The Pennsylvania State University

The Graduate School

College of Education

INEQUALITY FROM THE FIRST DAY OF SCHOOL: THE INFLUENCE OF TEACHERS' ACADEMIC INTENSITY AND SENSE OF RESPONSIBILITY ON THE LEARNING GROWTH GAP

A Dissertation in

Educational Theory and Policy

by

Minjong Youn

Submitted in Partial Fulfillment

of the Requirements

for the Degree of

Doctor of Philosophy

August 2012

The dissertation of Minjong Youn was reviewed and approved* by the following:

Mindy L. Kornhaber
Professor of Educational Theory and Policy
Dissertation Advisor
Chair of Committee
Professor-in-Charge of Educational Theory and Policy

Suet-Ling Pong
Professor of Educational Theory and Policy

Katerina Bodovski
Professor of Educational Theory and Policy

John Christman
Professor of Philosophy

Liang Zhang
Professor of Educational Theory and Policy

*Signatures are on file in the Graduate School

Abstract

The aim of this study is to investigate whether teachers' academic intensity and sense of responsibility for learning can moderate the growth of the gap in students' learning that is engendered by different levels of school readiness at the start of school. The data for this study comes from the Early Childhood Longitudinal Study-Kindergarten cohort (ECLS-K) released by the National Center for Education Statistics (NCES).

Much of the related literature on school readiness has highlighted the lasting impact of early school readiness on later achievement and what factors constitute the definition of school readiness. Interestingly, many policy attempts at helping students with low school readiness have focused on interventions before school, such as building pre-literacy skills, whereas a lack of attention has been devoted to how the school itself may benefit those students who enter school at a disadvantage. Thus, this study aims to merge two important but seldom integrated inquiries: the impact of school readiness on children's learning growth trajectory and the role of teachers' academic support and responsibility in students' learning progress.

Findings from this study suggest that children who enter school with low readiness (measured through math, reading, and approaches to learning scores) demonstrate consistently lower learning gains throughout their elementary school years. In addition, although teachers' academic intensity and sense of responsibility for learning increased the overall learning gain, only the responsibility of teachers appeared to moderate the math learning growth trajectory given different levels of school readiness at school entry. In addition, the benefit of school readiness for children with low readiness was cumulative across the elementary school years. Another noteworthy finding from this study is that while teachers appeared to have a lower sense of academic responsibility toward students with low readiness, these students did not in fact experience less academic intensity with their teachers. Based on these results the present study suggests a need for continuous support during the schooling years, as well as before the start of school, to compensate for a lower skill level at school entry.

Revealing the impact of teachers' academic intensity and responsibility for learning on those children with low school readiness could help to identify practices and attitudes that will benefit students who are behind at the entry of school. These findings will aid in developing policies and interventions targeted at improving learning in the early school years and thus enhance educational opportunities for socially and economically disadvantaged students. Indeed, this study emphasizes the importance of teachers' academic intensity and sense of responsibility for learning to enhance learning gains during the elementary school years for disadvantaged children and suggests that the school reform effort should be devoted to changing the school as a *community.*

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

The present study investigates which experiences in school settings can alter the learning growth trajectory of children with low readiness at school entry. Of particular interest is whether teachers' academic intensity and sense of responsibility for learning can contribute to closing the learning gap engendered by different levels of school readiness, and thus help those students with low readiness to overcome their initial deficits. To reveal the association of how within-school processes can benefit students with low school readiness, this study is grounded in two theoretical frameworks. The first one relates to the literature on the constituents of school readiness and its impact on children's learning gain; the second one to the moderating role of teachers' academic intensity and sense of responsibility for academically disadvantaged students. This study merges these two theoretical frameworks and examines whether teachers' academic support and sense of responsibility for learning may benefit students who start school with low readiness.

The question of how the subsequent elementary school experience can serve to overcome early deficits in school readiness has not been thoroughly investigated, although there has been substantial effort and interest invested in improving school readiness before school entry. Proponents of early investments emphasize that early intervention translates into long-term benefits for children and society (Heckman, 2011). Accordingly, state and federal support for early intervention programs have gained increasing popularity as a means of preparing children to be ready to learn at school entry. Head Start reforms, the Goals 2000: Educate America Act, and the expansion of state-funded prekindergarten and other intervention programs reflect these commitments to prepare children to be ready to learn by the time they enter school (Bowman, Donovan, & Burns, 2001; Committee for Economic Development, 2002; Wolfe & Scrivner, 2003). However, the extent to which this investment of public funds in early interventions may translate into long-term benefits in reducing the gap in learning cannot be determined solely by high levels of school readiness. It is also important to understand the degree to which subsequent school experiences contribute to reducing early disparities (Magnuson, Ruhm, & Waldfogel, 2007).

In this view, children who experienced initial deficits, regardless of whether they attended any intervention program, need continuous support during their years of schooling, as well as before they start school, to compensate for their lower level of skills at school entry (Downey, Broh, & von Hippel, 2004; Hamre & Pianta, 2005). That is, children with low readiness may fall further behind without an enriching learning environment, and it is hard to expect that a year or two of early intervention programs can completely alter a child's learning trajectory (Magnuson, Ruhm, & Waldfogel, 2007). Indeed, any advantage bestowed by an early education program (e.g., Head Start) may fade out if children are not exposed to a subsequent enriching learning environment, suggesting that the persistence of early intervention program effects is highly contingent upon the quality of the later school experience (Currie & Thomas, 2000; Magnuson, Ruhm, & Waldfogel, 2007; Barnett, 2011). This implies that the elementary school experience may play a pivotal role in reducing early academic disadvantages and maintaining the effectiveness of early intervention programs that were employed prior to the start of school.

However, there is a significant lack of evidence regarding exactly what kind of school environments children with low school readiness may need to overcome their initial deficits and catch up. Indeed, there is little evidence gathered about how within-school processes might benefit children who have experienced initial deficits long before school entry. The lack of research on how elementary schools can best serve less-prepared students may be partly because few longitudinal studies have collected the data on later school experiences. Consequently, the few studies in this area have not been able to identify those school experiences that may help to boost the learning growth trajectory over the long time span. From this perspective, the present study aims to merge two important but seldom-integrated inquiries: the impact of school readiness on children's learning growth trajectory during the elementary school years (from 1st through 5th grade) and the role of teachers' academic intensity and responsibility for students' learning progress. More specifically, this study will employ a large nationally representative dataset, the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K), to address the following questions:

1) Do students demonstrate any variation in their learning gains from 1st through 5th grade according to their different levels of readiness, after controlling for student and school characteristics? If there is variation, does the association between school readiness and learning gains continue or attenuate across the schooling years?

2) Do teachers' academic intensity and sense of responsibility for learning help reduce a math learning growth gap, given different levels of academic skills and learning-related behaviors at the entry to school?

3) Do students experience different levels of academic intensity and responsibility, depending on their level of school readiness at the time of entry to school?

To address these questions, this study focused on mathematics score gains during the elementary school years, since a number of studies have shown this measure to be less affected by the child's family demographic characteristics and is thus a more useful variable for understanding school influence. Furthermore, the math learning trajectory preceding middle school is critically important for predicting later academic success and failure (Alexander, Entwisle, & Horsey, 1997). Indeed, the entry into elementary school, and first grade in particular, is the transition period during which children start to experience different social contexts (i.e., higher academic expectations, educational sorting) and are expected to function in an institutional academic context (Entwisle & Alexander, 1993). This problem of a mismatch between the home and school culture, especially for disadvantaged students given their lesser extent of human, cultural, and economic capital at home, suggests a need to focus particular attention on disadvantaged children in order to facilitate their positive adaptation.

