' own attitudes about childrearing. These educational programs are not only programmatically different, with a specific educational curricula offered in preschool and Head Start, but are likely perceived differently by those who are considering them as options. Parents who display educational child rearing attitudes are going to choose programs that they see benefitting their child through academic preparation.

While the income, education, and parenting factors greatly influence the child care decisions in the year before kindergarten, parents' choices are also structured by where they live. Parents in the west use all kinds of care less frequently. Small town and rural families use preschool less and Head Start more. What is unclear from these analyses is whether this is actually due to differences in supply, or in differences in attitudes toward these institutions across geography.

Further, when examining choices among families in poverty new and different patterns emerge. Families with more educated mothers and stronger child-rearing attitudes and behaviors still overwhelmingly select preschool. However, for Head Start it appears racial factors, in contrast to necessity or child-rearing factors determine enrollment. This finding points perhaps to stigmas against Head Start in the white impoverished community, differential recruitment of black and American Indian families, or perhaps to more fine-grained differences in where Head Start centers are placed relative to residences of different racial ethnic groups. Necessity is the greatest explanation for daycare use for the sample of children in poverty, as it was for the sample overall.

Additionally, even within one type of care such as preschool, children are accessing much different programs in terms of intensity and quality. For students in preschool, most racial minority children experience a greater number of hours in care, and are less likely to attend a program that charges a fee. While it is unclear what a greater intensity of preschool may mean, programs with fees are likely to be of greater quality, have better prepared teachers, or other factors associated with program quality. For children in Head Start, minority children are again exposed to a greater number of hours per week and black children are exposed to classrooms with more students per teacher. It is important to point out that while the hours differences are still large for Head Start, the ratio differences are relatively small. Unfortunately, student teacher ratios were not reported for preschool, but it may be safe to guess that the magnitudes would be larger. What is called "preschool" or understood by parents as "preschool" is likely to vary greatly in quality, versus the variability of Head Start. In this way, while students of various races may be experiencing preschool, what a child experiences from classroom to classroom may vary quite substantially.

This study had a number of notable limitations. The variable indicating mother's work does not line up exactly with the time period in question, which may bias results. Further, income had to be imputed for 25% of the sample, which is a large proportion but not unusual for nonresponse on income questions. However, having variables for mother's education, employment, and family structure, all with low rates of missingness, hopefully attenuates concerns about imputation of income. Also, scholars have called into question the ability of parents to accurately distinguish the types of care in question and children are often exposed to multiple types, even in the single year before they enter school.

Even so, this analysis puts forth evidence that the year before kindergarten is in fact treated differently from other periods of early development, where a preference for children to stay home with non-working mothers is still the norm. However, in the year before kindergarten it appears that thoughts about educational preparation come into play and clear preferences for preschool are exhibited by more advantaged families, both in terms of education and in terms of income. Just as K-12 schooling may have filled a historical need for childcare but had attitudes towards its purposes evolve to be educational, so too has this pattern extended to the year prior to school. Preschool is seen as educational in and of itself and privileged families whether or not they need someone to look after their children, choose to enroll because of what else they believe is provided by that experience.

Chapter Four

Even as the support for early childhood education as a policy solution increases, coming up in President Obama's 2013 State of the Union Address, a lack of evidence about preschool's long term effects remains. The medium-term and long-term effects of early childhood educational experiences continue to be unknown. While there are a number of studies that follow children who participated in tightly controlled, high quality experimental preschools, and Head Start attendees, into their early thirties and find positive long term effects (Garces, Thomas, and Currie 2002; Currie 2001; Haskins 1989; Barnett 1995; Gorey 2001), applicability and generalizability of such experiences to those of typical preschool enrollees is not clear (Barnett and Belfield 2006; Magnuson, Ruhm, and Waldfogel 2007; Lowenstein 2011). This lack of generalizability is due to the fact that these studies used homogenous samples of highly disadvantaged minority children and exposed children to extremely high quality early childhood experiences (Barnett and Belfield 2006; Magnuson, Ruhm, and Waldfogel 2007; Lowenstein 2011). Therefore, the problem with applying these findings more generally are two-fold: (1) the same effects may not be found with more heterogeneous groups of students, and (2) these effects may only be found with extremely high quality programs, which the majority of children in early childhood educational programs are not likely to experience.

A majority of children in the United States attend early childhood education of one form or another, including preschool, daycare, or Head Start (National Center for Education Statistics). However, we know little about the long-term outcomes for children in these diverse programs. Further, we know even less about the mechanisms by which early childhood education experiences lead to these medium and long term outcomes. With many public entities considering funding early childhood education, such as universal prekindergarten, it is an important time to understand exactly what effects can be expected from preschool investment and how any effects may operate.

Literature review

Early childhood programs have been found to have direct impacts on cognitive outcomes at the start of kindergarten. Evidence from Perry/High Scope and the Abecedarian Project has been used to support the importance of early childhood education. These experimental programs consisted of research based intensive interventions and children who attended showed significantly higher test scores at the beginning of elementary school (Garces, Thomas, and Currie 2002; Currie 2001). While these experimental interventions strongly suggest that intensive, high quality intervention can have great effects on school readiness, most children who attend early childhood education do not attend such high quality programs (Barnett and Belfield 2006). Thus, it is important to study generic preschool programs and their average impacts on participants as well as racial/ethnic differences in outcomes.

A number of recent studies have used nationally representative data to determine what if any effects average preschool programs have on school readiness. Magnuson et al. (2004) use the Early Childhood Longitudinal Study and find that children who attend center based preschool

programs in the year prior to kindergarten have higher scores on reading and math skills at kindergarten entry than those who did not attend such programs. The study also found that the positive effect associated with center based preschool persisted to the end of 1st grade, and that preschool attendees were also less likely to be held back in kindergarten (Magnuson et al. 2004).

Various specific programs, such as state sponsored pre-kindergarten and Head Start, have also been found to have positive short term effects. For example, Magnuson et al (2007), find that pre-kindergarten programs are associated with better math and reading scores at the start of school and Gormley et al. (2008) use a regression discontinuity design and find that Oklahoma's universal pre-kindergarten program improves cognitive development. Head Start has also been found to lead to short term gains in educational achievement and success (Haskins 1989; Currie 2001; Barnett 1995). However, Magnuson et al (2004) in the paper cited above using ECLS-K data did not find significant effects of Head Start on cognitive skills, net of school and neighborhood characteristics, though there appeared to be a slight reduction in grade retention. Positive Head Start outcomes are observed in small-scale randomized experimental evaluations (Ludwig and Phillips 2008). Therefore, these experimental studies suffer from the same lack of generalizability as Perry and Abecedarian as far as sampled children and breadth of programs, but do not have the same issues in terms of the program not matching what most students are exposed to. On the other hand, studies which are observational, most of which use the ECLS-K, have generally failed to find positive effects of Head Start.

Further, Magnuson, Ruhm, and Waldfogel (2007) again using ECLS-K data, find Head Start to be uncorrelated with academic outcomes and positively associated with externalizing behavior, but state that "the uniquely disadvantaged nature of Head Start children makes it difficult to find a comparable control group." In fact, Magnuson, Ruhm, and Waldfogel (2007)

attempt to use propensity score matching but were unable to construct a valid comparison group using the ECLS-K. Since propensity score matches take into account background and family characteristics to assign scores, these methods attempt to compare children who attended the program with children with similar propensities to attend (i.e. similar background characteristics) who did not access the program. Magnuson, Ruhm, and Waldfogel's (2007) difficulty in using propensity score matching to identify a comparable control group should caution all researchers who attempt to use ECLS-K data to test the effectiveness of Head Start.

It is important to note that studies with better matched controls, such as those utilizing sibling analyses, find stronger and longer lasting effects of Head Start (Currie and Thomas 1995; Thomas and Currie 2001). On the other hand, scholars do worry that Head Start centers in general may suffer in terms of program quality because of low pay and low levels of provider education (Ripple et al., 1999; Zigler & Styfco, 1994), an alternative explanation as to why scholars have had difficulty finding Head Start effects when using the ECLS-K data source.[13]

Most of the claims of longer term effects of preschool come from research which relies on experimental studies of high quality programs, such as Perry/High Scope, or impact studies of Head Start. The Perry/High Scope model is difficult to scale up because of its cost and difficultly in maintaining fidelity of implementation across multiple sites (Rolnick 2014), while Head Start centers are found across the country but are known to be of lower quality. These studies tend to find that the cognitive gains fade over time, especially for Head Start (Haskins 1989; Currie et al 2002; Barnett 1995). Currie and Thomas (1995) point out that the fade out of the Head Start

[13] The assessment of the effects of Head Start specifically is not necessarily a goal of this study. Prior research has elucidated that ECLS-K is not a good source for a fair comparison of the Head Start population to non-exposed children. Instead, the impacts of more general preschool programs, which are generally unregulated by any central authority is of interest in this paper. However, not taking into account Head Start exposure, or analyzing all types of early childhood education as "preschool" would make invisible the important distinctions among programs. Therefore, while results for Head Start may be reported, these important limitations persist and will be discussed in the results section and the discussion.

effect in particular is likely due to differences in elementary school environments attended by those in the program and students who were not in Head Start. In Head Start recruitment, the most disadvantaged are often given priority. Therefore, even among the low-income population eligible for Head Start, the students who are selected to attend are likely to be even more disadvantaged and the most at risk. Head Start students are also more likely to enroll at worse schools than low-income non Head Start students (Currie & Thomas 1995). This may be especially problematic if all or nearly all low income children who have additional markers of disadvantage are recruited for the program, since the non-exposed group, even with controls, may still offer a poor comparison.

The supposed fade out of effects may actually be the result of poor instruction and learning during later schooling experiences. Even so, randomized experiments such as the Abecedarian Project preschools see the cognitive gains reduced, though not eliminated, over time (Barnett 1995; Currie 2001). As these studies used random assignment, the later school experiences of children should be roughly equal across the experimental and control groups, suggesting that the cognitive advantages of preschool may dissipate over time.

However, generalizing from such studies is still problematic, as these studies draw inferences about the long term effects of early childhood education from analysis of a socioeconomically and racially homogenous population (Magnuson, Ruhm, and Waldfogel 2007; Lowenstein 2011). The common thread between the experimental and Head Start studies is that these interventions served low-income and/or racial minority students exclusively (Garces, Thomas, and Currie 2002). Since scholars know that low income and minority children gain less from year to year, and attend worse school environments, perhaps any longer term effect of programs on cognitive skills is suppressed. Therefore, the current research literature contains a

large gap in understanding long term effects of average programs. To ameliorate this problem, the proposed study will examine longer term cognitive outcomes for a nationally representative sample of children.

The Role of Noncognitive Skills

Very few studies that find these medium and longer term outcomes have investigated the mechanisms by which these positive outcomes might operate. Recently, many researchers have emphasized the role that noncognitive skills may play (Heckman 2006; Heckman and Masterov 2007; Farkas 2003). Noncognitive skills are as of yet not agreed upon or clearly defined across the literature. In fact, in many cases the definition of "noncognitive skills" is found in the phrase itself: simply skills that are not cognitive, or more simply not test scores. Non-cognitive skills have been described with diverse language such as "personality traits, persistence, motivation" (Heckman, Stixrud, and Urzua 2006), "motivation, tenacity, trustworthiness, and persistence" (Heckman and Rubenstein 2001), or "agreeableness, extroversion, work orientation, emotionality, and helpfulness" (Bowles and Gintis 1976). A few studies have examined these issues in relation to preschool, but have tended to rely on the same high-quality, experimental programs that have influenced most of our knowledge about preschool (see for example: Reynolds, Temple, and Ou 2010). However, the term "noncognitive" has become a catch-all for everything besides cognitive test scores (Heckman and Rubenstein 2001; Farkas 2003), and often are conceptualized as either behaviors/skills, implying that they can be taught or trained, and traits, implying they are inherited or part of an individual's personality.

I conceptualize a particular subset of noncognitive skills as a type of cultural capital, which I call school capital (see Bourdieu 1984). Unlike many researchers who have approached

the study of non-cognitive skills from a psychological or economic perspective, I theorize that school capital (non-cognitive skills) are in fact not personal dispositions which are distributed across populations as an individual difference. Instead, school capital is a personal resource which is transferred to children and adolescents through socialization and interactions with their environment, such as interactions with parents, caretakers, other children, and preschool teachers. School capital and it associated behaviors are directly related to the capacity for executive function. Executive function is the individual's ability to deliberately control thought, action, and emotion (Zelazo and Carlson 2012). In fact, referring to these abilities as non-cognitive is incorrect, as they require memory, reasoning, and decision making and lie at the connections between brain structure and expressed behavior (Zelazo and Carlson 2012). In any case, the cognitive control of one's behavior, alternatively referred to as self-regulating, is central to meeting the demands of the schooling environment. Children in classrooms must suppress their natural impulses, pay attention to certain tasks with the presence of distracting stimuli, and remember rules and follow directions.

These behaviors are directly related to neural structures, namely the area of the prefrontal cortex (Blakemore and Choudhury 2006). Since a specific area of the brain is responsible for the cognitive control that allows for school capital behaviors (e.g. attention, rule following, delaying gratification) executive function is governed by sensitive periods of brain development. Multiple studies suggest that early childhood (before age 6 or 7) is when executive function increases most rapidly and represents the sensitive period for its development (McLellan and Cameron 2012). While the plasticity of the brain allows for growth in executive function after this sensitive period, brain structures are built early and any changes are most likely to work at the margins of these abilities (Thomas and Knowland 2009).

While the abilities associated with executive function, such as paying attention and following directions, are likely to aid in learning in and of themselves (Knudsen et al 2006), I argue that they also are rewarded by the institution of school and by teachers, because they act as a signal and smooth the transition to school. Global executive function across all domains of life is important; it is how college students decide to stay in and study instead of going out to a party, or how adults manage their ever growing to-do lists. However the behaviors expected at school (raising one's hand, waiting to get out of one's seat, sitting quietly for hours of the day), while governed by executive function and the frontal lobe, are not necessarily associated with greater cognitive skill or success. Instead, the serve to smooth the transition to school, lead to more positive interactions with teachers and institution of school, and ensure positive labeling of the student as a good learner. This in turn leads to more investment by teachers and more engagement by students. Therefore, it is important to distinguish global executive function or how child approaches day to day life, from the similar behaviors exhibited in the classroom. If global executive function is more influential, then it is likely these skills are simply allowing students to be more successful and retain learning more easily. However, if school specific behaviors and how a child is viewed by teachers are more important, then school capital, and the subsequent effect on school interaction and belonging, are indeed influential on later school outcomes.

Scholars have argued that the reason that cognitive advantages of early childhood programs fade out over time, while measurable and large social benefits remain, including greater educational attainment, is because the benefits of preschool come through the early introduction of noncognitive skills or "school capital," including self-regulation, task persistence, and motivation (Rolnick 2014). Such skills may also be instilled in the home, but the specific

ways in which they apply to school environments is likely to transfer the most easily in specific environments such as early childhood education classrooms. Children who enter the early grades with a disposition conducive to learning and who possess or display school capital when they arrive in school are known to experience faster development (Hart et al 2003) and are judged more highly by their teachers (Entwisle and Hayduk 1982; Entwisle et al. 1986).

For all this time, researchers have assumed that this faster growth and better outcomes are due to the children themselves learning more quickly and easily. But what if the reason that children with these skills experience faster development and are rated as better students by their teachers is an artifact of the child displaying the behaviors of skills of school capital, and that teachers and schools, not the child, determine the child's trajectory. A simple analogy would to sports: children of slightly varying abilities end up with large differences in later performance because of the investment of coaches who select those children who are most "coachable" or receptive to the coach's feedback. In this example, these children who are more "coachable" may perform better because of that coachability, but it is likely their success is due to the large investments on the part of the coach in that child's development. Similarly, teachers serve as gatekeepers to knowledge and content, and thus theoretically, through labeling children according to their "teachability" or school capital, could set children off on divergent trajectories. Further, if early childhood education is one way to accumulate the resource of school capital, it is likely that it is through this pathway that such educational experiences influence medium and long term outcomes for students.

An individual's environment is closely tied with ascriptive characteristics such as race, class, and gender. Therefore, school capital is likely to be differently transferred to children across these various groups. As a form of cultural capital, school capital can be used to signal to

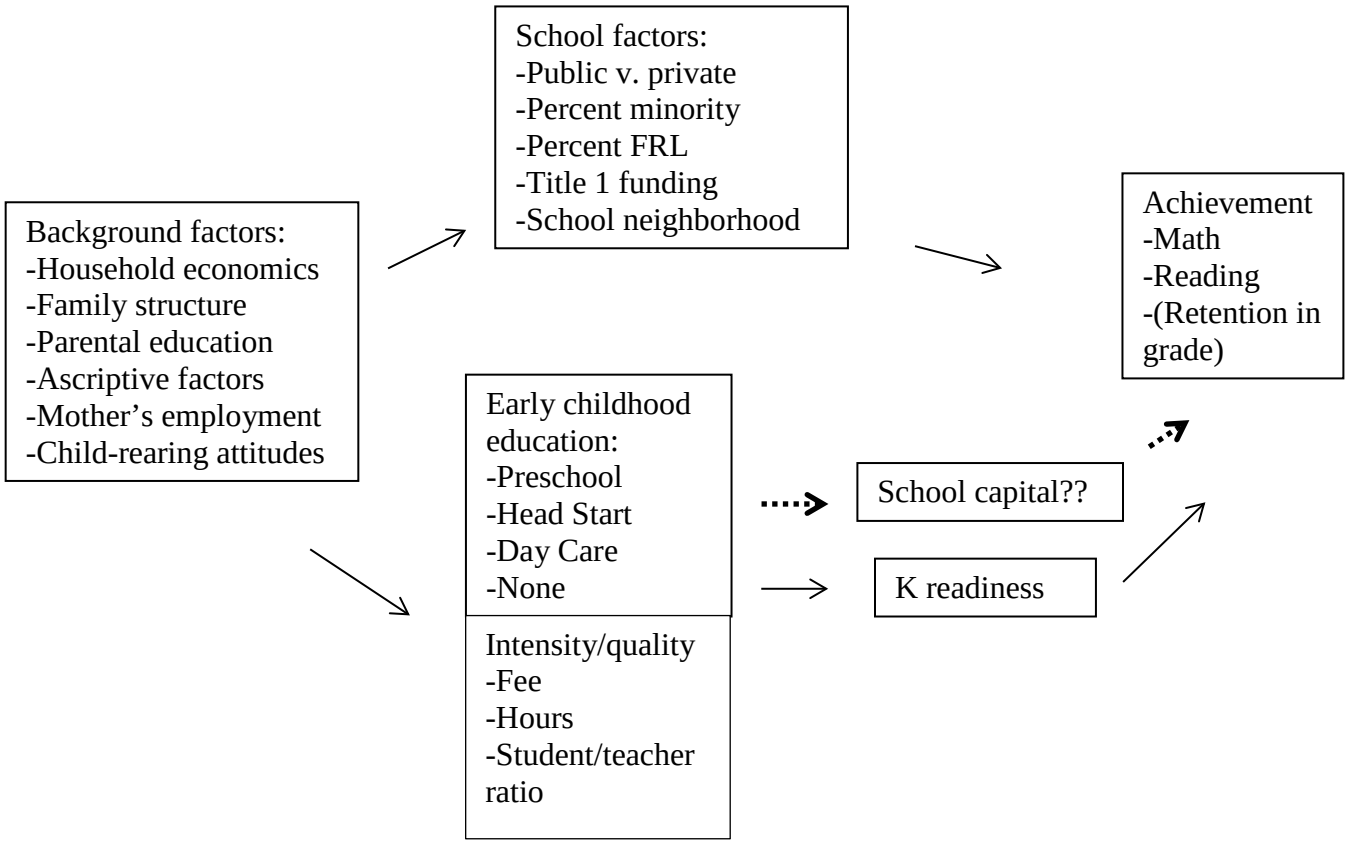
those of the dominant school culture that one "fits in." Children who show up in the early grades displaying school capital—they are able to sit still, pay attention, raise their hands—signal to their teachers and other school personnel that they are "good students" and are likely to receive positive responses from their teachers and more attention, leading to a positive feedback loop for those children possessing high levels of school capital. Therefore, in addition to early cognitive skills determining the success of the transition to school culture, cultural resources of school capital are also likely to determine the course of a child's education. In this conceptualization, school capital becomes a central factor in determining a child's later trajectory

The Current Study

With these gaps in the prior literature in mind, this chapter will examine medium-term effects—through 8th grade—of early childhood education. The effects that I have chosen for examination include better cognitive outcomes and lower rates of retention in grade (see Barnett and Belfield 2006; Haskins 1989; Barnett 1995). The conceptual model below represents my best thinking at this point about how early childhood education may influence academic achievement. In Chapter 3, I examined factors which predict the likelihood of enrollment into early childhood educational experiences. The background factors which prove to be important in determining enrollment include household economics, family structure, parental education (Leibowitz et al 1998; Fuller et al 1996), ascriptive factors (Liang et al 2000), mother's employment (Leibowitz et al 1998), and the parent' child-rearing attitudes (Liang et al 2000). These factors, whether through a conscious rational decision-making process, or alternatively through information flowing through social networks or even through unconscious class based decisions (Bourdieu 1984), lead to the sorting of children across types of early childhood education experiences.

I predict that these experiences will influence the academic achievement of children throughout their K-12 career, and I will test empirically whether this is the case. Studies of experimentally controlled, high quality preschool programs find both short term and long term positive effects (Haskins 1989; Currie et al 2002; Barnett 1995), but the data I use, the ECLS-K, allows me to look at the more typical experiences of early education children are exposed to.