The current study focuses on the role of teachers' academic intensity and sense of responsibility for learning of students, considering the shared perceptions of teachers to be the school's embedded culture that can moderate the early deficits that exist at school entry. This broader focus on the school, rather than on the individual teacher's interactions with students, is particularly essential for examining the learning growth over a long time span because the shared beliefs and attitudes that characterize a school's culture may persist throughout the school years and translate into long-term benefits rather than dwindling after children change classrooms or teachers. Under this longitudinal approach, the school may serve as an important mechanism that moderates early learning deficits in math learning growth. Furthermore, the ECLS-K does not provide teacher or classroom information for every wave of data, at least for the elementary school years, which does not allow for tracking the change in children's teachers and classrooms each year. This difficulty is particularly crucial when examining the moderating impact of teachers on learning growth over a long time span, since the learning growth of children cannot then be adequately attributed to the particular teacher or classroom.

Concern about the continuing differences in school readiness and its impact on the learning growth gap has led researchers and government leaders to endorse pre-k intervention programs. However, the aim of this study is to examine whether students with low readiness can overcome their initial deficits by attending schools whose teachers exhibit high levels of academic intensity and sense of responsibility for learning. Understanding how the within-school processes, especially the efforts of teachers, may reduce the gap in learning progress given different levels of school readiness will contribute to developing effective policies and interventions to improve learning in the early school years.

Purpose of Study

The aim of this study is to investigate whether teachers' academic intensity and sense of responsibility for learning can moderate the growth of the gap in students' learning that is engendered by different levels of school readiness. To address this question of whether the schooling experience, characterized by the attitudes and practices of teachers, contributes to enhancing the learning growth trajectory of students with low readiness, the present study estimates the math learning growth trajectory of children with different levels of school readiness during the elementary school years. More specifically, the main objectives of this study are:

1) To estimate the impact of school readiness on the math learning growth trajectory during the elementary school years. For the present study, school readiness is defined as a construct of math skills, reading skills, and approaches to learning measured at kindergarten entry, following the findings of previous studies (Duncan et al., 2007). In

this way, the relative importance of each aspect of school readiness to learning growth can be estimated.

2) To examine whether teachers' academic intensity and sense of responsibility for learning contribute to math learning growth during the elementary school years and, if so, whether there is any significant interaction between teachers' academic support and responsibility as moderators of the growth of the learning gap created by school readiness.

3) To examine whether students are exposed to different levels of teachers' academic intensity and sense of responsibility for learning depending on their level of preparedness at school entry. The answer to this question provides evidence for how the learning experience of children is stratified depending on their level of school readiness during the elementary school years.

To address these objectives, three levels of Hierarchical Linear Growth Curve modeling, assessment nested within individual, and individual nested within school, were employed to estimate math learning gains during the elementary school years. The data for this study comes from the ECLS-K, which contains repeated observations of a nationally-representative sample of students. For the purpose of this study, three waves of data collection, from the spring of the 1st, 3rd, and 5th grades, were employed to examine the moderating role of teachers' academic intensity and sense of responsibility for learning on the learning growth of children with low school readiness. To this end, this study will wed two important but seldom-integrated lines of inquiry into how school readiness influences students' learning progress and whether teachers' academic intensity and willingness to take responsibility for their students may reduce the achievement gap engendered by different levels of school readiness at the start of school. This study is an attempt to answer the question of whether attending a school with higher academic intensity and responsibility makes a difference in the learning growth trajectory of a child with low readiness.

CHAPTER 2

LITERATURE REVIEW

The present study examines the extent to which variation in teachers' academic intensity and sense of responsibility for learning can compensate for lower levels of academic skills and behavior at school entry. Determining which subsequent school experiences can alter the learning trajectory of children with low readiness requires integrating three different research questions: 1) the impact of school readiness on children's learning growth trajectory, 2) the moderating role of teachers' academic intensity and sense of responsibility for learning in students' math learning progress, and 3) the varying exposure to academic intensity and responsibility depending on children's level of school readiness. Below, in the theoretical background section, I discuss how the question regarding the quality of the schooling experience for children with low school readiness has been rarely asked, and thus is still open. Then, theoretical and empirical studies related to these three research questions are reviewed in order to show the necessity and direction of the present study.

Theoretical Background

The search for the source of the inequality in educational outcomes among socioeconomic and demographic groups has been a salient subject over the past several decades. Research in this tradition has provided evidence that families of greater economic, cultural, and social means demonstrate their higher expectations for the educational success of their children by providing stimulating interactions and a learning environment that may support educational success. For example, one of the classic studies on social stratification and educational outcomes, the Wisconsin model, basically showed that socioeconomic status affects educational attainment and income through its effects on parental and peer influences on educational aspirations (Sewell et al., 1969, 1970; Sewell & Hauser, 1975). Moreover, different social reproduction theorists argue that cultural and social sources of inequality favor non-cognitive characteristics such as differences in habits, tastes, attitudes, preferences, and language use associated with high-status, making it more difficult for students from disadvantaged families to succeed in school (e.g., Bourdieu & Passeron, 1977). In addition, exposure to the social networks that allow students to access insights and information that can help them take full advantage of educational opportunities is also restricted to middle class families (Lareau, 2003).[1]

Research in this tradition illustrates that social structure shapes educational opportunity from an early age in life. Children from different socioeconomic backgrounds are exposed to different learning environments depending on the availability of human, social, economic, and cultural resources, thereby stratifying educational abilities even before children enter school. That is, the difference in resources in the early childhood experience plays a formative role in shaping school readiness and largely explains the skill gaps at school entry (Magnuson, Meyers, Ruhm, & Waldfogel, 2004). Children from families with economic and cultural deficiencies, for example, often experience less of the cognitive and language stimulation that facilitates learning development. Indeed, Duncan and Magnuson (2009) found that parental education, family income, family structure, and neighborhood conditions explained about half of a standard deviation of the test score gaps between White and minority students. A

[1] Relatively early studies on educational inequality and school effects appeared to concentrate on high schools or adolescents, given the interest in how youngsters from different social backgrounds (i.e., high vs. low SES, racial-ethnic groups) acquire educational credentials with different labor market values, so that whether they reproduce the social stratification of their parents or school functions as the stratification ladder. Thus, it was necessary that these studies concentrated more on the school-to-work transition to see how social structure affects educational stratification (Entwisle, & Alexander, 1993).

similar study indicated that about 40 percent of the variance in academic performance is explained by the low quality of the home learning environments (Smith, Brooks-Gunn, & Klebanov, 1997). These findings illustrate that children from disadvantaged families get off to an especially shaky start at the first grade transition, and this deficiency persists throughout the later schooling years. These gaps amount to insurmountable inequality once the children become adolescents (Phillips, Crouse, & Ralph, 1988; Ross, Smith, Salvin, & Madden, 1997; Stipek & Ryan, 1997; Ferguson, 1998; Jencks & Phillips, 1998; Alexander, Entwisle, & Kabbani, 2001; Heckman, 2011).