Figure 4.1: Conceptual model of the academic achievement process, with the role of early childhood education and school capital theorized



Further, I will spend some time in this chapter determining, in the case positive effects are found, if they may be explained by a specific set of non-cognitive skills (Heckman 2006; Heckman and Masterov 2007; Farkas 2003) or as I call it school capital. I draw on theories of other types of capital, such as social and cultural, to make the argument that children may not benefit from early experiences due to the academic content offered by these experiences, but due to the transference of school capital, such as the ability to sit still and hold their attention, which in interactions with teachers leads to positive labeling of children as "good students" and may lead to a feedback loop of positive interactions between teacher and child. Children then begin to see themselves as fitting the archetype of good student, and their teachers believe the same. The development of school capital is governed by the growth of executive function, which governed by the prefrontal cortex, an area of the brain most malleable during early childhood (McClelland and Cameron 2012; Zelazo and Carlson 2012). Therefore, a child's ability to exhibit many of the behaviors demanded by school, including ignoring distraction and resisting impulses, is directly related to brain development during the preschool period. As such, understanding how preschool influences school capital is a natural and important pursuit. Further, distinguishing behaviors of "school capital" from more general executive function (e.g. self-regulation and self control) is important for understanding the mechanisms by which early learning influences later life outcomes.

To adequately assess whether there is any influence of early childhood education on academic achievement, I must take into account sorting selection of children into schools by family background and other characteristics. Prior studies have found that the fade out of Head Start effects may be partially explained by Head Start children attending worse elementary

schools (Lee and Loeb 1995). Thus, as the conceptual model illustrates, I take into account many school level factors which are likely to affect students' learning.

Data and measures

The Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K) is a nationally representative sample of more than 20,000 American children who entered kindergarten in 1998.[14] The ECLS-K is ideal for the current study because it is the most recent and representative sample of children in schools, it begins data collection during the start of formal schooling at kindergarten entry, and asks a number of the questions necessary to break early childhood center based care into its various types. The ECLS-K draws from approximately 1,000 schools, with an average of 20 students in each sampled school. Data collected include information from parents, teachers, and school administrators. For the current analysis, data are taken from five waves of the survey: fall of kindergarten, spring of first grade, spring of third grade, spring of fifth grade, and spring of eighth grade. Attrition leads to smaller sample sizes over time, as children progress through their education. Since attrition will disproportionately come from more disadvantaged children, the analysis in this chapter is likely to underestimate any gaps between disadvantaged and advantaged children. This may lead to biased results for Head Start especially, since children must meet a certain income level to qualify, but also for daycare and preschool, since these services are accessed by more advantaged children. To reduce the bias I include covariates which are likely to be correlated with attrition, including socioeconomic variables such as family income and parental education.

[14] The are a small number of students in the sample who were retained in kindergarten and thus were second-time kindergarteners. The results are not sensitive to including or deleting these cases. As of May 2011, 42 states and the District of Columbia required their school districts to offer kindergarten programs, and 15 states and the District of Columbia required children to attend kindergarten (see Digest of Education Statistics 2012, table 197).

A hierarchical design in this case is helpful to account for the sampling of children within schools and to allow for school level characteristics to be included in the model without bias. Since students in the same school may be similar to each other because of their exposure to the same school context, the observations within a school are likely to be correlated. Using a hierarchical design will account for this contextual similarity and more accurately reflect the effects of individual level covariates. Since children's learning is affected by the schools that they attend, controlling for school characteristics of interest is extremely important when trying to isolate the effects of early education.

Outcome Measures: The outcomes of interest in this analysis include cognitive scores in reading and mathematics and prior retention in grade. Children are tested on their achievement in reading and math at each wave of the study. The exams are adaptive and are scored on a vertical scale which covers all grades kindergarten to eighth. The children are only given a small number of items, and through a method called item response theory (IRT) a score is calculated based on a predictive model which estimates the child's score if they were to have seen all the items on the test. For more detailed information on item response theory (IRT) see the technical appendix. For this study, reading and math scores are taken from the fall kindergarten and springs of 1^{st}, 3^{rd}, 5^{th}, and 8^{th} grade. Retention in grade is measured at two points in time. The first measure is whether children were retained in kindergarten, and the second measure is weather the student was retained at any point between kindergarten and eighth grade.

Explanatory variables of interest: The main predictor of interest in this chapter is the type of early childhood education children were enrolled in the year prior to entering kindergarten, at age four. The parents of sampled children provided this information in the parent survey

administered during the fall of the kindergarten year. Early childhood education type is categorical and is divided into the following categories: no care, preschool, Head Start, and day care. Since early childhood education is categorical, it is included in all models as a series of dummy variables, with no care used as the reference category. In the year before kindergarten 31% of children were not in any regular care outside the home, 47% were primarily in preschool, 13% were primarily in Head Start, and 9% were primarily in day care.

The other predictor of interest is school capital, which I have defined as a personal resource which is transferred to children and adolescents through socialization and interactions with their environment, including interactions with peers, parents, and teachers. Specific school capital behaviors are associated with the components of executive function, which includes attentional flexibility, working memory, and impulse control (Zelazo and Carlson 2012, McClellan and Cameron 2012). These functions determine the ability of children to meet the demands of early schooling, including being able to ignore a distracting classmate, wait one's turn to speak, or complete a multi-step process, such as a worksheet assignment. Children with more school capital are hypothesized to develop more quickly and to be judged more highly by teachers, leading to positive feedback loops and cumulative advantage (Entwisle and Hayduk 1982; Hart et al 2003). School capital in this study is operationalized using teacher ratings of students' approaches to learning. Teachers rated students on a number of academic and nonacademic dimensions during the kindergarten year. The six questions reproduced below are used to calculate the approaches to learning subscale.

Figure 4.2: Teacher ratings of "approaches to learning" from the ECLS-K

11. Keeps belongings organized.
14. Shows eagerness to learn new things.
15. Works independently.
21. Easily adapts to changes in routine.
23. Persists in completing tasks.
24. Pays attention well.

The approaches to learning subscale aligns well with my conceptualization of school capital. First, the subscale score is based on ratings of specific behaviors and skills which are easily observed in a classroom setting. Being organized, eager, independent, adaptable, persistent, and attentive have all been components of the "noncognitive skills" advanced in the literature and are the sorts of behaviors that allow children to learn and progress in school. Second, the approaches to learning scale is a teacher rating scale, which again aligns closely with my conceptualization of school capital. In addition to the importance of these skills in and of themselves, I theorize that these behaviors also serve as a signal to teachers of the worthiness and preparedness of student. Teacher ratings of these behaviors, in lieu of an objective observer, are a good representation of manifested school capital.

In order to distinguish "school capital" from broader positive noncognitive dispositions and skills, I also use parent ratings of approaches to learning. Parents were also asked to rate their children on a number of attributes, and the six approaches to learning subscale items are reproduced below. Unfortunately, the items are different across the parent and teacher rating scales. However, there is a fair amount of conceptual overlap including task persistence, eagerness/interest in new things, and attentiveness. This scale is used to make distinctions between executive function behaviors/skills that children possess more generally (parent ratings)

and those specific behaviors that are included in school capital (teacher ratings). If parents ratings are just as influential or more influential on later outcomes, then self-regulation itself is likely to be influencing later outcomes of students. However, if the teacher ratings of children's approaches to learning are stronger predictors, that is evidence that teacher perception of students, mainly through exhibiting school capital behaviors, is more consequential for students' learning outcomes. In fact, these two scales, both measured during the fall of a child's kindergarten year, are only correlated at 0.22, a surprisingly low correlation for two scales which seem to be highly aligned conceptually. Therefore, its an empirical question if general executive functioning, represented by parent ratings, or school specific teacher perceptions of school capital, are more consequential for later learning, and whether either measure explains any identified effects of early learning experiences.

Figure 4.3: Parent ratings of "approaches to learning" from the ECLS-K

10. Keep working at something until {he/she} is finished?
13. Show interest in a variety of things?
15. Concentrate on a task and ignore distractions?
18. Help with chores?
22. Eager to learn new things?
24. Creative in work or in play?

Control variables: Household economics variables include household income and mother's employment while child was 0 to 5. Over 71% of children's mothers worked while they had preschool aged children, with about 4% missing on this item. The mean income is the sample is slightly over $53,000; however, the income variable contains a great amount of

missingness, at about 25%. Mother's education is also included as a family educational variable. Nearly 13% of mothers had less than a high school degree, about one-third had a high school degree, another third have attended some college, while about one-quarter have a college degree. Missingness in mother's education was minimal, at less than 1.5%.

Family structure is determined by presence of the father and by the availability of kincare. Nearly 20% of children have no father in the home as of fall of kindergarten year, with about 1% of cases being missing. Around 17% of families have access to family members for kin care, but this variable is highly missing, at 25%. Missingness on variables correlates strongly with disadvantaged statuses on other non-missing variables. To preserve cases I use multiple imputation, discussed below, to maintain the variability of the sample on other factors.

Racial and ethnic variables and language minority status are also controlled. Fourteen percent of the sample is black, 17 percent is Hispanic, 5 percent is Asian, and 58 percent is white.[15] Nearly one-quarter of the sample is of families whose primary language is not English. Child rearing and developmental attitudes are also controlled for in the analysis by the frequency of reading with children, the number of books in the home, and parental educational expectations for children. Nearly 20 percent rarely read books with their children, 35 percent read sometimes, and around 45 percent read every day. The average number of books in the home is about 75, with a range between 0 and 200. Three-quarters of parents expect their children to attain a bachelor's degree. Finally, regional variables are included. Nearly 19 percent of the sample live in the northeast, 32% live in the south, 23% live in the west, and 26% live in the Midwest. Thirty-eight percent live in the urban fringe, 22% live in small towns or rural areas, and 40% live in the central city. See Chapter 2 for basic descriptive statistics for the ECLS-K sample.

[15] Minorities were oversampled in the ECLSK.

In addition to these individual and family background variables two other types of control variables are included: those that have to do with development and those that have to do with the school environment. Differences in development can have a very large impact on cognitive outcomes, especially in early childhood. Therefore, without taking into account development, an assessment of cognitive outcomes in the early grades would be skewed. I control for the age in months of the child when he or she took the cognitive exam and the child's birth weight in ounces. Birth weight has been used as a proxy for prenatal development and in utero environment (for example Magnuson et al. 2004). Both of these measures should help control for individual differences in overall child development.

At the school level, I control for a number of school characteristics that may be correlated with the overall level of cognitive achievement at the school. While I use a varying intercept hierarchical modeling strategy to take into account school differences, I also desire to more explicitly control for school factors which are likely to be of interest. These characteristics include whether the school was public or private, the percent minority at the school, percent free or reduced priced lunch, whether the school received Title I funds, and characteristics of the city in which the school is located. Over 20% of children in the sample attend private schools. Nearly a quarter attend schools that are at least 75% minority, showing how schools continue to be highly segregated by race. On average, students attend schools where about 30% of students qualify for free or reduced price lunch. About half of students attend a school that receives Title I funds. Most children, over one in five, live in a small city.

In order to preserve cases, I use multiple imputation in Stata 13 to create twenty data sets, and combine these imputed datasets for all analyses.[5] Imputation is accomplished using the "ice" command in Stata, which uses chained equations to create imputed values, using values on non-

missing data to create a predicted imputed value. Using twenty data sets adds variability to the imputed value, as the values are not the same across the twenty sets.

Hypotheses

There have been a number of studies of the effects of early childhood education on children as they navigate K-12 schooling and even into adulthood. However, these studies have mostly examined model programs such as Perry/High Scope, or publically funded programs such as Head Start and state or city funded pre-kindergarten. While model programs such as Perry preschool have been found to be effective at creating short term gains in academic skills, the gains have been found to be reduced over time. Head Start is associated with short term cognitive gains (i.e. test score gains) that are completely washed out by the middle of elementary school.

However, social benefits from Head Start and other programs continue to be traced into adulthood. So while test score advantages may fade out, other advantages are still associated with attendance, including greater likelihood of graduating high school, less delinquency and teenage parenthood, and greater likelihood of being either in college or the workforce in adulthood. While these social benefits are seen for Head Start and model programs, it is unclear if general programs see the same benefits.

This chapter will examine the effects of the various preschool options children are actually participating in. Using the ECLS kindergarten cohort, a nationally representative sample of children in kindergarten in 1998, this study is able to find effects of the programs that children are exposed to in the preschool market, which more often than not do not resemble model or publically funded programs.

I predict that:

1. Students involved in preschool, controlling for selection, will maintain an advantage throughout elementary and middle school. This includes a cognitive advantage and less likelihood of retention. Studies of high quality preschool have found such effects to continue over time, but this may not be the case for the more varied programs average children attend when parents select preschool from the marketplace.
2. Students involved in Head Start, controlling for selection, will have a slight advantage at kindergarten, but will lose that advantage over time. This hypothesis is based on the longitudinal studies of Head Start, which find the elimination of any cognitive benefits of Head Start by 1st grade. However, Head Start students may still have advantages in regards to retention in grade.
3. Students involved in daycare, controlling for selection, will have no academic or retention advantage.
4. Students in preschool and Head Start will also see advantages in noncognitive skills and pro-social behavior. No such advantage is predicted for day care. These noncognitive advantages, which I term school capital, will at least partially explain the effect of early intervention on later school based achievement.
5. Measures of quality will explain the differences in effects between preschool and Head Start.

Analysis and results

Tables 4.1 and 4. 2 are hierarchical linear models with test score (in points scored) across grade levels as the outcome measure. Table 1 displays reading scores and table 2 displays math

scores. The first section of each table shows the bivariate relationship, without any controls in the model. Without any controls, preschool and daycare have a strong positive effect on both reading and math, while Head Start has a strong negative effect. These effects are apparent at the fall of kindergarten and remain substantial and significant in every grade level. In fact, without controls for family background and school characteristics, it appears that the relationship grows in size over time. However, as the previous Chapter 3 made clear, selection into types of early childhood care is not random, and many factors beyond early childhood experiences are likely to influence the cognitive outcomes that are examined in these tables.

Therefore, the second section of each table reports the coefficients for early childhood education once background factors as illustrated in the conceptual model, as well as school level factors, are controlled for. The growth of the effects over time found in the bivariate model is completely accounted for by the control factors added to the models. In fact, in these fully controlled models the effect of day care and preschool grows smaller over time, with the daycare effect completely dissipating by 1st grade and the preschool effect growing slightly smaller by 8th grade. All control variables are in the expected direction with income, education, and positive parenting attitudes and practices all positively associated with cognitive outcomes.

Table 4.1:Reading achievement K-8 by early childhood education type

Bivariate Relationship	K Fall			1st Spring			3rd Spring			5th Spring			8th Spring		
	Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE	
Preschool	3.61	0.18	***	6.52	0.44	***	8.42	0.54	***	8.48	0.57	***	6.94	0.66	***
Head Start	-1.59	0.30	***	-5.36	0.73	***	-7.13	0.90	***	-6.90	0.95	***	-9.30	1.13	***
Day Care	1.92	0.28	***	2.55	0.71	***	4.80	0.88	***	4.95	0.94	***	2.83	1.05	**
Reference is no care															
Number of observations	15,948			13,844			12,101			9,597			7,935		

Relationship net of controls	K Fall			1st Spring			3rd Spring			5th Spring			8th Spring		
	Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE	
Preschool	1.81	0.18	***	2.41	0.44	***	2.46	0.53	***	2.50	0.55	***	1.30	0.64	*
Head Start	-0.27	0.28		-1.69	0.70	*	-1.92	0.84	*	-1.62	0.88		-2.91	1.05	**
Day Care	1.05	0.27	***	0.37	0.69		1.09	0.84		0.58	0.89		-0.59	1.00	
Reference is no care															
Number of observations	15,948			13,844			12,101			9,597			7,935		

Controls: Child age at testing period, child birth weight, household income, mother's education, mother's employment, family structure, race/ethnicity, home language, number of siblings, parent child-rearing behaviors, region, urbanicity, and school variables: % FRL, % minority, private.

Table 4.2: Math achievement K-8 by early childhood education type

Bivariate Relationship	K Fall			1st Spring			3rd Spring			5th Spring			8th Spring		
	Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE	
Preschool	3.12	0.15	***	5.11	0.33	***	7.74	0.49	***	7.31	0.55	***	5.85	0.53	***
Head Start	-1.42	0.25	***	-4.31	0.54	***	-6.22	0.80	***	-8.44	0.90	***	-8.31	0.90	***
Day Care	1.82	0.24	***	2.49	0.54	***	4.40	0.79	***	3.99	0.89	***	2.96	0.85	**
Reference is no care															
Number of observations	16,831			14,078			12,176			9,606			7,986		

Relationship net of controls	K Fall			1st Spring			3rd Spring			5th Spring			8th Spring		
	Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE	
Preschool	1.40	0.14	***	1.81	0.33	***	2.87	0.47	***	2.37	0.53	***	1.48	0.52	**
Head Start	-0.06	0.23		-1.09	0.52	*	-1.22	0.75		-2.82	0.85	**	-2.81	0.85	**
Day Care	1.01	0.23	***	0.78	0.52		1.77	0.75	*	0.78	0.85		0.44	0.81	
Reference is no care															
Number of observations	16,831			14,078			12,176			9,606			7,986		

Controls: Child age at testing period, child birth weight, household income, mother's education, mother's employment, family structure, race/ethnicity, home language, number of siblings, parent child-rearing behaviors, region, urbanicity, and school variables: % FRL, % minority, private.

As hypothesized, preschool attendees have a cognitive advantage in both math and reading understanding at the start of kindergarten. In both cases, this advantage grows over time until 5th grade, relative to similar kids in similar schools with no preschool experience. By the end of 8th grade, preschool attendees still maintain a statistically significant advantage in both math and reading. However, contrary to my hypothesis, Head Start children enter kindergarten with no advantage (nor disadvantage) relative to children with no care. Further, a significant negative effect of Head Start is found starting in 1st grade, and only expands by 8th grade. Daycare follows the pattern I expected from Head Start: a slight advantage that fades out over time. These relationships are found even when parenting behaviors, family background, and school variables, which predict both academic achievement and early childhood education, added to the models.

Magnuson, Ruhm, and Waldfogel (2007) point out that it may be difficult to find an appropriate comparison group for children who enroll in Head Start in the ECLS-K sample. Therefore, the negative effect of Head Start may simply be due to looking for an effect across all income levels, when Head Start is generally available to very disadvantaged children (and to children with special needs who do not income qualify). To try to ameliorate this concern, I try to adjust the comparison group in a number of ways. First, in Table 4.3 I examine the effect of Head Start (and other ECE) only for those families who reported a use of WIC benefits, controlling for family and school factors outlined in my conceptual model. Again, I find no effect of Head Start in the fall of kindergarten year. However, unlike the previous analysis, the gap does not appear to grow over time, except for the significant negative gap in the end of 1st grade. Compared to other children whose mother's qualified for WIC benefits, those that attend Head Start have no discernable benefit. Additionally, those that attend preschool appear to have a

small long lasting cognitive benefit but it fades out by 8th grade. Due to the nature of the ECLS-K sample, it is to be expected that effects of Head Start may be difficult to find.

Table 4.3: Reading Scores by ECE Type For Mothers Who Used WIC

	Fall K			Spring 1st			Spring 3rd		Spring 5th			Spring 8th	
	Coef	Std Err		Coef	Std Err		Coef	Std Err	Coef	Std Err		Coef	Std Err
Preschool	1.57	0.20	***	1.47	0.63	*	1.14	0.87	2.44	0.97	*	0.37	1.24
Head Start	-0.26	0.23		-1.88	0.74	*	-1.87	1.02	-1.05	1.12		-2.63	1.44
Day Care	0.83	0.29	**	0.12	0.94		0.15	1.31	1.17	1.51		-1.20	1.84

I also limited the sample based on kindergarten income to attempt to find a fair matched comparison groups. I divided the sample into 100% of the poverty line or below, 100% to 130% of the poverty line, 130% to 150% of the poverty line, 150% to 200% of the poverty line, and 200% or above. Again I found no effect of Head Start, and the standard errors for the effect of Head Start became very large, due to decreased sample size. Further, the direction of the effects were not consistently positive, as one might expect. However, considering that Magnuson, Ruhm, and Waldfogel (2007) were unable to identify a comparison group using even propensity score matching, I believe this is simply due to a lack of a sizable and comparable group of disadvantaged students not exposed to the program available in the ECLS-K.

Does school quality play a role in the effects?

To assess whether school quality may partially explain differences in effects of early childhood education experience, I ran the following models: (1) ECE effects with all controls in the model except school characteristics and (2) ECE effects with all controls including school characteristics. Reported here are just the results for reading achievement, but math achievement does not differ in any significant way.

Prior research has suggested that for Head Start in particular, the fade out effect may be due to children in Head Start attending entirely different schools that children who did not attend, even among the low income population. In Table 4.4, I do see that controlling for the school characteristics reduces both the positive effects of preschool, and the increasingly negative effects of Head Start. However, it does not completely eliminate either of these effects. This does suggest that children in preschool and children in Head Start attend qualitatively different schools from similar peers who did not participate in early childhood education.

Table 4.4: Effects of ECE with and without controls for school quality

Relationship without school quality controls (but with all other covariates in the model)

	K Fall			1st Spring			5th Spring			8th Spring		
	Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE	
Preschool	1.85	0.18	***	2.47	0.44	***	2.60	0.55	***	1.72	0.64	**
Head Start	-0.35	0.28		-1.86	0.70	**	-1.94	0.88	*	-3.75	1.06	***
Day Care	1.08	0.27	***	0.41	0.69		0.57	0.89		-0.47	1.01	
Reference is no care												
Number of observations	15,948			13,844			9,597			7,935		

Relationship with school quality and controls (and all other covariates)

	K Fall			1st Spring			5th Spring			8th Spring		
	Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE	
Preschool	1.81	0.18	***	2.41	0.44	***	2.50	0.55	***	1.30	0.64	*
Head Start	-0.27	0.28		-1.69	0.70	*	-1.62	0.88		-2.91	1.05	**
Day Care	1.05	0.27	***	0.37	0.69		0.58	0.89		-0.59	1.00	
Reference is no care												
Number of observations	15,948			13,844			9,597			7,935		

Does "school capital" explain the preschool effect?