As a result, preparing children to be ready to learn from the first day of school became an important quest over the past few decades (Raver & Zigler, 2004). The increase in federal support and the adoption of state-level early intervention programs has been a response to this idea that improving school readiness at school entry will translate into long-term benefits for disadvantaged children and reduce inequality in educational outcomes. Empirical findings indicate that center-based care and preschool programs for 3- and 4-year olds raise academic preparedness and performance at school entry. In addition, the magnitudes of these benefits were particularly sizable for disadvantaged children. Although non-experimental studies do not consistently find long-term effects of these programs on academic achievement, experimental evaluations lend strong support to this line of argument, revealing the positive effect of early intervention programs on children's learning outcomes (Barnett, 2011).[2] One of the most popular includes research on the Perry Preschool program and the Abecedarian studies that employed randomized trials to document the effectiveness of early intervention programs on improving the reading and math achievement test scores (.33 SD) of 14-year-olds. Other positive impacts

[2] However, previous studies on Head Start and other large scale program evaluations showed that the positive effects dissipate after a few years (Barnett, 2011).

include lowering the rates of repeating grades and special education and the attainment of higher levels of education (for a detailed review see Barnett, 2011).

One common explanation for why intervention should target an early age is based on the idea that there is a sensitive and *'critical period'* for human development. Certain abilities are effectively manipulable at certain ages, and these sensitive periods come earlier in life for learning traits, but later in life for non-cognitive traits, given the slower development of the prefrontal cortex (Heckman, 2011). According to Jencks (1985), the rates of learning in terms of standardized tests during the early school years are ten times as great as they are in high school. These early learning skills may lead to self-reinforcing motivation to learn more, and therefore, are more likely to continue (Cunha, Heckman, Lochner, & Masterov, 2004; Heckman, 2011); therefore, the early skills of children evolve as the children accumulate knowledge (Cunha, Heckman, Lochner, & Masterov, 2006; Heckman, 2011).

This line of studies has commonly emphasized that early intervention may contribute to lessening this gap to a larger extent via early identification of a large number of children as compared to later remediation during the school years (Hooper et al., 2010). They argue that, on average, later remediation is less effective, in that the returns for the most disadvantaged children are lower than the returns for the more advantaged (Carneiro & Heckman, 2003). For example, Heckman (2008), in one of the most popular works in this vein, provided evidence for the importance of skills acquired via early intervention programs and suggested that early intervention lowers the cost of later investment. More specifically, if the return on intervention is productivity, the rate of this return is much greater when the intervention takes place at younger ages, given the plasticity of the young (Cunha, Heckman, & Schennach, 2010).

From this perspective, researchers and research associations (e.g., The National

Association for the Education of Young Children and the National Council of Teachers of Mathematics) have emphasized identifying the early academic skills and related behaviors that will potentially limit later academic success and creating environments that promote pre-literacy skills from an early age (Snow, Burns, & Griffin, 1998; Wang, & Goldschmidt, 2003; Duncan et al., 2007). Yet, interestingly, while there has been substantial effort and interest in improving school readiness before the entrance of school (e.g., pre-k, Head Start), there is a significant lack of evidence to indicate whether within-school processes during the schooling years may benefit those children with low school readiness. This underscores the need to extend the previous literature on school-effects and school readiness by investigating the potential of the school to benefit those students with low school readiness, specifically by identifying the type of teacher attitudes and support that may assist those children. From this perspective, the present study examines whether students with low readiness can overcome their initial deficits by attending schools whose teachers exhibit high levels of academic intensity and sense of responsibility for learning.

To address this research purpose, I integrate different theoretical perspectives and empirical evidence around each research question in order to indicate the necessity of the present study. The first section, regarding the first research question, reviews whether children demonstrate any variation in their learning growth trajectory depending on their level of school readiness at school entry. In particular, this section of review focuses on the influence of early academic skills and behaviors on children's later learning outcomes to identify those factors that need to be incorporated into the definition of school readiness. In section two, I illustrate the relevant evidence regarding the second research question that indicates the potential role of the school in enhancing the learning growth trajectory of disadvantaged students and suggests that teachers' academic intensity and sense of responsibility for learning are important for disadvantaged children to overcome their initial deficits in school readiness. Section three reviews the related literature regarding the third research question of whether children are exposed to a different schooling experience depending on their level of school readiness at school entry.

These reviews are intended to provide the theoretical foundation for the present study and at the same time point out some limitations of the previous studies. This study will thus also fill a gap in the literature on school readiness and school effects.

The Influence of School Readiness on Learning Outcomes

In this section, I review the literature related to the first research question on the influence of school readiness on children's learning growth. In particular, this section focuses on what factors are critical for later learning achievement and thus identifies factors that need to be integrated into the definition of school readiness.

Many of the school readiness studies are designed to determine which early measures can best explain later student achievement, aiming to identify the best predictor, so that those specific skills assessed by those measures can be modified prior to school entrance. The logic underlying this line of research is that if early acquisition of a specific domain of skills forecasts later achievement, it may be beneficial to add those skills to the definition of school readiness and encourage interventions aimed at promoting those skills prior to elementary school (Duncan et al., 2007). Yet, these studies do not offer a consensus as to what comprises school readiness. In general, two approaches have emerged in the current debate about what constitutes school readiness. One line of argument emphasizes the pre-literacy and math skills of children before school entry as the main component of school readiness (i.e., See Snow, Bruns, & Griffin, 1998; Magnuson et al., 2004). On the other hand, others suggest that a broad constellation of behaviors and skills enables children to learn in school (Rimm-Kaufman, Pianta, & Cox, 2000). These include student conduct, the ability to follow directions, and other nonacademic skills. This perspective suggests that children's emotional or social behavioral development is at least as important as their academic skills (Rimm-Kaufman, Pianta, & Cox, 2000; Dockett & Perry, 2001), or possibly more important, in predicting later achievement (Tramontana, Hooper, & Selzer, 1988; Schefer & McDermott, 1999; Lin, Lawrence, & Gorrel, 2003).

Following this line of argument, this section is divided into two subsections: 1) the association between children's behaviors and learning outcomes, and 2) the association between early academic skills and children's learning growth. This review is intended to suggest a theoretical argument on what are the important early indicators that need to be incorporated into the definition of school readiness.

Children's Behaviors and Academic Achievement

There is no consensus yet about which particular behavioral issues are the 'best' predictors of later achievement and therefore should be included in the definition of school readiness. The predictive relationship between children's status, in terms of emotional, social, or externalizing behaviors, is somewhat mixed, depending on the sample size, age of the child, the particular criterion used for assessing performance, and how and when the performance was assessed (See Tramontana, Hooper, & Selzer, 1998, for further review). Of those studies that find a significant effect on later achievement, the magnitude of the effect appeared to be small (Hooper et al., 2010). Moreover, an increasing number of studies indicate when behavioral problems are combined with learning-related behaviors, the impact of behavioral problems decreases or disappears (Duncan et al., 2007). Also, in another study based on the ECLS-K data, Bodovski & Youn (2011) found that when the four teacher-judged student behavior measures (approaches to learning, interpersonal behaviors, externalizing behaviors, and internalizing behavior problems)[3] are used together to predict later test scores or the net of prior test scores, approaches to learning is by far the most powerful predictor.

In contrast, accumulating research consistently suggested that learning-related behaviors measured at kindergarten entry are strongly associated with the children's achievement throughout the elementary school years, regardless of other behavioral indicators (Hooper et al., 2010; Bodovski & Youn, 2011). In particular, children with poor work-related skills began school performing worse on academic measures and continued to lag in later school years. Based on this finding, some argue that the effect of attention-related behavior is cumulative over the schooling years. According to one early study, a child's positive behaviors, related to task interest and classroom participation, can lead to a substantial increase in math scores by the end of the first and fourth grade years (Alexander, Entwisle, & Dauber, 1993). Specifically, greater levels of attention, task persistence, and active participation show the strongest associations with standardized test scores, independent of initial cognitive ability and prior basic skills (Horn & Packard, 1985; Tramontana, Hooper, & Selzer, 1988; Alexander, Entwisle, & Dauber, 1993; Finn & Pannozzo, 1995; Schaefer & McDermott, 1999; McClelland, Morrison, & Holmes, 2000; Yen,

[3] *Externalizing problem behaviors*: argues with others, fights with others, easily gets angry, acts impulsively, and disturbs ongoing activities. *Internalizing problem behaviors*: anxiety, loneliness, low self-esteem, and sadness. *Interpersonal behavior*: forming and maintaining friendships, getting along with others, comforting or helping other children, expressing feelings, ideas and opinions in a positive way, showing sensitivity to the feelings of others.

Konold, & McDerrnott, 2004; Duncan et al., 2007).

Furthermore, the association between learning-related behaviors and achievement appeared to persist throughout the middle school years. According to Duncan and his colleagues (Duncan et al., 2007), a study based on six different longitudinal data sets[4] revealed that the average effect size of attention-related skills on learning gain during the elementary schooling years is moderate, while the average effect sizes of externalizing and internalizing problem behaviors and social skills were close to zero. Interestingly, these relationships held universally for boys and girls and for children from both higher and lower socioeconomic backgrounds (Duncan et al., 2007). A consistent pattern of relationship was also reported in a replication study by Hooper and his colleagues (2010), indicating the importance of attention-related skills to learning growth from 3rd through 8th grade, relative to other problem behavior indicators. Based on such evidence, some researchers suggested that students vary widely along a learning-related behaviors spectrum at school entry, and they suggested that students from lower SES backgrounds and minority students could benefit from improved learning related behaviors in terms of higher academic achievement and reduced disparity in learning outcomes (Bodovski & Youn, 2011). These findings suggest the importance of learning-related behaviors, as the fundamental constituents of school readiness given their strong predictive relationship with later achievement compared to other types of behavioral problems (e.g., Kohn & Rosman, 1974; Stevenson et al., 1976).

[4] *The Early Childhood Longitudinal Study–Kindergarten Cohort* (ECLS-K), *National Longitudinal Survey of Youth* (NLSY), *the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development* (NICHD, SECCYD), *Infant Health and Development Program* (IHDP), *Montreal Longitudinal-Experimental Preschool Study* (MLEPS), *British Cohort Study* (BCS).

Children's Early Academic Skills and Academic Achievement

Early academic skills, basic literacy, and numeracy functions are the foundation for further learning development, as learning is a highly cumulative process that involves acquiring new skills and improving already-acquired skills (Duncan et al., 2007; Hooper et al., 2010). As a result, students with the lowest academic performance at school entry, on average, show the least gain during the elementary years compared to high academic performance groups of students (Bodovski & Farkas, 2007). Accordingly, the bulk of the evidence has shown that the level of a child's academic skills at school entry is strongly and positively related to later academic achievement, suggesting that how well a child initially starts the academic routine explains the ultimate group differences (e.g., Whites vs. Blacks) in later year academic performance (Stevenson & Newman, 1986; Alexander, Entwisle, & Horsey, 1997; Stipek & Ryan, 1997; La Paro & Pianta, 2000; Aunola, Leskinen, Lerkkanen, & Nurmi, 2004; Hair, Halle, Terry-Humen, Lavelle, & Calkins, 2006; Miles & Stipek, 2006; Duncan et al., 2007). In addition, the magnitude of the influence of initial academic skills at school entry on later achievement is so substantial that it erases potential differences in the quality of early childhood care, parenting, and full- and half-day kindergarten exposures (Chatterji, 2005).

The substantial influence of early academic skills at school entry on children's learning growth throughout their school years has been supported by different meta-analytic studies. According to one review based on 70 longitudinal studies, LaParo & Pianta (2000) indicated that the average effect size of prior academic ability on first grade outcomes is .49 and on second grade outcomes is .51. Other studies also supported this line of argument, indicating that early math skills was the strongest predictor of later math achievement, showing an average effect size of .34, followed by less powerful, but consistent evidence for language and reading skills .17 (Duncan et al., 2007; Hooper et al., 2010).

Interestingly, one common finding across these studies is that the ability in one domain of academic skills was found to be critical for academic performance in another domain in later years, at least in the early stages of learning development. Indeed, early reading skills were indicated as a powerful predictor of later math achievement and early math skills predict later reading achievement (Duncan et al., 2007; Hooper et al., 2010; Bodovski & Youn, 2011). In this regard, Hooper and his colleagues (2010), based on a relatively longer time span, from elementary through middle school, using NICHD, SECCYD, and ECLS-K found that there are indications of the importance of early expressive language skills to math, regardless of the demonstrated math ability and approaches to learning.

Another notable pattern of findings across these studies is that the predictive relationship of early academic skills and learning growth does not appear to be consistent throughout the school years. In other words, the impact of early academic skills tends to fluctuate as students progress through the school years. For example, Miles and Stipek (2006), using The School Transitions Study, a longitudinal, multisite study on development in childhood that followed approximately 400 low-income children and families from kindergarten through 5th grade, revealed that the strength of association increased as students proceeded toward the later grades, from 3rd through 5th grade relative to 1st through 3rd grade. It appears that the gap between weak- and well-performing children at the entry to school widens in each subsequent grade (Miles & Stipek, 2006; Jordan, Kaplan, Ramineni, & Locuniak, 2009). Reardon and Galindo (2009) suggested that the achievement gap trajectory among groups such as Hispanic and Black children narrows by roughly a third in the first 2 years of schooling but remains relatively stable for the next 4 years. These findings imply that, particularly in studying students' learning growth, the use of average achievement growth over long time spans (i.e., differences in test scores between 1st and 8th grade) could mask the varying influence of early academic skills and behaviors.

Moreover, much of the school readiness literature has not taken into account the role of the school in estimating the association between early academic skills and learning growth trajectories. Investigating the link between school experience and children's achievement is challenging because the effects may vary with children's background characteristics (Connor, Morriso, & Petrella, 2004; Magnuson, Ruhm, & Waldfogel, 2007). However, excluding the influence of school characteristics could lead to bias in the estimates. Furthermore, omitting school experience leaves the within-school process as a black box, so that little is known about the variation in the schooling experience of students with different readiness. However, some recent school effects literature has suggested the possibility that school experience may contribute to reducing the gap among students at school entry, which suggests that the school may serve as an important equalizer in reducing the learning growth gap. However, despite the empirical evidence highlighting the importance of school readiness at school entry for learning development, little empirical evidence is provided about how the within-school process could benefit students with low readiness at school entry.