To examine whether school capital explains some of the patterns I see across early learning type, I use the same prediction equation for 8th grade reading and math achievement, this time adding the student's kindergarten teacher's rating of their "approaches to learning" which includes observations of behaviors like sitting still, controlling emotions, and paying attention. The approaches to learning variable offers the best proxy of my concept of school capital. School capital are those behaviors demanded by school which signal to teachers, even early in a child's educational career, that they are worthy of time and investment. These behaviors are theorized to lead to positive labeling by teacher and positive feedback loops whereby children are more likely to identify themselves as capable students and to remain engaged with school. Further, this positive reinforcement also leads to differential attention and investment by teachers and to a students continued development of these skills and behaviors throughout their lives. By this process, early assessments by teachers are theorized to ease the transition to school, allow children to feel they belong at school, ensure positive feedback from teachers and other school adults, and continue to increase these behaviors in students, leading to better educational outcomes years later, in this case in 8th grade.

Results from these hierarchical linear models are found in Table 4.5. Model 1 and Model 3 reproduce the findings for 8th grade found in Table 1 and 2 respectively. These models do not control for approaches to learning. Model 2 and Model 4 control for approaches to learning rating made by the kindergarten teacher In Models 2 and 4, the coefficients for preschool are cut almost in half and are no longer significant. The Head Start coefficients are reduced as well, but remain large and significant, even with approaches to learning controlled. Finally, daycare's coefficients appear unaffected by the inclusion of approaches to learning. It appears that a

teacher's perception of a kindergartener being a good learner can predict achievement 7 years later in eighth grade. Further, part of the positive long term effect of preschool functions in just this way: children who have exposure to a early school environment at age 4 gain school capital, and are likely to use that capital both to learn more in their schooling experience and be perceived as "good students" by teachers, and the benefits of this labeling has consequences years into the future.

Since these models control for family and school factors, as well as parenting attitudes and behaviors, the evidence indicates that it is not family differences in school preparation, which is controlled for, but because of the teacher ratings of school capital. While it is unclear if school capital is leading to positive effects on cognitive scores through allowing students to attain academic skills faster, or through positive labeling and interactions with teachers, what is clear is that school capital is highly associated with participation in preschool, net of background and school characteristics, and that positive effects of preschool are completely explained by the ECLS measure of school capital.

Table 4.5: 8th grade math achievement with school capital controlled

	Reading Scores						Math Scores					
	Model 1			Model 2			Model 3			Model 4		
	Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.	
Preschool	1.30	0.64	*	0.62	0.62		1.48	0.52	**	0.81	0.50	
Head Start	-2.91	1.05	**	-2.29	1.05	*	-2.81	0.85	**	-2.22	0.84	**
Day Care	-0.59	1.00		-0.25	0.97		0.44	0.81		0.84	0.77	
Reference is no care												
Number of observations	7,935			7,935			7,986			7,986		

To lend support to the idea that teacher assessment is a key feature of the impact of school capital, I run the same analysis using parent's ratings of approaches to learning, instead of those obtained from teachers. While the items do not overlap completely many of them do including "eagerness to learn new things" and "persists in completing tasks"/"works at something until he/he is finished." Table 4.6 displays these results, and compares them to results with teachers ratings included, and without school capital. The parent ratings are significant predictors of later math and reading achievement. However, this addition does not attenuate the effect of preschool. Parent ratings of their children's behaviors and dispositions in the home are significant predictors of children's reading and mathematics achievement, but they are not associated with preschool and thus do not explain the preschool effect. This is in direct contrast to the model using teacher ratings of approaches to learning, or what I am conceptualizing as school capital. Further, teacher's assessments of school capital are correlated with a child having attended preschool and can thus completely explain the preschool effect on reading and mathematics achievement in 8th grade. Kindergarten teachers' assessments of a child's school capital entirely explain the preschool benefit at 8th grade.

This finding is conceptually important, because it points out the uniqueness of school capital and the importance of teacher student interaction. Parents are likely to know their children's dispositions, personalities, and habit more intimately than a kindergarten teacher. However, it is teacher's assessments that both lead to better model fit when predicting 8th grade scores, and which explain the impact of preschool. This could mean a number of things about school capital and its place as a mechanism through which early learning operates. First, as I argued in the literature review in Chapter 1, school capital refers to those behaviors and dispositions that have bearing on school performance in particular. While a child may persist on

a task under the watchful eye of mom or dad at home, the same may not be true of his or her response in a school situation. Capital is context dependent and it is school capital which matters in educational settings. Second, teacher ratings are important and conceptually this fits with my theorization of school capital. School capital determines how a teacher views a student as early as kindergarten, so teacher ratings can be used as a fair proxy for embodied school capital, or school capital that has been exchanged for favor with teachers and other adults. While these skills and dispositions may also accelerate a student's pace of learning, it is essential not to discount the possible impacts of teacher labeling on students. In a K-12 setting, teachers are the keepers of knowledge and can decide who is worthy of investment and who may be a lost cause or troublemaker. Even if the exact pathway through which school capital impacts later outcomes is left unanswered in this analysis, the identification of such a possibility in and of itself is an advance for the field and offers a number of interesting directions for further study which will be discussed in the conclusion of this chapter.

Table 4.6: Kindergarten and 8th grade math achievement with school capital controlled, compared with parent ratings

	Reading Scores								
Reading	No rating			Teacher rating			Parent rating		
	Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.	
Preschool	1.31	0.64	*	0.64	0.62		1.31	0.64	*
Head Start	-2.93	1.06	**	-2.31	1.05	*	-2.91	1.08	
Day Care	-0.59	1.00		-0.24	0.97		-0.35	1.00	
Reference is no care									
Number of observations	7,935			7,935			7,935		

	Math Scores								
Mathematics	No rating			Teacher rating			Parent rating		
	Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.	
Preschool	1.48	0.52	**	0.81	0.5		1.44	0.51	**
Head Start	-2.85	0.86	**	-2.25	0.84	**	-2.82	0.88	**
Day Care	0.44	0.81		0.84	0.78		0.65	0.81	
Reference is no care									
Number of observations	7,986			7,986			7,986		

To investigate further the influence of global executive function in contrast to embodied school capital, I add both teacher and parent ratings from the fall of a child's kindergarten year to the model predicting math and reading test scores in Table 4.7. As before, the preschool effect is completely explained with both controls in the model. As suspected, both teacher and parent ratings are significantly related to the outcome, 8th grade test scores, even net of each other. However, it is the kindergarten teacher's rating that has the effect which is largest in magnitude. For every increase of one point on the 4 point approaches to learning scale, test scores increase between 9 and 10 points net of controls for teacher ratings, and slightly over 2 points net of controls for parent ratings. With evidence from the two previous tables indicating that the effect of preschool is mediated only when teacher ratings are included, there is strong evidence that preschool's long term effects on test scores may operate through increasing school capital and

improving teacher assessments of children's "teachability." Parent ratings represent global executive function, or the ability to self-regulate. With parent ratings controlled the teacher ratings (net of these parent ratings) capture school capital or school related behaviors associated with the ability to self-regulate including ignoring distractions and waiting one's turn. The covariate measuring these behaviors, with global executive function controlled, has both the largest effect on 8th grade test scores, it also is the measure that mediates the relationship between preschool and 8th grade outcomes.

Table 4.7: Reading and Math Scores with Teacher and Parent Ratings Controlled

	8th Grade Reading			8th Grade Math		
	Coef.	SE		Coef.	SE	
Preschool	0.63	0.62		0.82	0.49	
Head Start	-1.99	1.06		-1.97	0.85	**
Day Care	-0.22	0.97		0.87	0.77	
Reference is home care						
Teacher rating	9.95	0.42	***	9.39	0.34	***
Parent rating	2.07	0.43	***	2.10	0.34	***

Retention in grade

While other studies have found that cognitive effects of various early childhood interventions may fade out over time, other benefits, including a reduced likelihood of retention in grade are often found. In this analysis, I use a multi-level logistic regression to uncover whether the probability of being retained during the kindergarten year and anytime before 8th grade is predicted by enrollment in early childhood education.

Table 4.8 displays the results of this analysis. Preschool significantly reduces the log-odds of retention during the kindergarten year, while neither Head Start nor daycare are related to retention. When examining any retention kindergarten through eighth grade, for the smaller

sample which remained in the study until 8th grade, preschool has a significant negative effect on the log-odds of retention. However, Head Start appears to be associated with a slightly greater likelihood of retention as compared to the no care group and a much greater likelihood of retention as compared to the preschool attending group. Again, as with the cognitive/academic test score analysis, it is difficult to trust these results due to the lack of a good control group for Head Start attendees in the ECLS-K sample.

Table 4.8: Effect of early childhood education on the log-odds of retention

	In Kindergarten			By 8th Grade		
	Coef.	St. Err.		Coef.	St. Err.	
Preschool	-0.28	0.09	**	-0.34	0.10	**
Head Start	0.12	0.15		0.29	0.13	*
Day Care	-0.10	0.11		-0.08	0.16	
Reference is no care						
Number of observations	13920			8348		

Which preschool types are associated with positive outcomes?

Preschool quality and intensity are likely to be associated with academic outcomes. There are very few indicators in the ECLS-K data of quality and intensity, a major limitation for the dataset and for this study. However, two variables are available that can serve as a proxy for each. The ECLS-K asks parents if their child attended a program that required a fee, whether or not the parent themselves paid for it. Preschools which charge a fee are likely to be of higher quality than those that do not. The ECLS-K also asks parents to report on how many hours per week their child attended preschool. This variable serves as a good indicator of the intensity of preschool for children. Table 4.9 displays the distribution of ECLS-K children across the categories.

Table 4.9: Percent of preschool attendees across quality and intensity measures

	Percent
Fee	80%
No Fee	20%
Less than 20 hours	61%
20 to less than 40 hours	24%
40 hours or more	15%
Fee - Less than 20 hours	50%
Fee - 20 to less than 40 hours	16%
Fee - 40 hours or more	13%
No Fee - Less than 20 hours	11%
No Fee - 20 to less than 40 hours	8%
No fee - 40 hours or more	2%

Table 4.10 displays hierarchical regressions with the same individual, background, and school level variables controlled. The models predict reading achievement. The difference from the earlier models is that I categorize preschool into those that charge a fee and those that do not. Both types of preschools are associated with higher reading achievement. However, those that

charge a fee have a much larger effect than those that do not. Children who attended a no fee preschool have about half a point advantage over children who attend no preschool, while children who attended a fee charging preschool have an advantage of over two points compared to children who did not attend any preschool. The fee preschool attendees continue to enjoy a substantial advantage on their reading achievement relative to their peers who had no exposure to early childhood education, while the free preschool attendees have no advantage after the kindergarten year.

Table 4.11 displays the same hierarchical regressions but this time predicting math achievement. Unlike with reading achievement, only those children who attended a preschool program that charged a fee show increased math achievement. Kindergarteners with experience in preschools that charge a fee enjoy a 1.8 point advantage. They continue to maintain their math advantage through eighth grade. The children who attended no fee preschool show no math advantage at kindergarten, and continue to show no advantage throughout elementary and middle school.

Tables 4.12 and 4.13 display regressions examining preschool intensity's impact on reading and math achievement, respectively. As before, the tables report the regression coefficients for distinct intensity levels of preschool—fewer than 20 hours, 20 to less than 40 hours, and 40 hours and above—with individual, family, and school level controls in place. For both reading and math, in the fall of kindergarten, all intensity levels are associated with better achievement outcomes than comparable children who did not attend any program. Also, there is no statistically significant difference between levels. However, by the end of 1st grade the positive impact of 40 hours and over on reading achievement is no longer significant, and by the end of 5th grade the impact on math achievement is also no longer significant. In fact, by the end

of 8th grade, only children who attended preschool less than 20 hours a week enjoy a test score advantage in both reading and math. The positive impact on reading and math achievement for the middle category, 20 to less than 40 hours, continues through 5th grade, but fades out by 8th grade.

Tables 4.14 and 4.15 combine the two categorizations into a typology. The categories of the typology include low, medium, and high intensity fee charging programs and low, medium, and high intensity programs without a fee. This analysis reveals that it is the low and medium intensity preschools that charge a fee which have long lasting effects. Fee charging preschools with longer hours are not associated with long term benefits relative to no early childhood care. Further, for preschools that do not charge a fee intensity does not seem to matter, since all fee-free preschools do not have long lasting effects relative to no care.

Clearly quality and intensity matter for achievement outcomes. Attending a preschool center that charged a fee, whether the fee was paid by the parent or someone else (e.g. voucher or subsidy) is associated with higher reading and math test scores at kindergarten entry, and with a continued test score advantage through 8th grade. However, programs without fees do not offer such cognitive benefits. Further, it appears that low intensity preschool, of fewer than 20 hours per week, is associated with longer lasting positive outcomes. When intensity and quality are combined, it becomes clear that high quality (fee charging) programs are the preschools which are leading to positive effects, but this is only when the programs are of low or moderate intensity.

Table 4.10: Preschool type (fee versus no fee) and reading achievement

	K Fall			1st Spring			3rd Spring			5th Spring			8th Spring		
	Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.	
Preschool – Fee	2.24	0.19	***	3.50	0.48	***	3.91	0.58	***	3.69	0.61	***	2.45	0.69	***
Preschool - No Fee	0.58	0.28	*	-0.39	0.69		-1.20	0.82		-0.56	0.86		-1.94	1.01	
Head Start	-0.37	0.28		-1.93	0.70	**	-2.24	0.84	**	-1.90	0.88	*	-3.24	1.06	**
Day Care	1.11	0.27	***	0.54	0.69		1.34	0.84		0.81	0.89		-0.38	1.00	
Reference is no care															
Number of observations	15,948			13,844			12,101			9,597			7,935		

Table 4.11: Preschool type (fee versus no fee) and math achievement

	K Fall			1st Spring			3rd Spring			5th Spring			8th Spring		
	Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.	
Preschool – Fee	1.82	0.16	***	2.74	0.36	***	4.07	0.52	***	3.21	0.58	***	2.20	0.56	***
Preschool - No Fee	0.35	0.22		-0.51	0.51		-0.18	0.73		0.17	0.83		-0.59	0.82	
Head Start	-0.14	0.23		-1.28	0.52	*	-1.48	0.75	*	-3.01	0.85	***	-3.01	0.86	***
Day Care	1.08	0.23	***	0.93	0.52		1.97	0.75	**	0.94	0.85		0.57	0.81	
Reference is no care															
Number of observations	16,831			14,078			12,176			9,606			7,986		

Table 4.12: Preschool intensity and reading achievement

	K Fall			1st Spring			3rd Spring			5th Spring			8th Spring		
	Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.	
Less than 20 hours	1.80	0.20	***	2.78	0.49	***	2.79	0.58	***	2.82	0.61	***	1.48	0.70	*
20 to less than 40 hours	1.82	0.26	***	2.01	0.66	***	2.18	0.80	**	1.71	0.84	*	1.16	0.97	
40 hours or more	1.90	0.31	***	1.55	0.80		1.43	0.96		2.28	1.03	*	0.87	1.20	
Head Start	-0.27	0.28		-1.72	0.70	*	-1.95	0.84	*	-1.63	0.88		-2.92	1.06	**
Day Care	1.06	0.27	***	0.34	0.69		1.06	0.84		0.56	0.89		-0.59	1.00	

Reference is no care

Table 4.13: Preschool intensity and math achievement

	K Fall			1st Spring			3rd Spring			5th Spring			8th Spring		
	Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.	
Less than 20 hours	1.39	0.16	***	1.91	0.37	***	2.99	0.52	***	2.57	0.58	***	1.53	0.56	**
20 to less than 40 hours	1.48	0.21	***	1.23	0.49	*	2.82	0.71	***	2.11	0.81	**	1.23	0.79	
40 hours or more	1.35	0.26	***	2.40	0.60	***	2.60	0.86	**	1.92	0.99		1.61	0.97	
Head Start	-0.06	0.23		-1.10	0.52	*	-1.24	0.75		-2.82	0.85	**	-2.82	0.85	**
Day Care	1.01	0.23	***	0.79	0.52		1.76	0.75	*	0.77	0.85		0.44	0.81	

Reference is no care

Table 4.14: Preschool intensity and quality and reading achievement

	K Fall			1st Spring			3rd Spring			5th Spring			8th Spring		
	Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.	
Fee - Less than 20 hours	2.17	0.22	***	4.03	0.54	***	4.41	0.64	***	4.07	0.67	***	2.76	0.75	***
Fee - 20 to less than 40 hours	2.53	0.30	***	3.09	0.77	***	3.88	0.93	***	3.26	0.99	***	2.39	1.13	*
Fee - 40 hours or more	2.15	0.32	***	2.05	0.84	*	2.23	1.00	*	2.85	1.08	**	1.60	1.25	
No Fee - Less than 20 hours	0.73	0.36	*	-0.98	0.86		-1.71	1.01		-0.60	1.07		-2.44	1.24	*
No Fee - 20 to less than 40 hours	0.41	0.43		0.59	1.06		-0.35	1.29		-0.67	1.37		-0.72	1.62	
No fee - 40 hours or more	0.52	0.90		-0.31	2.21		-2.35	2.79		0.17	2.96		-3.02	3.62	

Table 4.15: Preschool intensity and quality and math achievement

	K Fall			K Spring			3rd Spring			5th Spring			8th Spring		
	Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.	
Fee - Less than 20 hours	1.796	0.179	***	2.18	0.24	***	4.27	0.57	***	3.42	0.64	***	2.29	0.61	***
Fee - 20 to less than 40 hours	2.076	0.253	***	2.39	0.34	***	4.34	0.84	***	3.53	0.95	***	2.08	0.92	*
Fee - 40 hours or more	1.477	0.267	***	1.92	0.36	***	3.32	0.90	***	2.45	1.03	*	1.85	1.02	
No Fee - Less than 20 hours	0.211	0.282		-0.01	0.38		-0.46	0.91		0.49	1.03		-1.10	1.01	
No Fee - 20 to less than 40 hours	0.420	0.343		0.23	0.47		0.48	1.16		-0.25	1.31		-0.24	1.30	
No fee - 40 hours or more	1.182	0.716		1.01	0.99		-0.94	2.51		-0.24	2.83		1.10	2.94	

Who Benefits the Most from Preschool?

According to this study, the quality and intensity of preschool has much to do with the positive outcomes children enjoy. This section examines a different but related question: what types of children appear to benefit more (or less) from their experiences in early childhood education? Holding the programs constant, some children may find greater benefits from their participation.

To explore this question, I interact preschool participation across two important ascriptive characteristics: race/ethnicity and social class. Racial ethnic categories include white, black, Hispanic, Asian, Native Hawaiian and Pacific Islander, American Indian and Alaska Native, and children of more than one race. As a proxy for social class, I use mother's level of education which was ascertained in the kindergarten year.

Table 4.16 displays results of the interactions across the racial/ethnic categories of the ECLS-K. Due to small cell sizes Native Hawaiian and Pacific Islander, American Indian and Alaska Native, and children from more than one race are combined into the other race category. Unfortunately, the "other" coefficient becomes difficult to interpret, since it collapses so many distinct groups into one category. However, models (not shown here) run with complete list of race categories showed inflated standard errors, evidence that the cell sizes were too small for accurate estimates. The first two columns examine reading in the fall of kindergarten and then the spring of 5^{th} grade, the third and fourth columns examine math in kindergarten and 5^{th} grade, and the final columns examine retention in kindergarten and any time before entering 8^{th} grade. In kindergarten, the effect of preschool for white children (the coefficient for preschool) is positive for both math and reading (column 1 and 3) and on retention is significantly negative (column 5). Further, in kindergarten Asian students benefit considerably more from preschool

than students of other races, at least for reading test scores. Besides the considerable kindergarten advantage for Asian students in reading, children from all races benefit equally from preschool in kindergarten, as exhibited in the non-significant interaction effects. Interestingly, the decreased retention effect in kindergarten of preschool is not found for children from Asian or Hispanic backgrounds. By 5th grade, the positive effect of preschool on math and reading achievement is similar across all races. As for retention before 8th grade, children from all racial/ethnic backgrounds benefit equally from attendance at preschool.

Table 4.17 displays the results of the interaction analysis across levels of mother's education. Children who have mothers who have a college degree (the reference group) gain the biggest cognitive benefits (reading and math test scores) from preschool attendance during kindergarten. The interaction effects for all other class groups when predicting math and reading achievement in kindergarten are negative, meaning that children with mothers who have less than a college degree benefit to a lesser extent than those whose mothers are college graduates. Preschool experiences appear to increase the achievement of already advantaged children more than the achievement of less advantaged children. This may be because children of better educated mothers are more likely to access higher quality experiences when choosing preschool in an open marketplace. However, the retention benefit appears to be constant across levels of mother's education.