To this end, previous studies, including meta-analytic studies and experimental and non-experimental studies, have suggested that early learning-related behaviors and early academic skills are the most predictive factors that need to be considered when examining the role of school readiness in future learning (Duncan et al., 2007). From this perspective, this study conceptualizes school readiness as a composite of learning-related behaviors and academic skills at school entry in estimating its influence on students' learning growth throughout the elementary school years. Furthermore, the present study examines whether teachers' academic intensity and sense of responsibility for learning moderate the learning growth gap engendered by early differences in math, reading, and approaches to learning.

The Moderating Role of Teachers' Academic Intensity and Sense of Responsibility on Reducing the Learning Growth Gap

This section of the literature review provides the distinctive theory and empirical evidence related to the second research question, which examines whether teachers' academic intensity and responsibility contribute to reducing the gap in the learning growth trajectory given different levels of school readiness. This section is divided into two subsections: 1) the role of school for children with disadvantages, and 2) empirical evidence of teachers' academic intensity and sense of responsibility for the learning of disadvantaged students. This section will indicate that the school may play an important role in reducing the inequality in learning outcomes and suggest that teachers' academic intensity and sense of responsibility for learning may contribute to reducing the gap in learning growth created by different levels of school readiness.

The Role of School for Children with Disadvantages

A number of proponents of early intervention show skepticism regarding how much schooling and later efforts with adolescents can alleviate the gaps. This position is often grounded in the evidence that school quality and resources have relatively small effects on disadvantaged children in terms of academic deficits and only marginally explain the variance in test score gaps across different socioeconomic groups. Given the negligible contribution of school variances in explaining the achievement gap, a number of studies have indicated that school does little to reduce the educational inequality between different socioeconomic and ethnic groups (Coleman et al., 1966; Jencks, 1972; Hanushek, 1997). For example, Carneiro and Heckman (2003) claim that after second grade school plays only a minor role in alleviating these gaps. Jencks and Phillips (1998) are also skeptical about the role of the school, based on evidence that the disparity that exists between Whites and Blacks before children enter school does not diminish even when they attend the same school.

In contrast to these findings, however, there are an increasing number of studies indicating that the school may contribute to reducing the gap that exists among students at school entry. Although a student's achievement trajectory may be largely stable throughout the schooling years, students do demonstrate both transitory fluctuation and shifts in their academic achievement trajectory (Pungello et al., 1996; Kowaleski-Jones & Duncan, 1999). In particular, some studies suggest that school-to-school differences could have a greater consequence for the primary grades than for the upper grade levels (i.e. the early grades show larger coefficients and between-school variance compared to the upper grades) (Coleman et al., 1966: Table 3.21.2; Central Advisory Council for Education 1967; Entwisle & Alexander, 1993). Indeed, Downey and his colleagues (2004), based on the ECLS-K, adopted a seasonal comparison approach and found that socioeconomic and racial/ethnic gaps in reading and math skills grow primarily during the summer and are much smaller during the early school year, which suggests that the school functions as an important equalizer in reducing the learning growth gap. Consistent with this view, studies that combine within- and between-school effects indicated that school organizational characteristics substantially determined the learning experience (e.g., track location, coursework), and thus exert considerable influence on students' learning outcomes (Garet & Delany, 1988; Kilgore, 2001).

Furthermore, the role of school contexts in evaluating the long-term effects of early interventions has recently been receiving increasing attention, which suggests that the subsequent learning experience during the early school years is as important as early interventions. Findings in this line of research suggest that the benefits of early intervention, especially for disadvantaged families, can fade out by the second or third year depending on the subsequent learning experience of the formal schooling years (Currie & Thomas, 2000; Magnuson, Ruhm, & Waldfogel, 2007; Zhai, Raver, & Jones, 2012). More specifically, Magnuson and her colleagues (2007), focusing on children's classroom experiences, found that small classrooms with high levels of reading instruction facilitated ongoing reading skills and made early interventions more effective. In this view, one common explanation for why the effects of early intervention programs fade out more rapidly among Blacks than Whites is that Black children are more likely to attend poor quality schools (Currie & Thomas, 2000). On the other hand, for children with deficits who did not have the opportunity to attend early intervention programs, low-quality learning experiences and unchallenging programs may even widen the learning gap caused by those initial deficits, whereas high-quality experiences in the early elementary years contribute to reducing their learning gap and compensating for their low level of skills at school entry (Currie & Thomas, 2000; Hamre & Pianta, 2005; Magnuson, Ruhm, & Waldfogel, 2007; Zhai, Raver, & Jones, 2012).

Indeed, the transition into elementary school (i.e., the entry into first grade) is crucial, especially for children who were brought up without an enriching learning environment, given that the differences between the home and school conditions are dramatic. During this period, children should be able to function in an institutional context with higher academic expectations, one that requires working independently and having discipline, which is different from their home (Dreeben, 1968). In addition, children start experiencing a stratification process through their teachers' expectations and sorting mechanisms, such as ability groupings, special education, and retention (Entwisle & Alexander, 1988; Entwisle & Alexander, 1993). Those who are not ready to learn, however, are academically and behaviorally 'marked,' which entails a social evaluative component. This problem of a mismatch between children and their social context, given a lack of human, cultural, and social capital, magnifies at the entry of elementary school, and the consequences last into the schooling years (Entwisle & Alexander, 1993). This suggests that students who experienced early deficits need continuous support, both emotionally and academically, during the elementary schooling years in order to overcome their early deficits and catch up.

One of the most compelling theories about which intra-school processes matter the most for disadvantaged students' achievement is academic intensity, which can be defined as the amount of time spent 'on task' or engaged in learning activities in school (Phillips, 1997; Hamre & Pianta, 2005; Magnuson, Ruhm, & Waldfogel, 2007). Studies in this tradition claimed that the variables with the greatest explanatory power on disadvantaged children include the amount of time spent on instruction, the time spent 'on task' (engaged in learning activities), and the amount of homework assigned to students. Both the effective schools research and the early research on Catholic and private school effects belong to this tradition (Coleman, Hoffer, & Kilgore, 1982a, 1982b; Purkey & Smith, 1983; Bryk, Holland, Lee, & Corriedo, 1984; Rosenholtz, 1985; Magnuson, Ruhm, & Waldfogel, 2007).

Another schooling experience that may be important for disadvantaged students is the teachers' sense of responsibility for the students' learning (Jussim et al., 1996; Rosenthal & Jacobson, 1968; Rist, 1970; Ferguson 1998; Roscigno, 1998). This concept can be described as teachers' attitudes toward taking responsibility for all of their students' learning and to accept that a failure in students' learning is attributable to the quality of teaching, rather than outside determinants (Lee & Smith, 1996; Halvorsen, Lee, & Andrade, 2009). According to these studies, teachers often consider low-income and African American students as less capable of high academic performance given their low prior performance (Jussim et al., 1996; Diamond, Randolph, & Spillane, 2004). These low expectations of teachers for disadvantaged children is particularly troubling for children's achievement, since teachers' low expectations reduce students' academic self esteem, causing the students to exert less effort in school and leading teachers to give certain students less challenging coursework (Farkas et al., 1990; Farkas, 1996).