Table 4.16: Preschool by race interaction effects

	Reading						Math						Retention					
	K Fall			5th Spring			K Fall			5th Spring			Kindergarten			By 8th Grade		
	Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.		Coef.	St. Err.	
Preschool	1.55	0.21	***	2.12	0.67	**	1.37	0.17	***	1.31	0.64	*	-0.47	0.11	***	-0.36	0.12	**
Black X Preschool	0.55	0.45		-0.12	1.64		-0.02	0.37		3.37	1.57	*	0.14	0.23		-0.11	0.27	
Hispanic X Preschool	0.04	0.46		0.99	1.28		-0.08	0.34		1.74	1.23		0.64	0.20	**	-0.01	0.25	
Asian X Preschool	2.82	0.71	***	1.68	1.97		0.72	0.59		2.80	1.89		1.20	0.40	**	0.62	0.56	
Other X Preschool	0.88	0.67		2.01	2.20		0.21	0.56		5.50	2.11	**	0.29	0.28		0.42	0.37	
Head Start	-0.24	0.28		-1.61	0.89		-0.06	0.23		-2.53	0.85	**	0.14	0.15		0.27	0.13	*
Day Care	1.03	0.27	***	0.48	0.90		1.00	0.23	***	0.63	0.85		-0.13	0.11		-0.08	0.16	

Table 4.17: Preschool by mother's education interaction effects

	Reading						Math						Retention				
	K Fall			5th Spring			K Fall			5th Spring			Kindergarten			By 8th Grade	
	Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE		Coef.	SE
Preschool	2.61	0.33	***	3.04	1.03	**	2.02	0.27	***	2.57	0.99	**	-0.29	0.13	*	-0.22	0.23
Less than high school X Preschool	-1.33	0.66	*	-2.63	1.86		-1.00	0.49	*	-0.80	1.79		0.38	0.22		-0.22	0.34
High school X Preschool	-1.02	0.42	*	0.41	1.31		-0.75	0.34	*	0.36	1.26		0.05	0.16		-0.21	0.27
Some college X Preschool	-0.99	0.40	*	-1.12	1.26		-0.79	0.33	*	-0.64	1.21		-0.11	0.15		-0.06	0.28
Head Start	-0.33	0.28		-1.66	0.88		-0.10	0.23		-2.82	0.85	**	0.13	0.15		0.27	0.13	***
Day Care	1.13	0.27	***	0.65	0.90		1.07	0.23	***	0.78	0.86		-0.12	0.11		-0.06	0.16	
Reference is no care																	
Less than high school	-3.59	0.40	***	-14.15	1.24	***	-3.54	0.32	***	-13.04	1.19	***	-0.14	0.16		1.13	0.23	***
High school	-2.43	0.33	***	-9.12	1.05	***	-2.51	0.28	***	-8.31	1.01	***	-0.03	0.13		0.71	0.21	**
Some college	-1.41	0.33	***	-5.14	1.04	***	-1.58	0.27	***	-4.74	1.00	***	0.15	0.13		0.33	0.20	

By 5th grade the differences in preschool's impact across levels of mother's education are no longer significant. This may be because children with preschool experiences whose mothers have less education are still able to learn and master content more quickly and have more positive teacher student interactions than students who had no preschool experience. Therefore, the increased advantage for students whose mothers attended college dissipates over time because the preschool attendees with lower educated mothers are able to access their school capital and preparation and extend their advantage over similar situated peers.

Discussion and conclusions

This chapter examined whether different types, qualities, and intensities of early childhood education are associated with positive outcomes, including higher cognitive scores and a reduced likelihood of retention in grade. Further, I examined whether 'school capital' or non-cognitive skills gained during preschool which are likely to smooth the transition into school, might explain the positive cognitive outcomes related to preschool. Finally, I examined whether children from diverse backgrounds benefit differently from their experiences in early childhood experiences.

I find that preschool has significant and long lasting positive benefits for children. The cognitive benefit is evident at kindergarten entry when examining both reading and mathematics test scores, and remains through the 8th grade year. Further, the likelihood that children are retained in any grade before entering 8th grade was significantly reduced by participation in preschool. The odds of retention are reduced by nearly 30% when a child completes a preschool program. While other studies have found benefits lasting through 1st grade (see Magnuson Ruhm

and Waldfogel 2007; Magnuson et al 2005), this represents one of the first studies to use a national sample to examine longer term outcomes.

In this study, Head Start is found not to be associated with either positive or negative outcomes as compared to no early childhood education, when controls for negative selection into Head Start are employed. Generally, Head Start selects the most disadvantaged students from an already disadvantaged eligible population, which makes finding a comparably disadvantaged group in the ECLS-K very difficult. Therefore, this study makes no definitive claims as to the efficacy or effectiveness of Head Start due to concerns raised by other scholars (Magnuson Ruhm and Waldfogel 2007). Day care offers children a temporary increase in cognitive skills compared to other peers but this effect fades out quickly; it appears to be gone by the end of 1st grade.

This study expands on prior research by searching for one plausible mechanism through which preschool may be influencing cognitive outcomes: 'school capital.' Using a teacher reported indicator of children's ability to pay attention, focus, and manage their emotions to serve as an operationalization of school capital, I find that cognitive benefits are indeed mediated by such 'soft skills.' In fact, the 8th grade cognitive benefit in both reading and math found for children who attended preschool is completely explained by kindergarten teacher ratings of approaches to learning. Success and positive teacher ratings at kindergarten entry are related directly to cognitive success at 8th grade, and this is a plausible path through which the benefit of preschool flows. While preschools are preparing students for school through delivery of instruction on early literacy and numeracy skills, they are moving the needle on achievement through preparing children with the school capital necessary to function and succeed in a school environment and to interact positively with their teachers and other adults.

The impact of school capital is a continual, interactional process. Developmental theory tells us that the brain is shaped through one's environment and interactions with that environment and with others within it. Interactions with other actors are key for development, because it is through these interactions that individuals are exposed to the social stimuli that develop their brains and their behaviors. Just as a mother speaking to her infant encourages babbling behavior and an attachment to the mother, so too does the investment and attention of a teacher influence both learning and the engagement and attachment a child feels toward school. It is through the behaviors I deem school capital—regulating attention, controlling impulses, and following rules—that children can earn more positive interactions with teachers and engage in school both cognitively and emotionally. The sensitive period for developing the ability to self-regulate as described above closes early, by age 6 or 7, though the brain remains malleable thereafter. In any case, those children who have already practiced, and likely have been explicitly taught, self-regulation and executive function in a preschool classroom are more likely to have positive early interactions with school and with teachers, and as a result, learn more from year to year and identify more strongly as belonging in an academic context.

Positive interactions are theorized to influence later behavior and academic outcomes, both through encouraging the continued use of executive function and through the cumulating advantages that come with early school success and early labeling by teachers as "teachable" and "good kids." This chapter provided evidence that this could be a plausible mechanism. However, counterarguments could be made that executive function in and of itself (i.e. the ability to self-regulate) is the reason for the influence of kindergarten teacher ratings on later educational outcomes. Essentially, this argument states that children who have better self control are simply able to learn more. However, this chapter also presented evidence that global executive function,

in the form of parent reports of their children's approaches to learning, were influential on later outcomes, but did not attenuate the effect of preschool. This indicates that while global executive function does lead children to be more successful in school, that it is school based behaviors associated with executive function, such as sitting still and paying attention, that are provided to children through preschool and it is for this reason that children who attended preschool have a test score advantage at 8th grade.

As we may expect, the benefits of preschool depend on the quality and intensity of the care, and on the recipient population. Preschools that charge a fee have a longer lasting positive effect on children, irrespective of whether the parent themselves, or another entity, paid for the early education experience. Further, low and medium intensity types of preschool experiences are associated with better outcomes. Programs that children attended for fewer than 20 hours per week (likely half day preschool experiences) are associated with more positive and longer lasting positive cognitive outcomes. This finding may partially reflect unmeasured differences in socioeconomic status across children exposed to different intensities of early childhood educational experiences. Or perhaps programs that are half day may be more similar to each other, where more intensive experiences may more resemble daycare and not educational experiences. Still, too much of a good thing is not better in this case.

Finally, little in the way of racial/ethnic or social class differences in the effect of preschool is found in my analysis. I find that children from all racial backgrounds benefit cognitively equally at kindergarten entry and by the end of 5th grade with two notable exceptions: Asian children in reading at kindergarten entry and American Indian children at the end of 5th grade. However, for each of these groups the difference in effect is in a positive direction, they benefit *more* from preschool than other groups, while all other groups show an equal, but smaller

positive benefit. As for children across levels of mother's education, the benefit of preschool is larger at kindergarten for children whose mothers had college degrees, but this differential effect fades out by 5th grade. By this time, children from all levels of maternal education benefit equally from preschool experiences.

Overall, these analyses suggest a number of takeaways about early childhood educational experiences. First, preschools tend to be associated with the strongest and longest lasting positive effects, both on cognitive scores and through reductions in retention. Further, preschools have the greatest effects when they charge a fee and when children attend fewer than 20 hours per week. Fee charging programs are likely to be of higher quality, since they tend to pay teachers more, require more education from teachers, and contain more physical markers of quality, including books, play items (Phillips et al 2001). Children also may benefit more from a moderate amount of preschool, as other studies have found that exposure to more hours of preschool can sometimes be associated with poorer behavior at kindergarten entry (Magnuson Ruhm and Waldfogel 2007). Finally, preschool appears to have a positive long-lasting effect irrespective of racial/ethnic background and mother's education. For proponents of equity, this is a positive finding. However, the same can not be said of either daycare or Head Start experiences where there is no evidence of long term cognitive effects or retention benefits.

These analyses also offer evidence that preschool improves outcomes through improving children's school capital, while the same can not be said of Head Start and daycare. When children enter kindergarten, they must adjust to school culture. Those children who have gained school capital, a knapsack filled with the ability to pay attention, sit still, and wait their turn, are much more successful in school. Children appear to gain these skills through preschool attendance, but not through Head Start or daycare. The benefits of school capital also do not fade

out over time; school capital at kindergarten is positively associated with outcomes in 8th grade. Further, the benefits of preschool outlined above are completely explained by school capital. Children who attend preschool prior to kindergarten are much more likely to carry with them the school capital knapsack, and it is through this pathway that preschool effects long term outcomes for kids.

Chapter Five

Enrolling in and graduating from college have both become key mechanisms by which Americans are socioeconomically stratified. Whether individuals persist through college and obtain a bachelor's degree determine much of their future labor market outcomes (Kao and Thompson 2003). Economic research has found the existence of a 'sheep-skin effect' for bachelor's degrees, so named because originally diplomas were produced from sheep-skin. Employers appear to use not skills, ability, or years of education, but often degrees themselves—or the sheep-skin of a diploma—to delineate who is qualified for certain jobs (Jaegar and Page 1996). The sheep-skin effect means that individuals today must not only gain the knowledge and skills that time in college adds to their human capital, but must also persist in college and receive a diploma in order to see the greatest returns to their income and experience positive social mobility. In fact, there is much debate over whether the diploma is a "real" proxy for skills or whether is it just a "signal" that employers use to screen applicants.

Thus, the possible long term effects of early education experiences on enrolling in and graduating from college with a bachelor's degree are extremely important to understand. These outcomes represent two important turning points that determine a person's adult life trajectory. While these outcomes have been examined somewhat for Head Start (see Ludwig and Miller

2007; Garces, Thomas, and Currie 2000), we do not know much about the long term effects on college outcomes of more generic preschool. Further, even the research on Head Start is based on the outcomes of a homogeneous group of individuals and may not be generalizable to the large majority of children who do attend preschool. Therefore, this chapter will examine the long term effects of preschool and Head Start on enrollment and graduation from college, and will assess whether particular cognitive and noncognitive skills may mediate any relationship that is found.

Literature review

Researchers now recognize early childhood as a pivotal developmental period. Cognitive skills are highly sensitive to one's early environment and these environments can differ greatly across racial and socioeconomic groups (Duncan, Ludwig, and Magnuson 2007; Currie 2001). Additionally, early cognitive skill gaps are found to persist or even grow over time (Duncan et al 2007). Research in the field of brain development has also shed light on early childhood, showing that the first few years of life are important not only for cognitive, but emotional, social, and physical development (Karoly and Gonzalez 2011). The period of early childhood is a critical period, as deprivations in early years are very hard to overcome in later years. For example, children who begin school with disadvantaged families had worse school performance than others, even if their family situation later improved (Currie 2001). Research on the effects of poverty has found that the most important path between childhood poverty and intellectual development is through early cognitive stimulation (Guo and Harris 2000). Guo and Harris (2000) use the NLSY and structural equation models to uncover later factors through which poverty influences intellectual development, and they find that cognitive stimulation is the most

important path through which the disadvantage of poverty flows.. Given current knowledge of early childhood environments, poverty, and cognitive development, preschool programs and other early childhood interventions may be important for providing cognitive stimulation in the early years of life and in partially determining outcomes in both the short- and long-term.

The short-term effects of preschool participation are well documented. Participating in early childhood education is associated with higher cognitive skills at the start of formal schooling in observational studies. For example, research using the Early Childhood Longitudinal Study has found preschool attendance is associated with higher reading and math skills in kindergarten and first grade, and with a lower risk of being retained in kindergarten (Magnuson et al 2004). The largest effects have been demonstrated for youth from disadvantaged groups (Magnuson et al 2004). Since most retentions happen in kindergarten and first grade (Alexander, Entwisle, and Dauber 2003), early academic progress can have important impacts on later educational trajectories. Even though impacts have been found to be more profound for disadvantaged groups, short-term cognitive improvements have been found across the income spectrum (Melhuish et al 2008; Gormley, Gayer and Dawson 2005). Meta-analytic studies have found that preschool attendance improves short-term outcomes for participating children, especially in the cognitive domain, but also for social skills and social progress (Camilli, Vargas, Ryan, and Barnett 2010). These findings applied regardless of socioeconomic background (Camilli et al 2010). Additionally, Head Start, a program aimed at boosting school-readiness of disadvantaged children, is also found to be associated with similar short term improvements in test scores (Barnett 1995; Karoly et al 1998).

At the same time, these short-term effects have been found to fade out in the early elementary years. The initial gains made by children attending Head Start, for example, fade

away after one year of exposure to school (Haskins 1989). However, this may be due to the worse school environments in which Head Start students enroll as compared to students who did not attend Head Start (Lee and Loeb 1995).[16] Further, when examining the fade out of Head Start effects by race using the Children of the NLSY sample, Currie and Thomas (2000) find that African American test score gains disappear in elementary school, while white gains persist into adolescence and are associated with lower probabilities of retention in grade. Again, this may be due to the differences in school environments attended by blacks and whites (see Jencks and Phillips 1998). Nonetheless, Magnuson and Waldfogel estimate that the black-white test score gap would be about 24 percent larger without the Head Start intervention program (Magnuson and Waldfogel 2005).

Even model programs, or high quality programs used in various experimental designs to test the effectiveness of early childhood intervention, see declines in gains over time although participating children often continue to show cognitive advantages in adolescence (Haskins 1989; Barnett 1995). For average preschool programs, the deficit for children who do not participate in preschool narrows when students are placed in small classrooms with high instructional quality, and persists in lower quality school environments (Magnuson, Ruhm, and Waldfogel 2007). Unsurprisingly, quality is found to differ by race and socioeconomic status. For example, black children on average experience lower quality care than their white peers (Magnuson and Waldfogel 2005), mainly due to their higher incidence of enrolling in Head Start. Chapter 3 of this dissertation makes clear that while black children may access preschool at

[16] Lee and Loeb find that former Head Start students attend worse schools than their peers who did not attend any preschool and compared to peers who attended other forms of preschool. They find that when there is a scarcity of slots in Head Start programs, spaces are generally given to the most needy, leading to negative selection into Head Start. This is in contrast to other social programs which often enroll the most advantaged of qualifying individuals, a tactic often referred to as "creaming" (Lee and Loeb 1995).

similar rates to white children, their experiences in terms of hours spent, student-teacher ratios, and other indicators of quality put them at a disadvantage.

The long-term effects of early childhood intervention, and the mechanisms through which they may operate, are more variable and less well understood. While the effects of Head Start on test scores are known to fade out, studies using the Children of the National Longitudinal Study of Youth (NLSY) and the Panel Study of Income Dynamics (PSID) indicate that Head Start does affect school attainment (Duncan, Ludwig, and Magnuson 2007; Currie and Thomas 1995; Garces, Thomas, and Currie, 2002). Using data from the PSID, Garces et al (2002) find that Head Start attendees are more likely to graduate from high school and attend college, and have greater earnings in their twenties. Early childhood intervention through Head Start has also been found to be positively associated with years of schooling completed (Ludwig and Miller 2007). Using long term follow up data from the Chicago Child-Parent Center (Chicago CPC), a neighborhood based public preschool program in poor neighborhoods in Chicago, preschool has been found to positively impact broad areas of life including education, socioeconomic status, health behaviors, and crime outcomes (Reynolds, Temple, Ou, Arteaga, and White 2011). In the Chicago CPC those from higher risk families show the largest positive effects of early childhood education on long-term outcomes (Reynolds et al 2011). Studies of the Chicago Child-Parent Center also find large reductions in high school dropout due which are attributed to the mediating effects of school mobility, retention, special education placement, and years of parental involvement (Temple, Reynolds, and Miedel 2006). However, most children who attend preschool do not attend Head Start, or high quality programs such as the Chicago CPC which included interventions throughout childhood, both before and after preschool age. Further, as

Chapter 4 elucidated, in the case of Head Start, finding a similarly disadvantaged comparison group not exposed to early childhood education can be difficult.

Model programs have even greater positive effects. When examining the Carolina Abecedarian Project and the High-Scope/Perry preschool program, investigators find that attendees are more likely to graduate high school, have greater earnings, are less likely to be involved in crime, are less likely to use welfare, and are more likely to still be in school or ever attended college at age 21 (Garces, Thomas, and Currie 2002; Currie 2001). Additionally, children who participate in model early childhood interventions are less likely to be placed into special education and are more committed to school, while there is a modest protective effect against grade retention (Haskins 1989; Barnett 1995). Research on model programs which also included school age intervention components find that the preschool treatment had greater effects on adolescent academic achievement than the more proximate school age intervention (Campbell and Ramey, 1995), supporting the view of early childhood as a critical developmental period. While these studies tell us a great deal about the long term effects of model programs and a fair amount about the long term effects of Head Start, we do not know much about outcomes for children in generic preschool programs of varying quality which are available in the childcare marketplace. Further, since very few studies have examined long term effects of more generic programs, information on the mechanisms through which the effects operate is equally sparse.

While these positive long term outcomes have been found in a limited set of studies, plausible mechanisms by which an experience in preschool at age 4 would lead to outcomes such as reduced drop out, more years of schooling, and better health, have not been a focus of much of the early learning research. Because most our knowledge on long term outcomes comes from small experimental studies, the focus has not been on how early learning experiences influence

later outcomes, but instead on whether they have these effects at all. With observational studies such as the ECLS-K data used in Chapter 3 and Chapter 4 and the UW-BHS data used in this chapter, it is easier to uncover mechanisms by which early learning may influence later outcomes.

In this chapter, I again examine school capital as a plausible mechanism through which preschool effects child outcomes. School capital refers to school specific behaviors and skills which are governed by a child's executive function, including attentional flexibility, working memory, and impulse control (Zelazo and Carlson 2012). School capital skills and behaviors include paying attention and ignoring distractions, regulating one's impulses, and remembering and following directions. School capital is theorized to increase teacher's positive perception of students, leading to positive feedback loops and increased identification with school and sense of belonging for children. While in Chapter 4 I was able to examine school capital from teacher ratings of a child's kindergarten behaviors, in this chapter I examine student's perceptions of themselves, which is theorized to be influenced by teacher perceptions, interactions, and the transition to school.

Theoretically, preschool influences early school capital, allowing for children to transition to school more easily and leading to better teacher ratings of their behavior, positive labeling, positive interactions with and a sense of belonging in the institution of school. Students who have early positive reactions from teachers are likely to feel that they belong in school and are more likely to be confident in their academic and other abilities. Therefore, in this chapter I use two attitudinal measures which would theoretically be influenced by a positive transition to school and positive school labeling, self-esteem and locus of control. Self-esteem measures one's overall evaluation of their own self-worth, while locus of control is a measure of one's beliefs

about whether they are in control of their own destiny. These constructs are imperfect, as they are global attitudes and not school specific. However, they could plausibly be affected by early positive attachment to school and positive teacher interactions. Therefore, this chapter attempts to trace the effects of school capital and positive labeling into a student's self-concept.

The literature on short term effects of early learning programs is very rich and has been substantiated using many different types of methodologies while examining many different types of programs from preschool, to pre-kindergarten, to Head Start. However, the literature on long term effects of early intervention has relied for the most part on experimental studies of small homogenous populations, and has focused on high impact "model programs" or on Head Start. Less is known about the long term effects of early childhood education for the more general preschool population and for programs which are more representative of the quality of programs available to the average child. Indeed, most three- and four-year-olds who attend preschool are not in Head Start or other similar public program (Barnett and Belfield 2006). While long term effects are found for model programs and for Head Start, perhaps more typical early childhood interventions show different associations with longer term outcomes. Also, mechanisms by which these effects should influence adult outcomes have not been studied in depth, and in this chapter I will continue to examine "school capital" as one plausible mechanism. Therefore, this study will focus not only on uncovering any long term effects of Head Start and preschool on college going, but also on identifying mechanisms through which effects operate.

To examine long term effects of typical early childhood interventions, I use retrospective information about early childhood environment from a longitudinal study of a cohort of high school seniors' transition to college, called the University of Washington Beyond High School (UWBHS) project. While children are obviously not randomly assigned to participate in early

childhood education, the dataset offers a rich set of socioeconomic indicators which can be used to reduce selection bias. Further, while retrospectively collected data can be subject to recall error, researchers have argued that retrospective report will be of higher quality when the event to be recalled is salient, as is daily attendance at a preschool program (see Garces Thomas and Currie 2002).[17] This paper will examine the effects of preschool and Head Start attendance on the transition to both 2-year and 4-year college one year after high school graduation, and will test a number of mechanisms through which the effects operate. In doing so, this study will add to our understanding of the effects of more typical early childhood intervention on later educational trajectories.

Data and measures

The data used in this study come from the University of Washington Beyond High School Project (UWBHS). UWBHS is a longitudinal study that focuses on the educational attainment and early life course outcomes of young adults. The study focuses on the transition from high school to college, thus it contains information about post-secondary enrollment in addition to socioeconomic and family indicators, high school experiences and behaviors. Five cohorts of students from multiple school districts in a large metropolitan area on the West Coast were surveyed in the spring of their senior years. The UWBHS sample includes cohorts from 2000 and 2002-2005. The UWBHS response rate for the senior survey is 78% for enrolled seniors, for a total sample of 9,658 seniors from twelve comprehensive high schools (9 public

[17] Garces et al. (2002) also argue that recall worsens as the event in question stretches farther into the past. The UWBHS sample includes those in their senior years in high school. Thus, UWBHS respondents are approximately 18 years old and are asked to recall an event 13 years prior. However, in the Garces et al (2002) study, cohorts who are 18 to 30 years old make up the analysis sample. Therefore, in addition to having a precedent set for using retrospective preschool/Head Start enrollment, the UWBHS sample also is comparatively more likely to recall their early childhood experiences because the event is closer to the present for them.

and 3 private) and numerous alternative school sites.[18] The survey was administered within the schools, either in a classroom or auditorium setting.

Additionally, investigators conducted a short follow-up survey via phone, email, or the internet one year after the senior survey (springs of 2001 and 2003-2006). This follow-up survey collected student reports on educational and work history in the year following high school. Of the 9,658 high school seniors who took the senior survey, 8,885 were re-surveyed one year after, for a follow-up response rate of 92%. Further, all students were followed up 7 years after expected graduation using the National Student Clearinghouse database of college degree, to determine whether they had graduated from college with a bachelor's degree. While the UWBHS dataset is not nationally representative, the distribution of the UWBHS sample is similar to the first follow up of the Educational Longitudinal Study (ELS) of 2002 across key measures.

Measures

The outcomes of interest for this study are any college attendance (two- or four-year) and four-year college attendance one year after expected high school graduation, and obtaining a bachelor's degree within 7 years after expected high school graduation. Two year and four year college attendance comes from a one year follow up survey of students who were first interviewed in their senior years of high school. The response rate was high for a survey of this type, with 92% of surveyed seniors followed up one year later. The data on receipt of a bachelor's degree come from data obtained from the National Student Clearinghouse, which is a known source for education verification and student educational outcomes research. The National Student Clearinghouse offers complete coverage of students in the UWBHS sample.

[18] The UWBHS sample of 9,658 excludes 120 observations which were completed by exchange students, developmentally disabled students, students who could not be matched to school records, or students who completed the survey with entirely nonsensical answers.

The college indicator is binary for both any college and four-year college; either a student enrolled in any college (or a four-year college) within one year after high school graduation or he or she did not. The graduation indicator is also binary indicating whether a student had completed a bachelor's degree seven years after their expected date of high school graduation. As all outcomes are binary, logistic regressions will be used throughout all analyses.

The main predictor variable of interest is attendance in an early learning program. This information is taken from the senior survey. Two survey items are used to construct indicators of early learning programs. First is a question asking whether the student had attended "nursery or preschool" before 1st grade, and the second asking whether the student had attended "Head Start" before 1st grade. Students who affirmed preschool or nursery school attendance, but did not report Head Start attendance are coded as attending an early learning program. Those who affirmed attending Head Start, whether or not they also affirmed attending nursery school or preschool, are coded as attending Head Start. Head Start and other early learning programs are distinct, as Head Start has specific income requirements, and thus the coding scheme is meant to separate any Head Start attendance from those who only reported other early learning environments. About 11% of the sample (893 cases) is missing on both early childhood items, and had to be dropped from the analysis.[19]

In order to assess whether the early childhood intervention measures from UWBHS provide comparable estimates to national data, I carried out comparisons with National Center for Education Statistics estimates from similar time periods.[20] UWBHS respondents were seniors in high school during the years 2000-2005. Respondents were thus born between roughly 1984

[19] Analyses were also run where early childhood participation was imputed using multiple imputation in Stata 13, and the substantive conclusions do not change.

[20] The National Center for Education Statistics (NCES) compiles information on a host of educational trends, including early childhood education usage and childcare arrangements.

and 1987, and would be subject to childcare or preschool (younger than 1st grade) from 1987 to 1993. I take estimates from 1991 for 3-5 year olds from the NCES as a comparison. Summary statistics of early education program participation from the UWBHS sample, and comparable statistics from NCES, taken from 1991, are reported in Table 1. The first column indicates around 67.4 percent of UWBHS respondents report attending Head Start or another early education program. The second column indicates that 52.8 percent of all 3-5 year olds in 1991 were enrolled in any early education program. However, as Figure 1 suggests, enrollment in these programs increases between ages 3 and 4. The UWBHS figure is a cumulative figure, as it measures whether a student ever attended an early education program. As most children, once enrolled in these program are likely to stay enrolled until kindergarten, a more comparable figure may be the enrollment percentage of five-year-olds who are not yet in kindergarten. About 64 percent of five-year-olds are enrolled in early education programs, an estimate which closely matches the UWBHS figure of 67 percent.

Table 5.1: Early education program participation by race for UWBHS and ECE-NHES:1991

	UWBHS	3-5 years	5 years
Total	67.4	52.8	63.9
White	70.7	54.0	--
Black	70.6	58.3	--
Hispanic	55.9	38.8	--

Source: U.S. Department of Education, National Center for Education Statistics, Early Childhood Education Survey, Parent Survey, and Early Childhood Program Participation Survey of the National Household Education Surveys Program (ECE-NHES:1991)

Table 5.1 also shows enrollment breakdowns by race, but the NCES figures are only for the total population of 3 to 5 year olds. While the overall averages are thus not directly comparable, the racial patterns are similar across UWBHS and NCES figures. Whites and blacks from both samples have the highest levels of enrollment. Further, blacks and whites have similar levels to each other. Hispanics in both samples have by far the lowest participation. Even though UWBHS relies on retrospective self-reports, I argue that these reports are roughly comparable to the national figures from a similar time period. Although there may be some error in reporting preschool attendance by adolescent respondents, it is unlikely to be large enough to bias the analysis. Further, while UWBHS is not a representative sample it captures the overall national levels of preschool prevalence. Overall slightly over 52 % of the sample attended an early education program other than Head Start and 15% attended Head Start, adding up to the total figure of 67%. Additionally, 92% of the sample attended kindergarten.

A key concern for my analysis is that any association between early learning programs and college outcomes may be due to positive selection into these programs. Therefore, I include in my analyses a number of control variables for selection into various types of early childhood education. These measures fall into a three categories. First are the demographic variables which include race and gender. The sample is 63% white, 12% African American, 1% Native American, 16% Asian of various ethnicities, 2% Native Hawaiian or Pacific Islander, and 5% Hispanic, with an even gender split. These demographic indicators must be controlled for as African Americans, Latinos, Native Americans, and males show lower educational attainment than whites, Asian, and female students (US Department of Education 2003).

The second set of control variables are socioeconomic indicators. These include parental education level, home ownership, and family structure (McLanahan and Sandefur, 1994; Sewell

et al, 1970; Orr, 2003), as well as immigrant generation (Portes and Rumbaut, 2001). The modal category for parental education is college degree or higher, with 42% of students reporting this education level. The majority of students come from the third or higher immigrant generation, though 14% of students are first generation, and 18% are second generation immigrants. Around a third of students come from non-intact families, while a little over a quarter of students' families rent their homes.

The final set of control variables represents parenting and student-parent interactions. Parents and parenting styles are important for creating children's orientation toward schooling (Bowles and Gintis, 1976; Bourdieu and Passeron, 1977). More involved and supportive parents may also be more likely to send their children to early education, which may lead to a spurious effect of early childhood education. Therefore, a failure to control for parenting could lead to biased estimation of the effects of these programs. The parenting variables include whether the student's mother and father expected him or her to obtain a bachelor's degree and the frequency with which students discussed college and school activities with their parents. Obviously these components of parenting take place when the student is in high school, long after they have left preschool-age. Further, these parenting factors could also be response to good school performance and positive experience with schools, reversing the assumed direction of causality. However, assuming that parenting behaviors are relatively stable over childhood, these measures will capture at least part of the early parenting environment. Further, neglecting measures of parenting would bias the results, so even if these are imperfect early parenting indicators, they will reduce bias and thus should be included. Students report that 70% of their mothers expect them to get a bachelor's degree, while 66% of their fathers have that expectation. Most parents

seem to discuss activities and college with their children, but a non-trivial proportion of students report that their parents rarely or never discuss these things with them.

In addition to ruling out alternative explanations for any program effects through controlling for selection factors, I also explore possible mechanisms through which program effects may operate. I identify three broad categories of indicators which may serve as mechanisms. First, early education may influence student approaches to schooling and attitudes toward schooling, with some students having attitudes more positively associated with school performance and achievement. In contrast to Chapter 4, these measures are reported by the student and assess global attitudes that may be influenced by the early successful transition to school because of school capital.

Two such attitudinal constructs are locus of control and self-esteem. In social psychology, locus of control refers to the extent to which individuals believe that they can control events and outcomes in their own lives (Rotter 1966). Individuals with a high internal locus of control believe that events in their life are a result of their own actions. Individuals with a low internal locus of control believe that the events in their life are primarily a result of outside forces acting upon them. Often, those with a low internal locus of control believe their life events are influenced greatly by other people, by fate, or by chance. High internal locus of control has been found to be associated with greater college ambitions (Bankston and Zhou 2002; Ross and Broh, 2000). Locus of control could theoretically be influenced by a students early transition to school, aided by school capital, with a sense of higher locus of control a consequence of preschool participation and positive labeling. Self-esteem refers to an individual's perception of his or her own worth and is conceptualized as an enduring personality characteristic (Rosenberg 1965). Generally it has been argued that a positive relationship exists

between self-esteem and academic performance (Rosenberg, 1965). Just as with locus of control, positive self esteem could theoretically be influenced by early positive experiences with school brought about because of increased school capital, which Chapter 4 suggests is plausible.

Unfortunately, while locus of control and self esteem are conceptually related to my formulation of noncognitive skills, they do not fully measure the concept. School capital is a personal resource used to signal teachers that one fits in and is a good student, and also effects how children approach their learning, speeding up mastery of new material. Further, tracing the effects of school capital into the long term, I theorized that it would lead to a greater sense of belonging in school and self-identity as a learner and successful student. Global attitudes such as locus of control and self esteem do not align with the school specific sense of belonging and positive school identity that would be most useful for this analysis. Locus of control and self esteem are attitudes which are not specific to school, and do not necessarily correlate strongly with teacher ratings or learning approaches (e.g. attention, motivation).Further, since both concepts have their origins in the psychological literature, they are generally referred to as individual differences that are not influenced by structures or experiences. Still, they represent the best options in the UW-BHS dataset to investigate the consequences of early learning's increase of school capital, even if they are imperfect. Further, they offer a different way to measure the consequences of school capital and offer a new perspective as compared to the measures in Chapter 4. These two distinct measurement tactics will therefore allow for greater clarity in what school capital is and does, and what it is not and does not do.

The third set of mechanisms measure not overall attitudes, but engagement with high school and academic life (Rumberger and Larson, 1998; Rumberger, 1995). Engagement with school is theorized by be associated with a smoother transition to school, greater levels of school

capital, and more positive teacher and school interactions. I use two measures to capture engagement with high school, the number of school sponsored activities the student is involved in and the number of hours of homework the student completes in a typical week. On average, students participate in about one school sponsored activity, and report an average of 3.5 hours of homework per week. The last possible mechanism through which early childhood participation may influence college enrollment is through affecting high school performance. I have a single measure of high school performance, grade point average (GPA). The average self-reported GPA of the UWBHS sample is 3.18. Missingness in the UWBHS sample is minimal, from 1% to 6% on independent variables. To alleviate bias created by missing values on independent variables, I use multiple imputation in Stata 13 to create twenty data sets, and combine these imputed datasets for all analyses (see Rubin 1995).

Analysis and results

To answer the question of whether early childhood programs lead to a greater likelihood of enrolling in and graduating from college, controlling for family, home, and student characteristics, I used a series of logistic regressions to predict three distinct outcomes: (1) enrollment in either 2-year or 4-year college one year after high school graduation, (2) enrollment in 4-year college one year after high school graduation, (3) graduation with a bachelor's degree 7 years after high school graduation, and (4) graduation with a bachelor's degree 7 hears after high school, given enrollment one year after high school graduation.

For each outcome, I first examine the effects of preschool or Head Start on postsecondary education, with only kindergarten attendance as an independent variable. Then I examine the change in coefficients when individual ascriptive characteristics (race and generational status),

and family socioeconomic characteristics (homeownership and family structure) are included as covariates in the model. Next, I add characteristics of parenting and student-parent relationships, to control for the fact the better parents may enroll their children in preschool, thus leading to a spurious effect of early childhood education. Finally, I add non-cognitive attitudes including self esteem and locus of control, and in the next model a proxy for cognitive skills, self reported GPA to see whether any effects of preschool may be mediated through encouraging these individual characteristics. Lastly, I add academic and school related behaviors to see whether these behaviors may explain the effects of preschool.

Table 5.2 shows results for the outcome of enrollment in any college (2- or 4-year) one year after high school graduation. Model 1, which just includes preschool attendance or Head Start attendance and kindergarten attendance, indicates that preschool has a positive effect on the log-odds of enrolling in any college, while attending Head Start has a negative effect. Model 2 includes individual ascritptive characteristics and family socioeconomic variables. In this model, the negative effect of Head Start is no longer significant. This suggests that the seemingly negative impact of the program is primarily due to the selection of disadvantaged students into attending Head Start. While the positive coefficient for preschool attendance is reduced by almost half, the effect of preschool still remains positive and significant. Much of the total effect of preschool is due to selection into preschool programs. Children from more advantaged backgrounds are more likely to enroll, and thus when these background factors are taken into account the effect of preschool is reduced. However, a net effect of preschool still remains, suggesting a plausible effect of preschool on college going net of selection mechanisms.

Table 5.2: Enrollment in any college (2- or 4-year) one year after high school graduation												
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Coef		Coef		Coef		Coef		Coef		Coef	
Attended preschool	0.68	***	0.36	***	0.22	**	0.23	***	0.25	***	0.23	**
Attended Head Start	-0.24	***	-0.12		-0.16		-0.15		-0.14		-0.15	
Reference is no early education												
Attended Kindergarten	0.25	**	0.30	**	0.20		0.17		0.18		0.15	
Reference is no Kindergarten												
African American			0.27		0.18		0.20		0.40	*	0.35	*
Native American, Alaska Native			0.03		0.05		0.08		0.12		0.08	
Other Asian			0.18		0.15		0.20		0.17		0.17	
East Asian			1.00	***	0.81	***	0.84	***	0.81	***	0.82	***
Cambodian			0.41	***	0.43	***	0.45	***	0.46	***	0.47	***
Vietnamese			2.12	***	2.10	***	2.17	***	1.94	***	1.92	***
Filipino			0.20		0.13		0.14		0.18		0.18	
NHOPI			-0.50	*	-0.68	**	-0.62	**	-0.49	*	-0.58	*
Hispanic			-0.02		-0.08		-0.09		0.06		0.05	
Mexican			-0.02		-0.09		-0.11		0.00		-0.03	
Reference is White												
Father has HS degree or less			-0.94	***	-0.59	***	-0.60	***	-0.55	***	-0.51	***
Father has some college			-0.59	***	-0.43	***	-0.43	***	-0.39	***	-0.37	***
Father education unknown			-0.88	***	-0.47	***	-0.48	***	-0.42	**	-0.38	**
Reference is father has BA												
Mother has HS degree or less			-0.88	***	-0.54	***	-0.55	***	-0.53	***	-0.52	***
Mother has some college			-0.49	***	-0.27	**	-0.28	**	-0.25	**	-0.24	**
Mother education unknown			-1.12	***	-0.66	***	-0.64	***	-0.58	***	-0.56	***
Reference is mother has BA												
Family owns home			0.37	***	0.31	***	0.31	***	0.31	***	0.30	***
First generation			0.02		0.01		0.06		0.00		0.01	
Second generation			0.13	*	0.14		0.16	*	0.13		0.11	

Reference is third generation or greater												
Intact family			0.34	***	0.22	**	0.23	***	0.20	**	0.21	**
Never discuss activities					0.05		0.12		0.16		0.30	***
Rarely discuss activities					0.06		0.14	*	0.16	*	0.23	**
Sometimes discuss activities					0.06		0.10		0.13	*	-1.25	***
Reference is often discuss activities												
Never discuss college					-1.36	***	-1.30	***	-1.16	***	-1.22	***
Rarely discuss college					-1.37	***	-1.31	***	-1.20	***	-0.82	***
Sometimes discuss college					-0.95	***	-0.91	***	-0.82	***	0.30	**
Reference is often discuss college												
Father expects the student to attain a BA					0.40	***	0.38	***	0.32	**	0.51	***
Mother expects the student to attain a BA					0.67	***	0.65	***	0.59	***	0.67	***
Locus of control scale							0.54	***	0.33	***	0.30	***
Self esteem scale							-0.03		-0.13	*	-0.15	**
Self reported GPA									1.24	***	1.16	***
Hours spent in activities per week											0.02	***
Hours spent doing homework per week											0.04	**
Constant	0.49	***	1.10	***	0.76	**	-0.31		-3.30	***	-3.38	***
Observations	7947		7947		7947		7947		7947		7947	

Model 3 adds in parenting variables, to control for the real prospect that parents who exhibit positive parenting behaviors will enroll their children in early childhood education leading to a selection effect. While the coefficient for preschool attendance is reduced slightly it remains significant even when parenting behaviors are controlled for. It appears parents with more positive parenting behaviors choose preschool, explaining a slight amount of the total effect of preschool. While parenting decisions do matter for both enrollment in preschool and college, preschool still has a strong independent effect on the odds of enrolling in any college. Preschool therefore, may indeed affect individuals in such a way that they are more successful, determined, or focused on school and thus have better college enrollment outcomes.

Models 4, 5, and 6 add non-cognitive attitudes, academic achievement, and school related behaviors, respectively. These factors add to the explanatory power of the model, but they do not dampen the effect of preschool on any college attendance. The preschool effect remains strong and significant in the last three models. The net positive effect suggests that preschool does indeed influence a child's educational trajectory, though the exact mechanisms remain elusive. Alternatively, preschool may simply be capturing some features of income that I am unable to control for in this analysis. With the limits of the socioeconomic data in the UWBHS in mind, I argue there is the possibility of a long lasting effect of preschool on college going. If school capital is part of the explanation, perhaps students who come to school with school capital have more positive interactional experiences in school, come to identify more strongly with school, and therefore, even when controlling for observable school related behaviors, still enroll in colleges at higher rates.

Table 5.3 assesses the same models, this time with the outcome of enrolling in 4-year college. The pattern of results is largely the same. Preschool has a strong positive bivariate

effect, and Head Start a strong bivariate negative effect. Head Start's negative effect is eliminated when ascriptive and socioeconomic variables are taken into account. The positive effect of preschool is again cut in half by taking into account ascription and socioeconomic status. Again the coefficient for preschool is further reduced when parenting is taken into account, and as before, the possible mediating factors (attitudes, GPA performance, and behaviors) do not explain the positive preschool effect. Preschool appears to affect college going outcomes, but it does not do so through the proposed mechanisms in the model. Perhaps this is because school capital as theorized in Chapter 1 of this dissertation is not accurately captured by the measures available in the UW-BHS dataset.

In the final fully controlled model, Head Start appears to have no effect on four year college attendance and preschool has a small positive impact on the log-odds of four year college enrollment. One of the factors meant to correlate with my conceptualization of school capital, locus of control, is significantly related to the likelihood of enrolling but does not explain the preschool effect. Further, the significance of locus of control, probably the closest measure conceptually to school capital, is completely explained when both GPA and hours on homework are added to the model. Locus of control is the extent to which students feel they can affect outcomes in their life through their own hard work and effort. At the same time, self esteem completely unrelated to the log odds of attending college. These attitudinal measures were meant to be a proxy of school capital, but do not get at the behaviors and skills which are so important both for gaining knowledge and for signaling teachers and other staff in schools. While locus of control influences college enrollment, and this effect flows through school effort and academic behaviors, the variables are not associated with preschool strongly enough to explain the preschool effect, which remains significant throughout the last three models.