Taken together, this pattern of findings from previous studies leaves open the possibility that students, especially those with low readiness, may enhance their learning growth depending on the contextual conditions offered by the school. The literature suggests investigating the extent to which the formal schooling experience plays a role in overcoming early learning deficits in terms of school readiness. The role of school context in relation to children's school readiness, however, has been undermined. Instead, the school readiness literature has concentrated on debating what constitutes 'school readiness' in relation to academic skills and behavioral skills and what type of intervention programs (i.e., pre-K, Head Start, two years vs. one year) may be more effective in promoting school readiness before children enter school. Therefore the aim of this study is to examine what subsequent school experiences may promote learning among children who enter school with low readiness. In particular, this study concentrates on the moderating role of teachers' attitudes at the school level, which represent the shared values of the school members and thus characterize the organizational features of the school that shapes the learning experience, for disadvantaged children. Determining the subsequent educational contexts that can promote the learning progress of children that experienced early deficits will serve as evidence for how different the educational opportunities are given varying school readiness. This, in turn, will provide evidence that enables better policies and approaches for fostering the learning growth of children with early deficits.

Empirical Evidence of Teachers' Academic Intensity and Sense of Responsibility for the Learning of Disadvantaged Students

The accumulated theories and research argue that the elementary school experience is an important influence for students classified as both high- and low-skilled at school entry (Barnett, 2011). For example, children who enter school with an advantage in initial skills may stagnate, and their initial advantages may be lost, without an enriching learning environment (Woodhead, 1988; Zigler & Styfco, 1994). On the other hand, children with a lower level of academic skills at school entry might overcome and narrow the achievement gap if an enriching school experience is provided to compensate for their early deficits (Downey, von Hippel, & Broh, 2004; Magnuson, Ruhm, & Waldfogel, 2007).

In this view, among the different dimensions of school experience that may benefit children with disadvantages, Entwisle and Alexander (1999) conceptualized 'schooling effects' in terms of the 'faucet theory', which implies that a student makes academic gains as a function of having more exposure to academic instructional activities and learning. In particular, the amount of instruction and the time spent ‘on task’ (engaged in learning activities) is critical for students’ learning outcomes (Entwisle & Alexander, 1999). From this approach, the accumulated theories and research argue that the variation in the amount of a child’s exposure to instructional activities in terms of time allotted to instruction leads to higher academic gains and reduces the gap in academic performance (Palardy & Rumberger, 2008). As academic intensity increases, students with low academic level and social class are the first to benefit in their learning gains (Knapp, 1995; Cohen, Raudenbush, & Ball, 2003; O’Connor & McCartney, 2007). More specifically, Hamre and Pianta (2005) indicated that by the end of 1st grade, at-risk students placed in 1st grade classrooms offering high to moderate instructional support had achievement performance equal to that of their peers. In contrast, children at high risk who were placed in low instructionally supportive classrooms performed significantly below their peers with low demographic risk. Accordingly, Magnuson and her colleagues (2007), using ECLS-K, suggested that increasing time spent in academic instruction in small classrooms can eliminate any preschool-related gap (pre-K vs. other child care) in reading skills at school entry. This evidence aligns with findings from Morrison and Connor (2002) that showed that academically oriented teaching benefits students with learning difficulties more than it does students not showing early learning problems. Among others, time spent on instruction, time spent on tasks, and the frequency of supervised seat work showed the greatest benefit on the least advantaged students (Wharton-McDonald, Pressley, & Hampston, 1998). This pattern of findings is echoed in a study by Nye and Hedges (2004), which confirms that the effect size of teachers appears to be greater on socially disadvantaged students (Stevenson & Lee, 1990; See Peisner-Feinberg & Burchinal, 1997; Nye, Konstantopoulos, & Hedges, 2004).

Although teachers’ academic intensity may serve as extrinsic motivation for students, it must be accompanied by supplemental interaction and support from teachers in order for students to make continuous learning progress (Lee & Smith, 1996; Hawley, 2008; Sunderman & Orfield, 2008). In particular, according to Lee and Smith (1996), in schools dealing with exceptional challenges and serving large proportions of low-income students, the lack of either component can have a deleterious impact on student learning (Lee & Smith, 1996; Mintrop, 2008). From this perspective, an increasing emphasis has been suggested on the importance of teachers' attitudes and beliefs (Palardy & Rumberger, 2008), teachers' perception of their school's climate and community (e.g., Rowan, Raudenbush, & Kang, 1991; Raudenbush, Rowan, & Cheong, 1992), teacher efficacy (e.g., Newmann, Rutter, & Smith, 1989; Raudenbush et al., 1992; Goddard, Hoy, & Hoy, 2004; Hoy & Spero, 2005), emotional support (Pianta et al., 2002; Pianta, La Paro, & Hamre, 2005), and the teacher-child relationship (Anderson, Nagle, Roberts, & Smith, 1981; Birch & Ladd, 1996; Peisner-Feinberg & Burchinal, 1997; Ladd & Burgess, 2001). Accordingly, Leland and Harste (2005) highlighted that teachers who teach students from disadvantaged families under challenging circumstances should conceive of themselves as 'agents of change', with the belief and expectation that their students are capable of learning.

Within this research stream, different fields conceptualize teachers' beliefs and expectations in several ways, from the psychological perspective of 'teachers' efficacy' to a more sociological framework of 'teachers' responsibility.'[5] The concept of teachers' responsibility can be described as the "willingness of teachers to take responsibility for all their students' learning and to accept that students' success or failure is attributable to the quality of teaching, rather than to outside determinants, including students" (Halvorsen, Lee, & Andrade, 2009; p.183). In this

[5] Teachers' efficacy refers to teachers' belief that they are capable of being effective teachers and their confidence in their own ability to affect the outcomes of the instructional practices.

view, teachers are expected to hold the same expectation for the learning of all their students regardless of each student's ability, family background, or school condition (Lee & Smith, 1996; Lee & Loeb, 2000; Lee & Burkam, 2002; Halvorsen, Lee, & Andrade, 2009). Moreover, according to Lee and Smith (1996), assuming more responsibility for learning implies that teachers having a greater confidence in their own ability to affect the outcomes of the instructional processes (i.e., learning) for all students, and not just the most able or motivated. Indeed, those teachers who are willing to take responsibility for the learning of their students perceive that the success or failure of a student's learning is attributable to the quality of the teachers rather than to the students (i.e., SES, academic ability).Thus, according to this line of research, responsible teachers set a high expectation for all learners, focus on students' assets rather than their deficits, and perceive themselves as 'agents of change'.

Although a number of studies related to teachers' sense of responsibility are basically grounded on this conceptualization, the specific constructs used to study teachers' sense of responsibility on learning outcomes slightly vary according to the availability of the information in different data sets. For example, Lee and Smith (1996) using the National Educational Longitudinal Study of 1988 (NELS:88) mainly employed three components to measure teachers' collective responsibility: (1) teachers' internalization of responsibility, (2) their willingness to adapt teaching practices to students' needs, and (3) their sense of efficacy in their teaching practices. Another study conducted by Halvorsen, Lee, and Andrade (2009), using ECLS-K, included (1) teacher would choose teaching again, (2) teacher enjoys present teaching job, (3) teacher can make a difference in children's lives, (4) children incapable of learning, (5) children's misbehavior interferes with teaching, and (6) paperwork interferes with teaching. Although the specific construct may slightly differ between this line of studies, in general, this line of research consistently employed teachers' sense of self-efficacy, teachers' expectations for learning of their students, and teachers' attitudes to attribute the success and failure of students to their teaching practices rather than to the children and school as the fundamental components of teachers' sense of responsibility for learning (Lee & Smith, 1996; Lee & Loeb, 2000; Lee & Burkam, 2002; Halvorsen, Lee, & Andrade, 2009).

Based on this conceptualization, there have been two main approaches to examining the impact of the sense of responsibility of teachers. The first approach is to estimate the association between the sense of responsibility of individual teachers and the students' learning outcomes. Typically, this approach matches individual students with their teachers. The second approach is to aggregate the sense of responsibility of individual teachers at the school level, defining it as 'collective responsibility' and using the average score of the sense of responsibility of the teachers within the school to estimate the relationship with students' learning outcomes (Lee & Smith, 1996; Lee & Loeb, 2000; Lee & Burkam, 2002; LoGerfo, 2004).[6] The latter approach sees teachers' attitudes, in the aggregate, as an effective organizational feature of the school that contributes to raising students' academic performance (Lee & Smith, 1996; Lee & Loeb, 2000; Halvorsen, Lee, & Andrade, 2009). Thus, this perspective may describe schools on a continuum of teachers' attitudes. That is, for example, on one end of the spectrum, there are schools where most teachers are willing to take responsibility for the success or failure of their teaching practices. On the other end of the spectrum are schools where teachers see impediments to their teaching practices, such as students' ability, motivation, and background, and blame low performance on these outside factors rather than on their own teaching (Lee & Smith, 1996; Lee & Loeb, 2000).

[6] Based on the aggregate scores of the responsibility level of the kindergarten and first grade teachers, they then divided teachers into three categories of low, medium, and high.

The evidence lends empirical support to the argument that the shared responsibility of teachers for the learning of students is an important dimension of the school, that can help to boost disadvantaged students' learning and thus reduce the gap in learning gains (Lee & Loeb, 2000; Rumberger & Palardy, 2008). Indeed, O'Connor and McCartney (2007), based on the first three phases of the NICHD, revealed that teachers' beliefs and expectations about their students' actions buffered children from the negative effects of family risk factors, such as a lack of maternal attachment, on academic achievement. Similarly, a study based on public Chicago elementary schools showed that 6^{th} and 8^{th} graders learned more with higher levels of teachers' collective responsibility, and their learning gains were more equitably distributed by social class and academic level (Lee & Smith, 1996; Lee, Smith & Croninger, 1997; Lee & Loeb, 2000; Lee, 2001; Halvorsen, Lee, & Andrade, 2008;). Another study, using the base year and first follow-up year of the National Educational Longitudinal Study of 1988 (NELS:88) also found that higher teacher collective responsibility lowers the effect of student SES on learning gains in 8^{th} through 10^{th} grade, and also 10^{th} through 12^{th} grade. In other words, the learning rate of lower-SES students is similar to that of their higher-SES counterparts (Lee & Smith, 1996). The moderating effect of responsibility was also found in the study based on a sample of early elementary schools (Halvorsen, Lee, & Andrade, 2008). For example, Halvorsen and colleagues (2008), using mixed methods, demonstrated a consistent positive impact of teachers' sense of responsibility on how much children in low income public schools progressed in reading from the beginning of kindergarten to the end of 1^{st} grade, both individually and collectively. Moreover, although Rumberger and Palardy (2008) did not explicitly employ the concept of teachers' responsibility, teachers' expectations for students' learning indicated a positive association with students' math and reading gains compared to other indicators such as teacher qualifications.

Although these studies provide important implications for the role of teachers' sense of responsibility for disadvantaged students, conceptualizations of this term have been employed that are not directly relevant to teachers' responsibility for students' learning. For example, Halvorsen and her colleagues, based on the data from ECLS-K, included 'teacher would choose teaching again' , 'teacher enjoys present teaching job', and 'paperwork interferes with teaching' in constructing the measure of teachers' sense of responsibility. These items, however, may be consequences of teachers' sense of responsibility, but they do not directly explicate teachers' willingness to take responsibility for the learning of students (Lee & Smith, 1996). Moreover, although these items may be reasonable indicators of teachers' responsibility (i.e., Halvorsen, Lee, & Andrade, 2009), they are also reasonable indicators of teachers' job satisfaction. This entails mainly two problems. One is that teachers' job satisfaction may be associated with teachers' sense of responsibility or efficacy (Goddard, Hoy, & Hoy 2004). Second, when teachers' job satisfaction is included as an aspect of teachers' responsibility, we cannot be certain whether the effect is attributable to teachers' job satisfaction or responsibility. From this perspective, the broad use of the conceptualization of teachers' responsibility may introduce bias in examining the association with student learning outcomes.

Furthermore, the moderating role of teachers' sense of responsibility for learning and academic intensity for students with low school readiness at the time of school entry has not been thoroughly investigated. Instead, much of the moderating impact has been focused on a few specific factors that define 'disadvantage', such as low SES, school failure, and mother's education, among others. One approach close to achieving this objective may come from studies that investigated 'risk factors', but even this line of study shows inconsistency on how 'risk factor' is conceptualized by using different variables such as maternal educational level or test scores (e.g., Morrison & Connor, 2007). This inconsistency in how to define risk factors makes it difficult to infer their relationship with school readiness. Furthermore, studies on these various factors do not place them in relation to the overall composite measure of school readiness, which includes both academic and academic related behaviors at school entry.

In addition, most of the prior work on how the within-school experience could foster early learning deficits has focused on the role of each individual teacher's academic intensity and their interaction with students, paying less attention to the collective attitudes of the teachers within a school. Although there is substantial work suggesting the important role of individual teachers and their interactions with their students, teachers' attitudes can also be studied as a school level attribute: the product of the interactive dynamics of the group members, considering the context in which teachers' attitudes can affect student learning (Lee & Smith, 1996; Goddard, Hoy, & Hoy, 2004). Indeed, this may be particularly important for disadvantaged students attending schools with poor teachers, since it is hard for only a few motivated teachers to help overcome the learning deficits of disadvantaged students throughout the school years. That is, although disadvantaged students may benefit from a few highly qualified teachers, it is likely that such an advantage will rapidly fade out once the student is exposed to the larger school context. The importance of the shared perceptions of teachers toward the learning progress of students suggests that in order for disadvantaged students to continuously benefit during their schooling years, the improvement due to an individual teacher may be limited unless the teachers' behaviors and attitudes are enhanced at the school level.

This perspective underscores the need to extend the previous research by investigating the moderating role of teachers' academic intensity and sense of responsibility for learning at the school level for children with low readiness at the time of school entry rather than focusing on the role of individual teacher interactions with students. As a result, the present study constructed teachers' academic intensity and sense of responsibility for learning at the school level by aggregating at the school level and considering it as a school attribute (Lee & Smith, 1996; Halvorsen, Lee, & Andrade, 2009) in determining its influence on math learning growth during elementary school years. Moreover, the use of teachers' academic intensity and sense of responsibility for learning at the school level is somewhat inevitable in studying the learning growth trajectory over a long time period, since many data sets, including the ECLS-K data, do not provide the classroom or teacher information for every year. That is, students do not remain under the same teacher, and thus, the learning growth of children cannot be adequately attributed to the particular teacher's academic intensity and sense of responsibility. As a way to overcome this problem, this study employed teachers' academic intensity and sense of responsibility for learning by aggregating individual teacher responses at the school level. Although this aggregated measure may not be perfect, it is the closest approximation to capture the learning environment of children during the elementary schooling years (Lee & Smith, 1996).