Table 5.3: Enrollment in 4-year college one year after high school graduation												
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Coef		Coef		Coef		Coef		Coef		Coef	
Attended preschool	0.72	***	0.36	***	0.24	*	0.25	**	0.27	**	0.25	*
Attended Head Start	-0.24	*	-0.10		-0.14		-0.15		-0.08		-0.10	
Reference is no early education												
Attended Kindergarten	0.48	***	0.42	**	0.31	*	0.29	*	0.33	**	0.28	*
Reference is no Kindergarten												
African American			0.20		0.17		0.17		0.58	***	0.52	**
Native American, Alaska Native			-0.18		-0.16		-0.16		0.00		-0.08	
Other Asian			-0.18		-0.20		-0.18		-0.24		-0.26	
East Asian			1.13	***	1.03	***	1.09	***	1.07	***	1.08	***
Cambodian			0.17		0.30	*	0.34	**	0.35	*	0.32	
Vietnamese			1.06	***	1.05	***	1.12	***	0.71	**	0.61	**
Filipino			-0.20		-0.28		-0.25		-0.24		-0.29	
NHOPI			-0.29		-0.35		-0.30		-0.05		-0.18	
Hispanic			0.10		0.05		0.05		0.25		0.23	
Mexican			0.08		0.05		0.04		0.19		0.14	
Reference is White												
Father has HS degree or less			-0.87	***	-0.56	***	-0.58	***	-0.53	***	-0.50	***
Father has some college			-0.61	***	-0.48	***	-0.49	***	-0.45	***	-0.43	***
Father education unknown			-0.90	***	-0.45	**	-0.46	**	-0.39	*	-0.34	*
Reference is father has BA												
Mother has HS degree or less			-0.86	***	-0.58	***	-0.58	***	-0.57	***	-0.56	***
Mother has some college			-0.54	***	-0.37	***	-0.38	***	-0.37	***	-0.36	***
Mother education unknown			-1.01	***	-0.59	**	-0.56	**	-0.47	*	-0.44	*
Reference is mother has BA												
Family owns home			0.39	***	0.35	***	0.35	***	0.33	***	0.32	***
First generation			-0.26	*	-0.27	*	-0.22		-0.32	*	-0.31	*
Second generation			0.06		0.08		0.08		0.05		0.02	

Reference is third generation or greater												
Intact family			0.30	***	0.15	*	0.15	*	0.10		0.10	
Never discuss activities					-0.29	***	-0.18	**	-0.08		0.21	**
Rarely discuss activities					-0.11		0.00		0.04		0.27	**
Sometimes discuss activities					0.01		0.08		0.12	**	0.27	***
Reference is often discuss activities												
Never discuss college					-0.97	***	-0.90	***	-0.76	**	-0.92	***
Rarely discuss college					-1.03	***	-0.95	***	-0.79	***	-0.83	***
Sometimes discuss college					-0.85	***	-0.81	***	-0.70	***	-0.70	***
Reference is often discuss college												
Father expects the student to attain a BA					0.49	**	0.46	**	0.44	**	0.42	*
Mother expects the student to attain a BA					0.86	***	0.84	***	0.78	***	0.67	***
Locus of control scale							0.53	***	0.16	*	0.11	
Self esteem scale							0.11		0.01		-0.01	
Self reported GPA									1.97	***	1.88	***
Hours spent in activities per week											0.03	***
Hours spent doing homework per week											0.06	***
Constant	-1.09	***	-0.45		-1.10	***	-2.47	***	-7.56	***	-7.78	***
Observations	7947		7947		7947		7947		7947		7947	

For many students, enrollment is only half—or less—of the battle of completing college and obtaining a degree. Do attending preschool and/or Head Start seem to have a relationship with this important status attainment outcome? Table 5.4 displays the same set of models, this time predicting graduation from college in 7 years. As with college enrollment, with only kindergarten attendance controlled preschool has a positive association with college graduation, while Head Start has a negative association with college graduation. Around half of the association between preschool and college graduation is explained by the ascriptive and socioeconomic characteristics of preschool attenders. However, the negative effect of Head Start on college graduation remains even when personal and family characteristics are taken into account. In fact, even in the model where all controls are added, Head Start has a negative effect on the odds of attaining a bachelor's degree. The positive effect of preschool on the odds of graduating remains throughout the models. As much as possible with the limited set of covariates available in the UW-BHS data, attempts were made to minimize selection bias. As with the ECLS-K data, it is difficult within the UW-BHS data to find sufficiently disadvantaged students for a strong comparison group. Further, UW-BHS has fewer socioeconomic controls, most notably not containing any income information. In any case, using relevant and available controls in the UW-BHS dataset produces the results summarized in Table 4.

Table 5.4: Graduation from a 4-year college 7 years after high school graduation												
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	Coef		Coef		Coef		Coef		Coef		Coef	
Attended preschool	0.76	***	0.35	***	0.24	**	0.25	**	0.25	***	0.24	**
Attended Head Start	-0.43	***	-0.23	**	-0.27	**	-0.28	**	-0.22	**	-0.24	**
Reference is no early education												
Attended Kindergarten	0.26	**	0.20	*	0.09		0.06		0.08		0.06	
Reference is no Kindergarten												
African American			-0.26		-0.31	*	-0.32	*	-0.03		-0.06	
Native American, Alaska Native			-0.82	***	-0.84	***	-0.85	***	-0.76	***	-0.81	***
Other Asian			0.00		-0.02		0.01		0.00		-0.01	
East Asian			0.28	*	0.16		0.22		0.06		0.05	
Cambodian			0.11		0.25		0.30	*	0.28	*	0.22	
Vietnamese			1.12	***	1.11	***	1.19	***	0.84	**	0.77	**
Filipino			-0.28		-0.32		-0.28		-0.29		-0.32	
NHOPI			-1.12	***	-1.17	***	-1.13	***	-1.01	***	-1.11	***
Hispanic			-0.40	*	-0.47	*	-0.48	*	-0.42		-0.42	*
Mexican			-0.15		-0.18		-0.19		-0.10		-0.14	
Reference is White												
Father has HS degree or less			-0.93	***	-0.67	***	-0.69	***	-0.66	***	-0.63	***
Father has some college			-0.55	***	-0.44	***	-0.45	***	-0.40	***	-0.38	***
Father education unknown			-0.79	***	-0.41	**	-0.43	**	-0.36	**	-0.34	**
Reference is father has BA												
Mother has HS degree or less			-0.68	***	-0.42	***	-0.43	***	-0.39	***	-0.37	***
Mother has some college			-0.42	***	-0.27	***	-0.28	***	-0.26	***	-0.24	***
Mother education unknown			-0.89	***	-0.53	*	-0.50	*	-0.42		-0.39	
Reference is mother has BA												
Family owns home			0.49	***	0.45	***	0.44	***	0.42	***	0.41	***
First generation			-0.29		-0.28		-0.24		-0.31		-0.32	*
Second generation			0.07		0.08		0.08		0.07		0.05	

Reference is third generation or greater														
Intact family			0.36	***	0.22	*	0.22	*	0.17		0.17			
Never discuss activities					-0.41	*	-0.29		-0.20		-0.05			
Rarely discuss activities					-0.16		-0.05		0.00		0.12			
Sometimes discuss activities					-0.06		0.02		0.05		0.13	*		
Reference is often discuss activities														
Never discuss college					-0.64	*	-0.55	*	-0.36		-0.41			
Rarely discuss college					-0.94	***	-0.86	***	-0.68	***	-0.67	***		
Sometimes discuss college					-0.64	***	-0.59	***	-0.46	***	-0.45	***		
Reference is often discuss college														
Father expects the student to attain a BA					0.36	***	0.32	**	0.28	**	0.26	*		
Mother expects the student to attain a BA					0.78	***	0.75	***	0.66	***	0.60	***		
Locus of control scale							0.56	***	0.22	***	0.18	**		
Self esteem scale							0.11		0.04		0.04			
Self reported GPA									1.69	***	1.60	***		
Hours spent in activities per week											0.01	***		
Hours spent doing homework per week											0.04	***		
Constant	-1.41	***	-0.89	***	-1.37	***	-2.79	***	-7.14	***	-7.18	***		
Observations	8564		8564		8564		8564		8564		8564			

For the last analysis, I examined whether early childhood education had an effect on college graduation, given that a student enrolled in college. The previous table analyzed graduation for all students in the UW-BHS sample, Table 5.5 examines whether the odds of college graduation are increased for students who enrolled in a four year college one year after high school. The same controls are included in each model, but the coefficients for the complete set of control variables has been omitted to preserve space. Unlike in the previous analysis, the association between preschool and Head Start and college graduation is completely mediated when ascrtiptive characteristics are added in Model 2. Throughout the rest of the models, the effect of early childhood education remains non-significant.

This finding indicates that while preschool was positively associated with college graduation, and Head Start had a negative association, this is entirely due to differences in enrollments in college across the programs. Once the sample is limited to those who reported enrolling in four year college one year after high school, the associations between early childhood education and college completion are no longer found. Therefore, while preschool has a small effect on enrollment in college, I find no effect on persistence or completion. This is an interesting and unexpected finding. Perhaps the college environment represents a new and unique challenge for all students, and therefore the skills and behaviors gained and used through a child's K-12 experience are no longer equally as valuable in a higher education environment.

Table 5.5: Effect of early childhood education on college graduation, among college enrollees

	Model 1			Model 2		Model 3		Model 4		Model 5		Model 6	
	Coef.	SE		Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Attended preschool	0.48	0.09	***	0.20	0.11	0.17	0.11	0.17	0.11	0.19	0.11	0.19	0.11
Attended Head Start	-0.28	0.10	**	-0.13	0.09	-0.14	0.08	-0.14	0.08	-0.11	0.07	-0.11	0.07
Reference is no early education													

Model 1 controls: Kindergarten
Model 2 controls: Kindergarten, ascriptive characteristics
Model 3 controls: Kindergarten, ascriptive characteristics, parenting
Model 4 controls: Kindergarten, ascriptive characteristics, parenting, locus of control, self esteem
Model 5 controls: Kindergarten, ascriptive characteristics, parenting, locus of control, self esteem, GPA
Model 6 controls: Kindergarten, ascriptive characteristics, parenting, locus of control, self esteem, GPA, academic behaviors

Discussion and conclusions

This chapter set out to uncover whether early childhood education is associated with college enrollment and completion. These two long term outcomes of an individual's educational trajectory are incredibly important for social mobility. College completion in particular has become required for most jobs with a livable wage in the United States (Kao and Thompson 2003). The possible relationship between early childhood education and such a sociologically important outcome is the subject of this chapter. Further, while prior research has established such links for high quality programs, it is unclear whether this should be expected of generic preschool which the average American child attends. Therefore, this study uses a regional dataset from a study of the transition from high school to college to examine this issue from a new vantage point.

I find that high school seniors who reported that they attended early childhood education do indeed exhibit different college going behaviors as compared to their similar peers who did not report attending such programs. Preschool attendees were more likely to enroll in either 2-year or 4-year colleges and to have graduated within seven years after high school graduation. However, the effect of preschool on high school graduation appears to be explained completely by the higher rates of enrollment. Thus, while preschool seems to be associated with getting into a four year college, it is not associated with getting through college at any higher rate than other students who arrive on university campuses.

However, there is no evidence for the positive long term effects of Head Start. In my models, Head Start is unrelated to enrollment in either two or four year colleges. Head Start attendees enter colleges at similar rates to their peers who did not attend Head Start, controlling for background factors. Further, Head Start attendees have no advantage, according to my

analysis, in college completion and degree attainment. This may be due to limitations in the dataset, because it is difficult to find a disadvantaged enough comparison among the UW-BHS sample, just as it was in the ECLS-K sample. While this study does not add to evidence of Head Start's long term impact, it does not go so far as to disprove a long line of experiment-based Head Start findings which support long term effects.

However, this study does begin to shed light on the probable long term effects of generic preschools for children growing up today. This study adds to others that find that early experiences can extend into early adulthood and beyond. At the same time, this study is unable to uncover mechanisms through which such early childhood experiences may influence long term outcomes. As Chapter 4 suggested, early assessments of a child's school capital can have a long term impact on their cognitive achievements. Perhaps if these measures, teacher assessments in particular, were available in the UW-BHS data sample they might be able to explain some of the long lasting effects of preschool. Since locus of control and academic behaviors, as well as achievement indicators such as GPA, do not serve to explain the positive impact of preschool, perhaps these measures are not aligned strongly enough with the conceptualization of school capital to adequately test the school capital mediation hypothesis. Indeed, school capital is defined as a personal resource that a child can accumulate and "cash in" at school through both acquiring knowledge at a faster rate and through garnering more positive attention and assessment by teachers. In theory, just as the athletes who show the most promise get the highest investment of coaching, so might the children who show the most school capital get the highest investment from educators, and set them off on a much different trajectory than those who had shown only minimally less promise. However, the data and analyses in this chapter fail to make the empirical connection between school capital and college going outcomes. Even so, I still

believe that school capital should remain a possible mechanism of interest, and approaches to learning, especially when reported by teachers, should be included in new longitudinal data sets on education.

At the same time, this chapter in particular suffers from a number of limitations, the most major of which is the problem of selection. The UW-BHS data set contained only sparse controls for socioeconomic background. Parents' highest level of education, homeownership, and family structure were the only measures that captured socioeconomic status. The lack of information about income or occupation of students' parents leaves questions as to whether the preschool effect is just due to positive selection into preschool, and whether the negative Head Start effect on college graduation may be due to negative selection into that program. Further, the data offers no variables from the critical period of development I am concerned about except for the self-reported preschool measure. My conceptual model states that early environment is fundamental to brain development and later education outcome, and that is why early childhood education is interesting developmentally. However, I am unable to control for any aspects of early environment that may have influenced both enrollment in early learning and later life outcomes.

Another central limitation of this study is relying on self reports of early learning enrollment. While it is incredibly important to be precise about the types of programs that children access, using a self-report from a student's senior year of high school does not allow for much certainty in the precision of measurement. Further, insomuch as there is stigma associated with Head Start, even students who remember accurately may not be willing to report Head Start attendance. If this stigma is more likely to be found among advantaged Head Start attendees, results may be biased. More generally, relying on self reported attendance does not allow for a

great deal of certainty as to whether students are properly categorized on the main predictor of interest.

The third important limitation is that the sample of students in the UW-BHS are high school seniors, meaning any students who dropped out of school prior to the spring of their senior year are not included in this sample. The lowest performers on the distribution, and those who are least likely to transition to higher education are not included in any of these analyses. In so far as having dropped out prior to senior year is correlated with the predictor variable of interest, early childhood education, the inferences drawn from this sample may be in correct.

Even with its limitations, this study adds to our understanding of why early learning may influence later life outcomes. Though the mechanisms through which preschool may affect college going and completion remain elusive, the finding that these effects exist after controlling for such a wide range of background and personal factors should still be of interest. It lends support to the idea that preschool can bring about positive outcomes for kids of various backgrounds. At the same time more research is needed to understand for whom and under what conditions these positive very long term outcomes are found. At the same time, this analysis opens the possibility that even though the average child does not attend a preschool that is as high quality as the Perry/High Scope that the expansion of preschool could still lead to positive long term effects on college going. However, as Chapter 4 made clear, not all preschool is equal when it comes to observing those positive outcomes. Still, while this chapter can not make causal claims about preschool's later effect, it does call for more investigation and new longitudinal data sources, so that this issue can be more thoroughly researched.

Chapter Six

This dissertation is at its core an attempt to examine whether different types of early childhood education experiences led to positive cognitive and educational attainment outcomes for children, for whom and under what conditions, and whether school capital is a plausible explanation for the positive relationships that have been found in prior research. These research questions expand upon prior literature in a number of important ways.

First, the question of whether early childhood education has a positive long term effect has not been completely answered by previous studies. High-quality preschool experiences are associated with positive outcomes, in both the short and long term, for extremely disadvantaged children (Barnett 1995; Currie 2001; Haskins 1989; Currie et al 2000). While the effects of high-quality preschool on a homogenous group of children have been established and substantiated by numerous studies, there are few studies that look at the effects of the types of generic preschools that a majority of children attend, and even fewer that attempt to trace those effects into adolescence or adulthood. Just as tightly controlled research based laboratory interventions may fail when scaled up and implemented outside the lab, preschool's effects may not be the same in an open marketplace where the implementation may not even resemble that of the original

effective programs. While there is much public sentiment to the effect of "we know this works" there is not nearly enough research to support that assertion.

This gap in the research relates to the second advancement brought about by this research: the attempt to understand when early childhood education works and for whom. Not only has research of the long term effects early childhood education been narrow in terms of breadth of the population studied and types of programs studied, but it has also tended to ignore the possibility of variation among and within programs, and variation in effects across ascriptive groups. Both in terms of which children get access to which quality of programs, and in terms of whether the programs meet diverse children's needs, prior research has been lacking. Research on child care decisions in the year before kindergarten often miss the distinct reasons that parents select preschool over other options for childcare, thus often failing to examine which children get access to what types of experiences. Further, in studies of outcomes related to care, the differences within a broad category such as preschool, in terms of quality and intensity, are not often taken into account. Finally, the possibility that these programs could differentially affect different populations has been examined in terms of broad programs, but again with little nuance within programs. While this dissertation is far from solving these issues, it is my hope that it brings some of these issues to the forefront and begins to complicate our understanding of preschool effects.

Finally, prior research has often failed to identify a mechanism, even a conceptual one, to explain why early childhood education should have the long term effects that are often found in experimental studies. In terms of early cognitive outcomes, the mechanism seems clearer: programs which focus on academic skills such as early literacy and numeracy should directly affect children's early cognitive scores. However, given the research that seems to suggest the

early cognitive effects fade out (Haskins 1989; Currie et al 2002; Barnett 1995), these cognitive effects are often short lived as children who initially are behind catch up. Taken with a positive spin, this means children who do not experience early childhood education are "catching up." How then can we explain the long term effects of high quality experimental preschools on extremely disadvantaged children, including reduced retention and better social outcomes (Duncan, Ludwig, and Magnuson 2007; Belfield & Levin 2007; Lowenstein 2011)? We might expect these outcomes to be found for more generic preschool and for a wider range of children, but without a plausible mechanism, these associations can seem like nothing more than fishing for significant coefficients, or a consequence of selection into these experiences, versus an expectation and hypothesis based on sound theoretical reasoning.

Therefore, this dissertation hopes to advance one such possible mechanism: school capital. School capital is conceptualized as a personal resource that includes behaviors and attitudes conducive to school culture including attention and self control. These skills are socialized in children through institutions other than schooling, such as the family, but they are also reinforced by early childhood education. The particular behaviors I theorize to be central, such as waiting for one's turn to speak, remembering directions, and ignoring distractions are governed by a child's level of "executive function." Executive function is one's ability to manage attention, maintain tasks in their working memory, and resist impulses. Neuroscientific research shows the areas of the brain devoted to executive function are most sensitive in the preschool years (Zelazo and Carlson 2012; McClellan and Cameron 2012), meaning preschool interventions happen during this sensitive period. Executive function has been linked to positive academic outcomes (Diamond et al 2007; Clark, Pritchard, and Woodward 2010), but I assert that the behaviors associated with executive function become incredibly important in the school

context, where interactions with teaching staff determine a child's educational trajectory. Executive function, in and of itself, increases learning in children, but also ensures the child has more positive interactions with teachers and the institution of school. These positive interactions are theorized to lead to a feedback loop, where teachers' positive assessments of students lead to greater student identification with school and greater school success. Therefore, while cognitive effects may fade out, long term positive educational and life outcomes are likely due to positive attachment to school, and to the reinforcement of the behaviors associated with executive function, namely self-regulation.

The behaviors associated with executive function when deployed in school contexts, signal to teachers and other staff that a child is a "good student" and "ready to learn" and makes the process of inquiring academic skills quicker (Entiwisle et al. 2005; Entwisle and Hayduk 1982; Entwisle et al. 1986; Hart 2003), both because children with these skills are more likely to meet the demands placed on them from the way our schools are organized, and because they are more likely to receive positive attention and encouragement from their teachers. At the same time, the converse would be true. Children who enter school being labeled as "troublemakers" because they have not received as much of the school capital resources in their early environment, are likely to have negative interactions with school and to start the process of school disengagement early in the pipeline. Further, they may never be equipped with the skills associated with executive function, because K-12 schooling focuses on teaching skills and knowledge, not self-regulation. Therefore, early development of executive function, its relationship to early childhood education, and how exactly this process works to influence adolescent and adult outcomes is an important process to understand, especially since developmental psychology and cognitive neuroscience tell us the early years are so consequential

for later life. In this way, my dissertation is concerned not just with the question of if early childhood education has long term effects, but also with the question of why. Both Chapter 4 and Chapter 5 attempt to examine "school capital" using different datasets and different age groups. This represents an important extension of prior research.

My findings indicate that preschool does have the potential to lead to positive outcomes, but that these positive outcomes occur under certain conditions. Preschool has long lasting cognitive effects when the program is tuition based, whether or not the parent or other entity (e.g. subsidy) pays for the program. This indicates that program quality is key to obtaining positive results. Not all preschool experiences are substitutable and only those of the highest quality are associated with long term outcomes. Further, it appears that preschool is more effective when children attend only a moderate amount of hours. Thus, intensity of a program is also important. Perhaps once children attend preschool for many hours a day the experience ends up being more similar to daycare, with the quality of educational activities being diminished. More investigation of this counterintuitive effect of intensity should use qualitative methods to understand whether high intensity "preschools" are qualitatively similar to low intensity preschools when it comes to teacher child interaction, curricular focus, etc. While in the analysis of the preschool's relationship with college going I am not able to examine type of preschool in a nuanced way, I still find that children who attended preschool are more likely to enroll in and graduate from college. I would expect the effects to differ across the intensity and quality of program, just as the effects differed for cognitive outcomes through middle school. The consistent theme from both datasets is that preschool has the potential to lead to a greater likelihood of success in school, but that program quality and intensity matter.

I also find that the long term effects of preschool do not differ across background characteristics. Children from all racial backgrounds benefit equally over the long term from early learning experiences, specifically 8th grade achievement and retention over elementary and middle school. Further, children of all levels of parental education also benefit from the program across the same outcomes. While this indicates equitable outcomes for children from different backgrounds, it also suggests that preschool may not serve to close the achievement gap. If preschool is viewed as an opportunity to close gaps or equalize achievement levels, then supports across all of children's early experiences, birth to kindergarten, would be required to ensure equal opportunity to succeed. Also, while preschool experiences may keep gaps from being even wider, they are likely to do so without closing them. However, more study of whether and how preschool could serve to equalize opportunities, if that is truly the goal of that policy, should be undertaken.

Unlike past research, my analyses and data indicate no positive long term effects of Head Start. After carefully controlling for selection variables I do not find a negative effect on test scores, but in the college going analysis in Chapter 5 I do find a significant negative effect on four year college graduation. Overall I fail to find a positive long term effect of Head Start. Data limitations may be to blame for the lack of positive results, and for negative results, since it is difficult to find a sufficiently disadvantaged comparison group for children in Head Start (Magnuson et al 2007). Nevertheless, my analyses seem to agree that Head Start does not influence long term cognitive outcomes and may be negatively associated with educational attainment. Since I found that program quality and intensity matter, perhaps certain types of Head Start are more effective than other types of Head Start. While Head Start is seen as a single program, there is still likely to be variation within the category. Future research may need to

identify under which conditions Head Start does have long term impacts, and investigate the diversity that is present within Head Start centers, but this was out of the scope of this study.

These findings together have implications for the achievement gap. Intensity and quality matter: moderate intensity of preschool and higher quality programs lead to better outcomes. Further, when compared to preschool, Head Start appears to be less effective in leading to positive outcomes. The troubling fact is that children are inequitably sorted among early childhood educational programs, with disadvantaged children accessing less effective types of care. My analyses indicate that low income and black children are much more likely to access Head Start than other racial groups, a program which seems less effective than preschool, and low-income, Hispanic, and Native Hawaiian and Pacific Islander children are much more likely than whites to not access preschool and chose home care. Further, when minority children do access preschools, they access the types that are not associated with the best outcomes. They tend to attend care for much longer hours, 7.6 more hours a week for African Americans, which is associated with weaker cognitive boosts. Further, when they do access preschool, they tend to attend programs that are of lower quality (as indicated by charging a fee). While I find little in the way of differential effects of preschool across racial and socioeconomic groups, the fact that in a marketplace of preschool options minority and low income children access lower quality care is likely to contribute to race and class stratification.

School capital as conceptualized in this dissertation appears to be a plausible mechanism by which the effects of preschool operate. Using teacher reports of children's kindergarten approaches to learning (i.e. their attention and self-regulation) completely explained the 8th grade preschool effect. The approaches to learning scale measures teachers' assessments of behaviors associated with executive function, such as staying on task and ignoring distractions. Teacher

ratings of these behaviors, taken during the fall of kindergarten, are highly associated with test scores in 8th grade and explain the preschool effect completely. Further, when parent assessments of very similar behaviors, executive function more generally, are used instead the mediation of the preschool effect does not occur. Parent ratings of global executive function related behaviors taken during the kindergarten year do significantly predict 8th grade outcomes. However, the parent ratings do not attenuate the preschool effect. When both parent and teacher ratings are added to the model, the importance of teacher ratings becomes clear. Net of each other, and of the robust set of controls, the relationship between teacher ratings and 8th grade scores is much stronger than for parent ratings.[21] Additionally, only the teacher ratings are found to mediate the effect of preschool. This evidence lends support to the theory that preschool increases later achievement and long term positive outcomes through smoothing the transition to school and leading to more positive teacher labeling of students.

I theorize that teacher signaling and the feedback loop that is created when teachers see children as ready to learn can have real long lasting impacts. It allows children to identify and engage with school, and encourages the continued development and refinement of executive function itself. Children who can signal to their teachers that they possess the ability to self-regulate—to behave in the way that their teachers desire—gain an instant advantage in school. Further, this advantage is not just because these students possess that self-control. While that is an advantage in itself, as the parent ratings show, the gift of preschool is that the children are thought of as better behaved by their teachers.

However, I was unable to continue to trace out that advantage in the chapter on college going. In theory, early positive labeling and encouragement should lead to greater identification with school and confidence in one's abilities. Unfortunately, I found no plausible mechanism by

[21] Teacher and parent ratings are on the same 1 to 4 scale, and are only correlated at 0.22.

which early learning experiences affected college related outcomes, even when testing possible self concept pathways including locus of control and self esteem. The best analysis for tracing this mechanism through later outcomes such as college going would be to include teacher ratings throughout a child's K-12 career, their academic confidence and self concept, and their sense of belonging at school. Without such measures available in the UW-BHS dataset, I was able to use related measures, but they did not mediate the effect of preschool. Without teacher ratings and student identity measures in the study of college attendance, Chapter 5 suffered from weak measurement of the concepts in my conceptual model. Even so, my conceptual model offers a novel and plausible mechanism by which early childhood education influences educational outcomes, and how stratification in our educational system occurs more generally.

The lack of long term mediation may be due to a number of reasons. First, I was not able to directly measure school capital in Chapter 5, because I lacked teacher perceptions of students or students' own reports of their executive function related behaviors (e.g. attention, self-control). Instead, I used attitudinal measures that were theorized to be influenced by positive early school transitions and teacher feedback, namely locus of control and self-esteem. The drawback of these measures is that they are not school specific. Perhaps with measures of one's academic self-concept, sense of belonging at school, and perceptions of acceptance by teachers would explain the preschool effect. Future longitudinal studies of the transition to college should be sure to include measures of these constructs, as they are conceptually quite important.

Another explanation is that differences in school capital may be ameliorated over time, shifting teacher perceptions of students, such that between middle school and college graduation they no longer matter. Early teacher perceptions may smooth the transition to elementary school, but may not drive outcomes beyond adolescence. Perhaps school capital is best measured

throughout a child's educational career, allowing the analysis of the ebbs and flows of such behaviors and skills over time. While early childhood is a critical period in the development of executive function, the cognitive control which allows for school capital, it continues to develop through early adulthood. Therefore, measuring it at multiple points in time, and relating it to measures of achievement at multiple points in time, is a logical next step for future research. Further, the question of school capital and how it is best measured is an important one for future research to explore, since such strong evidence of school capital as a mediator of preschool's influence on cognitive skills through 8th grade is found in my study. Further, school capital represents an important attempt to theorize about the mechanisms through which early childhood education advantage operates, and other scholars with diverse backgrounds could elevate such a theoretical discussion.

This study had a number of notable limitations. Attrition of both the ECLS-K and UW-BHS respondents over time limits my ability to track outcomes longitudinally. The lack of data on students lost to follow up, most especially those disadvantaged students who may not have received any early learning intervention, could lead to biased inferences. Further, with the UW-BHS sample, students were surveyed in the spring of their senior years, after a significant portion of students have already dropped out. Therefore, UW-BHS students represent a select sample and do not represent a complete picture of the students who walked through the school doors at the beginning of kindergarten. Additionally, parent self-reports of enrollments in early childhood education in the ECLS-K, and differences in parent ability to correctly categorize the care received as Head Start, preschool, or daycare, may bias results. If parents who are more disadvantaged are more likely to misclassify their child's early educational experiences, this might lead to incorrect estimates. A related limitation of the UW-BHS data is that children self-

report their own attendance retrospectively which may also lead to bias due to misremembering. Further, as mentioned above when discussing school capital, the measures available in each in the UW-BHS dataset to capture and operationalize school capital and its consequences do not closely align with the concept.

Finally and most importantly, using observational data always is met with the danger of unobserved heterogeneity. Unobservables may still explain the early childhood education effects found in this study, though I am confident that I used the most robust set of controls available in each dataset. However, the set of control measures was much weaker in the UW-BHS dataset, leading to caution in interpreting the results in Chapter 5. The lack of ability to control sufficiently for social class and other unobservables that determine the selection into preschool means that associations with college going may in fact be inflated. At the same time, inferences about cognitive effects through 8th grade and on the importance of school capital are based on much stronger data from the ECLS-K and better modeling strategies. This study was undertaken because of the continued reliance on experimental studies of early childhood education, and the lack of generalizability that comes from such tightly controlled, narrowly sampled, temporally bound studies. However, observational studies also come with hazards, the most major of which is the role of unobservables. As such, more research needs to be done using a variety of data sources and analysis methodologies in order to understand the long term impacts of early childhood education.

Future research should continue to take seriously many of the issues raised in this dissertation. For example, the mechanisms by which researchers believe that early childhood education is influencing later outcomes remains an important area of theorizing and of empirical study. Future researchers may continue to investigate ‘school capital’ as a mechanism, by both

refining the conceptualization of the construct, but also through discovering creative ways to measure the construct. Further, this research should continue to specify the path through which early success in school and positive teacher perceptions influences a child's own sense of self. Internalizing such teacher perceptions into a child's sense understanding and identity is conceptually important, but more clarity in that process and better measurement of the process is called for. Future research should focus on understanding how teacher feedback and labeling influence children's self concepts and engagement in school, over time and throughout schooling. One limitation of this study was the operationalization of school capital, especially when trying to trace its effects into high school and beyond. As new studies are conducted and new data collected, researchers should consider seriously how to accurately measure school capital. This research was limited by the data available, so as more longitudinal studies are undertaken, prioritizing parent and teacher reports of self-regulation and school capital, as well as effective measures of students' school identities and attachment to school is essential. Early interactions with the institution of school matter, and I theorize that disengagement from school happens much earlier than once thought. However, these assertions remain theoretical, unless we begin to collect quality data that is able to examine these important constructs longitudinally.

Additionally, future researchers should also continue to theorize other mechanisms through which early childhood education influences later outcomes. Perhaps certain mechanisms explain the cognitive effects while others explain the long term social effects. Perhaps mechanisms depend on the composition of the school or the characteristics of the teachers. Perhaps preschool actually influences parent behaviors and this is the pathway through which early learning advantage is doled out. Without understanding the mechanisms through which successful programs influence long term outcomes—without understanding why programs

work—it is difficult to scale up existing programs or design new ones, because the reason for success, and what to do to replicate that success, is unclear.

Future research should also continue to investigate how parents make early education choices in the year before kindergarten. While I find that mother's education is a critical predictor of enrollment in preschool and in Head Start eligible families deciding to enroll in preschool (not Head Start), it is unclear why this is the case. Questions about how and why certain childcare choices are made, across ascriptive background variables, are best studied through rich qualitative methods that were outside the scope of this dissertation. However, future researchers could uncover much about how and why families make certain educational decisions throughout a child's life, which could be influential for understanding much about schooling decisions in the United States.

Policymakers, such as President Obama, should take heart that the effects of preschool are supported in my study, but should also understand that only under certain circumstances should positive outcomes be expected. Program quality and intensity matter. Programs that are more expensive, due to well-trained staff and better resources, are going to have the most long lasting effects. If the goal of early education policy is to replicate the long lasting successes of experiments like the Abecedarian Project, then replication of the level of quality of these programs is incredibly important. Lower quality programs available to families in the preschool marketplace do not appear to have effects beyond the early grades, while higher quality programs do. A wasteful investment would be to give children more access to low quality preschool, because there would be little to no return on such investment. Further, too much of a good thing is a bad thing. Children who attended preschools for a moderate amount of time, even when controlling for background factors, saw the strongest and most long lasting results.

Therefore, preschool is not a solution to the childcare problem that families face as more women are employed. If the best outcomes are found when children attend preschool for fewer than 20 hours a week, policy makers must think about what happens to children during the other hours when their parents work.

Additionally, it appears preschool programs may work because they offer children school capital which allows them to succeed in school. How best to instill children with school capital is, in fact, an unanswered question. How can we encourage the development of the prefrontal cortex in young children during sensitive periods of brain development? How can we encourage executive function and introduce the behaviors that teachers look for in their early students before they enter school? Self regulation seems to be central to success in school and later life, and it relates directly to behaviors observed by teachers when making assessments of students. Clearly, preschools can increase executive function (see Diamond et al 2007), but are there other perhaps cheaper avenues? Should preschools focus more on numeracy and literacy or executive function development? There is so much more research needed on how and why preschool works that takes into account mechanisms like school capital before the right policy actions can be selected.

Finally, when families try to gain resources on the open market, in this case secure preschool care for their children, disadvantaged families find themselves in the lowest quality types of care. Further, parents show different tastes for type of care due to educational background and ascriptive characteristics such as race. Therefore, any preschool initiatives meant to close the achievement gap must ensure the programs offered all clear a high bar of quality, because the worst off lose when there is variability in the marketplace. Further, if parents from various backgrounds have aversion to care outside of the home and are likely not to enroll

in such programs when offered, policy makers must consider other avenues through which to instill in children the skills they need to begin kindergarten ready and transition to school smoothly. Preschool can be a lever through which educational disadvantage associated with race and class with can be ameliorated. However, as with any other policy, attention to detail and nuance will guarantee the best outcomes.

References

Alexander, K. L., Entwisle, D. R., & Horsey, C. S. (1997). From first grade forward: Early foundations of high school dropout. *Sociology of education*, 87-107.

Alexander, K. L., Entwisle, D. R., & Dauber, S. L. (1993). First-grade classroom behavior: Its short-and long-term consequences for school performance. *Child Development*, *64*(3), 801-814.

Alexander, K. L., Entwisle, D. R., & Dauber, S. L. (2003). *On the success of failure: A reassessment of the effects of retention in the primary school grades*. Cambridge University Press.

Atkinson, A. M. (1994). Rural and urban families' use of child care. *Family relations*, *43*.

Augustine, J. M., Cavanagh, S. E., & Crosnoe, R. (2009). Maternal education, early child care and the reproduction of advantage. *Social Forces*, *88*(1), 1-29.

Bankston III, C. L., & Zhou, M. (2002). Social capital as process: The meanings and problems of a theoretical metaphor. *Sociological Inquiry*, *72*(2), 285-317.

Barnett, W. S., & Ackerman, D. J. (2006). Costs, benefits, and long-term effects of early care and education programs: Recommendations and cautions for community developers. *Community Development*, *37*(2), 86-100.

Barnett, W. S., & Masse, L. N. (2007). Comparative benefit–cost analysis of the Abecedarian program and its policy implications. *Economics of Education Review*, *26*(1), 113-125.

Barnett, W. S., & Belfield, C. R. (2006). Early childhood development and social mobility. *The future of children*, *16*(2), 73-98.

Barnett, W. S. (1995). Long-term effects of early childhood programs on cognitive and school

outcomes. *The future of children*, 25-50.

Barnett, W. S. (2003). Better Teachers, Better Preschools: Student Achievement Linked to Teacher Qualifications. NIEER Preschool Policy Matters, Issue 2.

Belfield, C. R., Nores, M., Barnett, S., & Schweinhart, L. (2006). The High/Scope Perry Preschool Program Cost–Benefit Analysis Using Data from the Age-40 Followup. *Journal of Human Resources*, *41*(1), 162-190.

Belfield, C. R., & Levin, H. M. (2007). *The price we pay: Economic and social consequences of inadequate education*. Brookings Inst Press.

Blair, C. (2002). School readiness: Integrating cognition and emotion in a neurobiological conceptualization of children's functioning at school entry. *American Psychologist*, *57*(2), 111.

Blair, C., & Diamond, A. (2008). Biological processes in prevention and intervention: The promotion of self-regulation as a means of preventing school failure. *Development and psychopathology*, *20*(03), 899-911.

Blakemore, S. J., & Choudhury, S. (2006). Development of the adolescent brain: implications for executive function and social cognition. *Journal of child psychology and psychiatry*, *47*(3-4), 296-312.

Blau, D. M. (1991). The quality of child care: An economic perspective. *The economics of child care*, 145-174.

Bloom, B. S. (1964). *Stability and change in human characteristics* (p. 88). New York: Wiley.

Bourdieu, P. (1984). *Distinction: A social critique of the judgment of taste*. Harvard University Press.

Bourdieu, P., & Passeron, J. C. (1977). Reproduction in education, culture and society. *Trans.*

Nice, R. London: Sage.

Bowles, S. G. H.(1976) Schooling in Capitalist America.

Brandon, P. D. (2000). Child care utilization among working mothers raising children wit disabilities. *Journal of Family and Economic Issues*, *21*(4), 343-364.

Brandon, P. D. (2004). The Child Care Arrangements of Preschool-Age Children in Immigrant Families in the United States. *International Migration*, *42*(1), 65-87

Bronfenbrenner, U. (1995). Developmental ecology through space and time: A future perspective. *Examining lives in context: Perspectives on the ecology of human development*, *619*, 647.

Campbell, F. A., & Ramey, C. T. (1995). Cognitive and school outcomes for high-risk African-American students at middle adolescence: Positive effects of early intervention. *American Educational Research Journal*, *32*(4), 743-772.

Campbell, F. A., Pungello, E. P., Burchinal, M., Kainz, K., Pan, Y., Wasik, B. H., & Ramey, C. T. (2012). Adult outcomes as a function of an early childhood educational program: An Abecedarian Project follow-up. *Developmental Psychology*, *48*(4), 1033.

Camilli, G., Vargas, S., Ryan, S., & Barnett, W. S. (2010). Meta-analysis of the effects of early education interventions on cognitive and social development. *The Teachers College Record*, *112*(3).

Capizzano, J. (2000). Child care arrangements for children under five: Variation across states.

Clark, C. A., Pritchard, V. E., & Woodward, L. J. (2010). Preschool executive functioning abilities predict early mathematics achievement. *Developmental psychology*, *46*(5), 1176.

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2009). The academic achievement gap in grades 3 to 8. *The Review of Economics and Statistics*, *91*(2), 398-419.

Coleman, J. S., Campbell, E. Q., Hobson, C. J., McPartland, J., Mood, A. M., Weinfeld, F. D., … & Gardner, J. W. (1966). Equality of Education .*Opportunity, Washington: DC. US Government Printing. Office*.

Consortium for Longitudinal Studies. (1983). *As the twig is bent—lasting effects of preschool programs*. Hillsdale, N.J: L. Erlbaum Associates.

Cunha, F., & Heckman, J. J. (January 01, 2009). The Economics and Psychology of Inequality and Human Development. *Journal of the European Economic Association, 7*, 2-3.

Currie, J., & Thomas, D. (June 01, 1995). Does Head Start Make a Difference?. *The American Economic Review*, *85*, 3, 341-364.

Currie, J. (2001). Early childhood education programs. *Journal of Economic perspectives*, 213-238.

Diamond, A., Barnett, W. S., Thomas, J., & Munro, S. (2007). Preschool program improves cognitive control. *Science (New York, NY)*, *318*(5855), 1387.

Dornbusch, S. M., Ritter, P. L., Leiderman, P. H., Roberts, D. F., & Fraleigh, M. J. (1987). The relation of parenting style to adolescent school performance. *Child development*, 1244-1257.

Duncan, G. J., & Magnuson, K. (2011). The nature and impact of early achievement skills, attention skills, and behavior problems. *Whither opportunity*, 47-69.

Duncan, G. J., & Magnuson, K. A. (2005). Can family socioeconomic resources account for racial and ethnic test score gaps?. *The future of children*, *15*(1), 35-54.

Duncan, G. J., Ludwig, J., & Magnuson, K. A. (2007). Reducing poverty through preschool interventions. *The Future of Children*, *17*(2), 143-160.

Duncan, G. J., & Brooks-Gunn, J. (Eds.). (1997). *Consequences of growing up poor*. Russell

Sage Foundation Publications.

Elder Jr, G. H. (1995). The life course paradigm: Social change and individual development.

Elder Jr, G. H. (1999). *Children of the Great Depression: Social change in life experience* . Westview Press.

Entwisle, D. R., Alexander, K. L., & Olson, L. S. (2005). First Grade and Educational Attainment by Age 22: A New Story1. *American Journal of Sociology*, *110*(5), 1458-1502.

Entwisle, D. R., & Hayduk, L. A. (1988). Lasting effects of elementary school. *Sociology of Education*, 147-159.

Entwisle, D. R., Alexander, K. L., Cadigan, D., & Pallas, A. (1986). The schooling process in first grade: Two samples a decade apart. *American Educational Research Journal*, *23*(4), 587-613.

Farkas, G. (2003). Cognitive skills and noncognitive traits and behaviors in stratification processes. *Annual Review of Sociology*, 541-562.

Fuller, B., Holloway, S. D., & Liang, X. (1996). Family selection of child-care centers: The influence of household support, ethnicity, and parental practices. *Child Development*, *67*(6), 3320-3337.

Fryer Jr, R. G., & Levitt, S. D. (2004). Understanding the black-white test score gap in the first two years of school. *Review of Economics and Statistics*, *86*(2), 447-464.

Garces, E., Thomas, D., & Currie, J. (2002). Longer-Term Effects of Head Start. *American Economic Review*, *92*, 4.)

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

Gormley Jr, W., Gayer, T., Phillips, D., & Dawson, B. (2004). *The effects of Oklahoma's universal pre-kindergarten program on school readiness*. Washington, DC: Georgetown University, Center for Research on Children in the US.

Guo, G., & Harris, K. M. (2000). The mechanisms mediating the effects of poverty on children's intellectual development. *Demography*, *37*(4), 431-447.

Halle, T., Forry, N., Hair, E., Perper, K., Wandner, L., Wessel, J., & Schultz, T. (2009). Disparities in early learning and development: lessons from the Early Childhood Longitudinal Study–Birth Cohort (ECLS-B). *Washington, DC: Child Trends*.

Hair, E., Halle, T., Terry-Humen, E., Lavelle, B., & Calkins, J. (2006). Children's school readiness in the ECLS-K: Predictions to academic, health, and social outcomes in first grade. *Early Childhood Research Quarterly*, *21*(4), 431-454.

Hart, D., R. Atkins, and S. Fegley. 2003. "Personality and Development in Childhood." *Monographs of the Society for Research in Child Development* 68 (272): 1–108.

Haskins, R. (1989). Beyond metaphor: The efficacy of early childhood education. *American Psychologist*, *44*(2), 274.

Heckman, J. J. (2006). Skill formation and the economics of investing in disadvantaged children. *Science*, *312*(5782), 1900-1902.

Heckman, J. J., & Masterov, D. V. (2007). The productivity argument for investing in young children. *Applied Economic Perspectives and Policy*, *29*(3), 446-493.

Heckman, J. J., & Rubinstein, Y. (2001). The importance of noncognitive skills: Lessons from the GED testing program. *The American Economic Review*,*91*(2), 145-149.

Heckman, J. J., Stixrud, J., & Urzua, S. (2006). *The effects of cognitive and noncognitive*

abilities on labor market outcomes and social behavior (No. w12006). National Bureau of Economic Research.

Helburn, S. W. (1995). Cost, Quality and Child Outcomes in Child Care Centers. Technical Report, Public Report, and Executive Summary.

Hoover-Dempsey, K. V., Walker, J. M., Sandler, H. M., Whetsel, D., Green, C. L., Wilkins, A. S., & Closson, K. (2005). Why do parents become involved? Research findings and implications. *The Elementary School Journal*, *106*(2), 105-130.

Hunt, J. M. (1961). Intelligence and experience.

Jaeger, D. A., & Page, M. E. (1996). Degrees matter: New evidence on sheepskin effects in the returns to education. *The Review of Economics and Statistics*, *78*(4), 733-40.

Jencks, C & Phillip, M. (Eds.). (1998). *The black-white test score gap*. Brookings Institution Press.

Kao, G., & Thompson, J. (2003). Racial and ethnic stratification in educational achievement and attainment. *Annual review of sociology*, *29*, 417-442.

Karoly, L. A. (1998). *Investing in our children: What we know and don't know about the costs and benefits of early childhood interventions* (Vol. 898). Rand Corporation.

Keil, F. (2006). Cognitive science and cognitive development *Handbook of child psychology*.

Kelly, S. (2009). The black-white gap in mathematics course taking. *Sociology of Education*, *82*(1), 47-69.

Kim, J., & Fram, M. S. (2009). Profiles of choice: Parents' patterns of priority in child care decision-making. *Early Childhood Research Quarterly*, *24*(1), 77-91.

Knudsen, E. I. (2004). Sensitive periods in the development of the brain and behavior. *Journal of Cognitive Neuroscience*, *16*(8), 1412-1425.

Knudsen, E. I., Heckman, J. J., Cameron, J. L., & Shonkoff, J. P. (2006). Economic, neurobiological, and behavioral perspectives on building America's future workforce. *Proceedings of the National Academy of Sciences*, *103*(27), 10155-10162.

Lareau, A. (2003). Unequal childhoods: Race, class and family life. *Berkeley: University of California Press*.

Lee, J. (2002). Racial and ethnic achievement gap trends: Reversing the progress toward equity?. *Educational researcher*, *31*(1), 3-12.

Lee, V. E., & Loeb, S. (1995). Where do Head Start attendees end up? One reason why preschool effects fade out. *Educational evaluation and policy analysis*, *17*(1), 62-82.

Lee, V. E., & Burkam, D. T. (2002). *Inequality at the starting gate: Social background differences in achievement as children begin school*. Economic Policy Institute, 1660 L Street, NW, Suite 1200, Washington, DC 20036.

Lerner, R. M. (1996). Relative plasticity, integration, temporality, and diversity in human development: A developmental contextual perspective about theory, process, and method. *Developmental psychology*, *32*(4), 781.

Leibowitz, A., Waite, L. J., & Witsberger, C. (1988). Child care for preschoolers: Differences by child's age. *Demography*, *25*(2), 205-220.

Liang, X., Fuller, B., & Singer, J. D. (2000). Ethnic differences in child care selection: The influence of family structure, parental practices, and home language. *Early Childhood Research Quarterly*, *15*(3), 357-384.

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

Lowenstein, A. E. (2011). Early Care and Education as Educational Panacea: What Do We Really Know About Its Effectiveness?. *Educational Policy*, *25*(1), 92-114.

Ludwig, J., & Miller, D. L. (2007). Does Head Start improve children's life chances? Evidence from a regression discontinuity design. *The Quarterly Journal of Economics*, *122*(1), 159-208.

Ludwig, J., & Phillips, D. A. (2008). Long-term effects of Head Start on low-income children. *Annals of the New York Academy of Sciences*, *1136*(1), 257-268.

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

Magnuson, K., Lahaie, C., & Waldfogel, J. (2006). Preschool and School Readiness of Children of Immigrants*. *Social Science Quarterly*, *87*(5), 1241-1262.

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

Magnuson, K. A., Meyers, M. K., Ruhm, C. J., & Waldfogel, J. (2004). Inequality in preschool education and school readiness. *American educational research journal*, *41*(1), 115-157.

McLanahan, S., & Sandefur, G. (1994). Growing up with a single parent: What helps, what hurts. *Cambridge, MA: Harvard University Press*, *17*, 21.

McClelland, M. M., & Cameron, C. E. (2012). Self-regulation in early childhood: Improving conceptual clarity and developing ecologically valid measures. *Child Development Perspectives*, *6*(2), 136-142.

McLoyd, V. C. (1998). Socioeconomic disadvantage and child development. *American Psychologist*, *53*(2), 185.

Melhuish, E. C., Phan, M. B., Sylva, K., Sammons, P., Siraj-Blatchford, I., & Taggart, B. (2008).

Effects of the home learning environment and preschool center experience upon literacy and numeracy development in early primary school. *Journal of Social Issues, 64*(1), 95-114.

Meyers, M. K., & Jordan, L. P. (2006). Choice and accommodation in parental child care decisions. *Community Development, 37*(2), 53-70.

Moffitt, R. (1983). An economic model of welfare stigma. *The American Economic Review*, 1023-1035.

Mundkur, N. (2005). Neuroplasticity in children. *The Indian Journal of Pediatrics*, *72*(10), 855-857.

Mulligan, G. M., Brimhall, D., & West, J. (2005). Child Care and Early Education Arrangements of Infants, Toddlers, and Preschoolers: 2001. Statistical Analysis Report. NCES 2006-039. *National Center for Education Statistics*.

Nelson, C. A., Thomas, K. M., & Haan, M. (2006). Neural bases of cognitive development. *Handbook of child psychology*.

Neidell, M., & Waldfogel, J. (2009). Program participation of immigrant children: Evidence from the local availability of Head Start. *Economics of Education Review, 28*(6), 704-715.

O'Neill, J. (1990). The role of human capital in earnings differences between black and white men. *The Journal of Economic Perspectives*, 25-45.

Orr, A. J. (2003). Black-white differences in achievement: The importance of wealth. *Sociology of Education*, 281-304.

Perry, B. D. (2002). Childhood experience and the expression of genetic potential: What childhood neglect tells us about nature and nurture. *Brain and mind, 3*(1), 79-100.

Peyton, V., Jacobs, A., O'Brien, M., & Roy, C. (2001). Reasons for choosing child care: Associations with family factors, quality, and satisfaction. *Early childhood research quarterly*, *16*(2), 191-208.

Piaget, J. (1952). The origins of intelligence in children.

Phillips, D., Mekos, D., Scarr, S., McCartney, K., & Abbott–Shim, M. (2001). Within and beyond the classroom door: Assessing quality in child care centers. *Early Childhood Research Quarterly*, *15*(4), 475-496.

Phillips, M., & Chin, T. (2004). School inequality: What do we know. *Social inequality*, 467-519.

Portes, A., & Rumbaut, R. G. (2001). *Legacies: The story of the immigrant second generation*. Univ of California Press.

Ramey, C. T., & Ramey, S. L. (1998). Early intervention and early experience. *American psychologist*, *53*(2), 109.

Ripple, C. H., Gilliam, W. S., Chanana, N., & Zigler, E. (1999). Will fifty cooks spoil the broth? The debate over entrusting Head Start to the states. *American Psychologist*, *54*(5), 327.

Rolnick, A. (2014). Investing in Early Childhood Development is Smart Economic Development. *The Science of Early Brain Development: A Foundation for the Success of Our Children and the State Economy*.

Reynolds, A. J., Temple, J. A., White, B. A., Ou, S. R., & Robertson, D. L. (2011). Age 26 Cost–Benefit Analysis of the Child-Parent Center Early Education Program. *Child development*, *82*(1), 379-404.

Rosenberg, M. (1965). Society and the adolescent self-image.

Ross, C. E., & Broh, B. A. (2000). The roles of self-esteem and the sense of personal control in

the academic achievement process. *Sociology of Education*, 270-284.

Rothstein, R. (2004). Class and schools: Using social, economic, and educational reform to close the achievement gap. *Washington, DC: Economic Policy Institute*.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological monographs: General and applied*,*80*(1), 1.

Rury, J. L., & Saatcioglu, A. (2011). Suburban advantage: Opportunity hoarding and secondary attainment in the postwar metropolitan North. *American Journal of Education*, *117*(3), 307-342.

Shonkoff, J. P., & Meisels, S. J. (1990). Early childhood intervention: The evolution of a concept. *Handbook of early childhood intervention*, 3-31.

Sewell, W. H., Haller, A. O., & Ohlendorf, G. W. (1970). The educational and early occupational status attainment process: Replication and revision. *American Sociological Review*, 1014-1027.

Smolensky, E., & Gootman, J. A. (Eds.). (2003). *Working families and growing kids: Caring for children and adolescents*. National Academies Press.

Stolzenberg, R. M., & Waite, L. J. (1984). Local labor markets, children and labor force participation of wives. *Demography*, *21*(2), 157-170.

Thomas, M. S., & Knowland, V. (2009). Sensitive periods in brain development–implications for education policy. *European Psychiatric Review*, *2*(1), 17-20.

Tilly, C. (2000). Relational studies of inequality. *Contemporary Sociology*, 782-785.

Uttal, L. (1997). "Trust Your Instincts": Racial Ethnic and Class-Based Preferences in Employed Mothers' Childcare Choices. *Qualitative Sociology*,*20*(2), 253-274.

Woodhead, M. (1990). Psychology and the cultural construction of children's

needs. *Constructing and reconstructing childhood: Contemporary issues in the sociological study of childhood*, 60-77.

Zelazo, P. D., & Carlson, S. M. (2012). Hot and cool executive function in childhood and adolescence: Development and plasticity. *Child Development Perspectives*, *6*(4), 354-360.

Zigler, E., & Muenchow, S. (1994). *Head Start: The inside story of America's most successful educational experiment*. Basic Books.

Zigler, E., & Styfco, S. J. (1994). Head Start: Criticisms in a constructive context. *American Psychologist*, *49*(2), 127.

Zill, N., Resnick, G., Kim, K., O'Donnell, K., Sorongon, A., McKey, R. H., ... & D'Elio, M. A. (2003). Head Start FACES 2000: A Whole-Child Perspective on Program Performance. Fourth Progress Report.

Technical Appendix

The ECLS-K assesses participating children's academic development during the period from kindergarten to eighth grade. In order to measure gains over this span of time and reduce ceiling and floor effects on children's scores, researchers developed new assessment instruments for both math and reading. These instruments were adaptive in nature, with an initial routing test that could be scored quickly followed by a second stage test determined to be at the appropriate level for the child. Additionally, these assessment instruments were designed to overlap across levels so that a vertical scale (where all scores from kindergarten to eighth grade can be placed) could be developed. This utilization of a vertical scale matches the longitudinal design of the ECLS-K and allows for the creation of valid change scores over all years of the study. This document outlines the design of the assessment instruments, development of the assessment forms, and the item response theory scaling for longitudinal measurement of achievement.

Assessment Design

This section explains the design and structure of the ECLS-K assessments in reading and mathematics. The National Center for Education Statistics (NCES) consulted with a team of teachers, school curriculum specialists, and academics in order to design and develop assessment instruments for the ECLS-K. The goals of the development team were to create a group of assessments that allowed for the creation of a vertical scale in order calculate valid change scores and minimized the time, cost, and burden on the students and teachers. Since assessments were to be administered to very young children who had little experience in formal testing environments, the team decided use an individually administered adaptive design. The adaptive

design required the team to develop multiple test forms at each grade level that vary in their level of difficulty. In order to produce a vertical scale, the assessments must also have overlapping items on various forms within a grade, as well as across grades. For example, a math item may show up on the high level form in kindergarten, and the low level for in first grade. In order to place children who have taken different test forms on the same vertical scale, Item Response Theory (IRT) assumptions are used. Item Response Theory will be explained in a later section of this memo.

In order to create frameworks for the appropriate testing domains in the various grades, the ECLS-K drew from the work which had been done to create the National Assessment of Educational Progress (NAEP) fourth-grade test of 1992, 1994, and 1996. If there was no framework for a particular grade from NAEP, the ECLS-K sought advice from early elementary school educators and curriculum specialists. The ECLS-K determined the relative allocation of items that composed the assessments by consulting typical curricula for the various grades.

The ECLS-K test includes around 50 to 70 items in reading and math respectively. Content areas in math consisted of number sense, measurement, geometry, data, and algebra. Number sense was the dominant focus of both math curricula in the elementary school years and the ECLS-K. Content areas in reading included basic skills, vocabulary, initial understanding, developing interpretation, personal reflection, and demonstrating a critical stance. Reading items were split evenly between fiction and non-fiction texts.

Since language minorities were a special focus of the ECLS-K, an oral language development scale was used in order to determine whether students had enough oral English to complete English language tests. The ECLS-K used 3 of the six scales of the PreLAS 2000 form C (Duncan & DeAvila 1998) to serve as the English screening test for the English assessments.

A score of 37 items correct out of 60 total items on the Oral Language Development Scale (OLDS) was set as the minimum score needed to take the math and reading assessments in English. Children who scored 36 or below on the English OLDS were not given direct cognitive assessments unless their native language was Spanish. Spanish speakers with OLDS scores below 37 were given the Spanish language version of the math test and were not assessed in reading. Students who scored below 36 on the OLDS were rescreened at each round of data collection, and once the child reached a score of 37 or above, he or she was assessed in English for all later rounds of cognitive assessments. Additionally, since small numbers of children were found to require Spanish assessments at the end of first grade, and the sample was not freshened with new children after this time, children were not screened for oral English in the third grade or later.

Test Form Development

This section explains the creation of the actual test forms for kindergarten, first, and second grade. The ECLS-K worked with item writers from Educational Testing Service (ETS), elementary school curriculum specialists, and teachers to develop pools of possible items for each test. Items were taken or modified from published tests including the Peabody Individual Achievement Test-Revised (PIAT-R), Peabody Picture Vocabulary Test-Revised (PPVT-R), the Primary Test of Cognitive Skills (PTCS), the Test of Early Reading Ability (TERA-2), The Test of Early Mathematics Ability (TEMA-2), and the Woodcock-Johnson Test of Achievement-Revised (WJ-R). Every item was checked for appropriateness of content, difficulty, and sensitivity issues, and those that passed screening were put into test forms which were then field tested. The ECLS-K field tested approximately 100 to 120 items in each domain. In order to

examine construct validity of the reading items from the ECLS-K field test, a subset of children received the reading test from the Kaufman Test of Educational Achievement (KTEA). The ECLS-K reading item pool correlated mid- to upper- eighties with the KTEA, supporting the ECLS-K reading section's construct validity.

Items were assessment for fit, and about 10 to 15 percent exhibited an overall lack of fit. ECLS-K then attempted to modify and retain items. Items were also checked for Differential Item Functioning (DIF) for males compared to females and for Black and Hispanic students compared to White students. Items that were determined to be problematic for a certain focal group were dropped, while items which were thought to be tapping differential skill across groups were retained. IRT goodness-of-fit results indicated the creation of a vertical scale was possible. The majority of the children were able to retain attention and complete the exam, so concerns over test fatigue were allayed. Items were retained when there was good item analysis statistics and IRT parameters, when the item had no DIF problems, and showed increase in percent correct over time, for example, between kindergarten and first grade.

The final test forms were created as follows. The kindergarten and 1st grade reading test consisted of a 20-item routing section that was completed by all children. The child's score on the routing test determined which of three second-stage forms the child would complete. The easy form was made up of 18 items, the medium form was made up of 29 items, and a hard form was made up of 29 items. In order to create scaled scores, the test forms were partially made up of overlapping items. The kindergarten and 1st grade mathematics tests started with a 17 item routing test. The routing test was then used to determine which of three second-stage forms the child would complete. The easy form consisted of 18 items, the medium form consisted of 23 items, and the hard form consisted of 31 items. The third grade reading test consisted of a 15

item routing test, and a low second stage form with 24 items, middle second stage form with 39 items, and high second stage form with 42 items. The third grade math test consisted of a 17 item routing test, and 25 item low second stage form, 24 item middle second stage form, and 24 item high second stage form.

Initially, ECLS-K intended to retest students in 2nd grade. However, budget constraints forced researchers to drop testing of ECLS-K students in 2nd grade and therefore delayed retesting after the spring of 1st grade until the spring of 3rd grade. Since the IRT scale scores rely on having overlapping items in a domain in order to create a vertical scale, the lack of a 2nd grade data point was cause for concern. Therefore, reading and mathematics assessment data was collected from a "bridge sample" of 2nd graders. The 2nd grade assessment was fielded with a sample of approximately 900 non-ECLS second graders in 43 schools. The data collected from these 2nd graders was used to measure the ability of the average second grader in order to calibrate the K and 1st grade items and scores with the 3rd grade items and scores.

Item Response Theory Scaling

This section explains Item Response Theory (IRT), the main method used by the ECLS-K for creating longitudinally comparable achievement scores. In order to track achievement gains throughout the waves of the study, all test-forms from kindergarten to fifth grade must be calibrated on the same scale. In order to carry out this goal, ECLS-K used Item Response Theory (IRT) as detailed in Lord (1980). In order for IRT to be appropriate, the assessments to be calibrated must measure the same underlying factor (reading or mathematics) in all years. In order meet this requirement, ECLS-K assessments were designed so that they covered the same content areas, but required increased problem solving as children aged.

IRT is a method by which an individual's probability of answering an item correctly is estimated. This probability, the IRT assumptions hold, is a function of the individual's ability level on the construct measured by the item, and also of the characteristics of that particular test item. Specifically, the test items are rated for their "guess-ability," difficulty, and discrimination, or how well the item distinguishes between ability levels. The IRT logistic model uses three parameters corresponding to difficulty, guess-ability, and discrimination, along with the pattern of right, wrong, and blank answers to give each child at a particular ability level (θ). Then, using an individual's ability level based on their answers to a small number of test items, a probability of answering any item correctly is calculated. The following equation gives the probability of a correct answer on item *i*:

$$P_i(\theta) = c_i + \frac{(1 - c_i)}{1 + e^{-1.702 * a_i (\theta - b_i)}}.$$

where θ = ability of the test taker

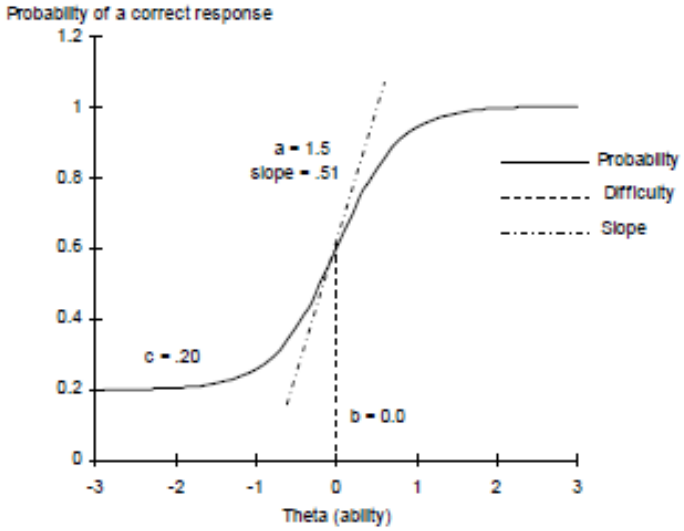
a_i = discrimination of item i, or how well the item distinguishes between ability levels at particular point.

b_i = difficulty of item i

c_i = "guess-ability" of item i

The "c" parameter gives the probability that a test taker with very low ability will get the item right. The "b" parameter represents the difficulty of the item. It also is equivalent to the point of inflection of the logistic function, which corresponds to a point on the horizontal ability (θ) axis. At that point, a test taker with ability θ has a probability of getting the answer right that is halfway between the guessing parameter "c" and 1. The "a" parameter, or item discrimination, is proportional to the slope of the logistic function at the point of inflection. An item with a steep slope is said to "discriminate well." Essentially, items with steep slopes are good at separating

those whose abilities are below the item's difficulty from those whose abilities are above the item's difficulty. Those with flatter slopes at the point of inflection are not as useful for separating test takers at the two levels of ability. The "a" or discrimination parameters should be over .50, and those above 1.0 are very good at discriminating. The "b" or difficulty parameters on the other hand, should span the level of abilities that are being measured, so as to use the items to hone in on an individual's level of ability. The "c" or guess-ability parameters are generally less than .25 for four choice items, but can vary. Overall, the ECLS-K parameters fall within these ranges.



NOTE: a = parameter for discrimination; b = parameter for difficulty; and c = parameter for guessing. The discrimination parameter is proportional to the slope (tangent) of the function at the point of inflection.

Taken from the Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K) Psychometric Report for the Third Grade Working Paper (August, 2005)

For the ECLS-K, test items were pooled over the years of testing, and were calibrated on the same scale as the ability estimates for the participants. Using the ability level calculated for an individual at each testing period, that individual's probability of a correct response to a particular test item in the pool can be calculated, even for testing items that have not been administered to the individual. In order to estimate the number correct responses for a set of

items, the ECLS-K simply sums the probabilities of correct answers for each item in the set. Therefore, the IRT scale scores included in the ECLS-K data are sums of probabilities of answering the entire pool of reading and math items correctly at a specific point in time.

References

Lord, F.M. (1980). *Applications of Item Response Theory to practical testing problems.* Hillsdale, NJ: Lawrence Erlbaum Publishers.

Pollack, J., Atkins-Burnett, S., Rock, D., and Weiss, M (2005). *Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K) Psychometric Report for the Third Grade.*

Rock, D. and J. Pollack (2002). *Early Childhood Longitudinal Study - Kindergarten Class of 1998-99 (ECLS-K), Psychometric Report for Kindergarten Through First Grade*.