To this end, this study weds two important but seldom-integrated lines of inquiry by examining how school readiness influences students' learning progress and whether teachers' academic intensity and sense of responsibility for learning contributes to reducing the learning growth gap created by different level of school readiness. Thus, this study intends to shed light on the potential role of the school to benefit students with low school readiness by specifically investigating whether teachers' academic intensity and sense of responsibility for learning can moderate the gap in math learning growth engendered by different levels of school readiness at the start of school.

The Varying Schooling Experience during the Schooling Years

This section of the literature review presents the studies related to the third research question of whether children with different levels of school readiness experience a stratified learning experience during their schooling years. Although the school readiness literature provides substantial evidence that the learning outcomes of children are stratified according to their level of school readiness at school entry, the question of whether students experience inequality in terms of their subsequent schooling experience according to their different levels of school readiness has been rarely examined.

However, the possibility that children may experience a stratified schooling process depending on their level of school readiness at school entry is implied from a number of previous studies, which suggested that teachers' attitudes and practices are tightly connected to students' background characteristics, such as academic skills, social class, race, and ethnicity, among others (Oakes, 1985; Hallinan, 1987; Jussim et al., 1996; Diamond, Randolph, & Spillane, 2004). According to these studies, students with a higher SES and academic skills are offered more rigorous and enriched programs (Gamoran, 1986). They are also more likely to attend schools with higher academic levels and be placed in high ability track courses where more time and emphasis are devoted to learning activities. Within this kind of learning environment, these students spent more time on tasks and are expected to spend more time on homework (Oakes, 1985; Currie & Thomas, 2000; Zhai, Raver, & Jones, 2012). On the other hand, low-income and African American and Hispanic students are enrolled in schools with low academic levels that provide less extensive and less demanding courses (Currie & Thomas, 2000; Zhai, Raver, & Jones, 2012). Furthermore, they are disproportionately assigned to low-ability classes where students have less access to math knowledge, fewer material resources, and less-engaging learning activities in their classrooms. Teachers serving these students tend to place less emphasis on academics, spending less time on tasks and showing lower expectations for time spent on homework (Hallinan, 1987; Oakes et al., 1990).

At least in terms of the amount of instructional time, however, there are indications that students from disadvantaged families do not necessarily experience a lesser extent of instructional time. For example, in schools with large concentrations of low income students, African American and Hispanic students were exposed to slightly more time per day of math instruction, with no difference in science instruction (Oakes et al., 1990).[7] One explanation is that teachers at low SES, high minority, and inner city schools spend more time on math because most of these schools qualify for federal assistance (i.e., Title I funds) targeted at improving disadvantaged students' basic skills. Thus, elementary schools with large concentrations of students who typically do poorly in math appeared to tackle this problem by spending slightly more time on math lessons, presumably in hopes of giving disadvantaged and minority students a good start in math (Oakes et al., 1990).

Another research stream has consistently indicated that teachers' sense of responsibility is tightly connected to students' particular backgrounds. Indeed, teachers often hold lower expectations for and self-efficacy toward children that experienced initial deficits. For example, according to these studies, teachers often consider low-income and African American students as less capable of high academic performance (Farkas, 1996; Ferguson, 1998; Roscigno & Ainsworth-Darnell, 1999). In general, these low expectations are influenced by their low prior performance (Jussim et al., 1996; Diamond, Randolph, & Spillane, 2004). Furthermore,

[7] However, this study does not undermine the fact that students from disadvantaged families are consistently exposed to a poorer quality of instruction compared to other students.

according to Diamond and her colleagues (2004), the racial, ethnic, and socioeconomic composition of the student body is deeply coupled with the expectations teachers hold about children's capacity achievement and the teachers' responsibility for supporting students' learning. In addition, these teachers emphasize students' deficits when low income or African American students make up a larger proportion of the student population. In contrast, when a larger proportion of the students are middle-income, White, or Asian, the students' intellectual assets are emphasized and teachers feel more accountable for what their students learn. These low expectations of disadvantaged children are particularly troubling, since they reduce students' academic self-esteem, cause them to exert less effort in school, and lead teachers to give certain students less challenging coursework (Farkas, 1996; Farkas et al. 1990).

Although these studies provide relevant implications for how the learning experience is stratified by children's family background characteristics, they do not suggest how the learning experience of children with different levels of readiness is stratified. Thus, building on the insights from the previous findings, the present study directly examined the question of whether children's learning experiences are stratified depending on their level of school readiness.

CHAPTER 3

DATA and METHODS

The aim of this study is to investigate whether teachers' academic support and responsibility can moderate the growth of the gap in students' learning that is engendered by different levels of school readiness at the start of school. To address this objective, the current study was designed to extend work related to school effects by following children identified with low readiness during the elementary school years; specifically it investigates whether the school environment to which they are exposed moderated their math learning growth. As Rutter and Maughan (2002) suggest, in order to effectively examine the environmental influences on child development, the use of longitudinal data to measure changes within individuals is essential. Accordingly, this study employed the ECLS-K to analyze the lasting influence of school readiness and the role of the schooling experience in reducing the variation in learning growth trajectory. In the following subsections, 1) the description of the ECLS-K, 2) the characteristics of the analytical sample, 3) the measures, 4) the analytical approach, and 5) the statistical models are presented.

Data

The data for this study comes from the Early Childhood Longitudinal Study-Kindergarten cohort (ECLS-K) released by the U.S. National Center for Education Statistics (NCES). The data set contains repeated observations of a nationally representative sample of students, their families, teachers, and schools over the period of kindergarten through 8th grade.

The ECLS-K focuses on young children's cognitive and non-cognitive growth, school readiness, health, and transitions to non-parental care (e.g. kindergarten and educational programs).

The ECLS-K employed a stratified design structure to randomly select 1,277 public and private schools that offered kindergarten. The ECLS-K was compiled in the fall and spring of kindergarten (waves 1 and 2, 1998-1999), and first grade (waves 3 and 4, 1999-2000), and in the spring of the third, fifth, and eighth grades (waves 5, 6, and 7, 2002, 2004, and 2007). Approximately 23 kindergarteners were selected from each school. The sample was freshened in the spring of 2000 to ensure a nationally-representative sample of first graders by including into the study students who were not enrolled in kindergarten during the 1998-99 school year. The sample was not freshened in grades 3, 5, or 8. The initial sample in the fall of 1998 contained 21,260 kindergarteners. A sample reduction is built into the ECLS-K data sample design.

Sampling for the ECLS-K involved a dual-frame, multistage sampling design. The first stage included the selection of 100 primary sampling units (PSU-counties and county groups). Public and private schools were then selected from PSUs, and children were sampled from the selected schools. By following students who entered kindergarten in 1998 through 8th grade, the ECLS-K data provide the first large-scale, nationally representative sample of children as they age through the elementary and middle school years (NCES, 2004).

The ECLS-K data is well suited for the purpose of my research for the following reasons. First, the ECLS-K is one of the very few nationally-representative studies that collected data from kindergarten through middle school, including comprehensive information on children, families, teachers, and school surveys. Second, the ECLS-K tracked a sizable sample over time, assessing both the cognitive and non-cognitive growth of children from kindergarten through 8th grade. Third, in addition to gathering student and school information over a long time span, the

ECLS-K data also include a comparatively comprehensive set of contextual information about the children's development and educational experiences, to include information on family, school, community, and other characteristics, allowing for statistical control of a variety of child- and school-related factors. These categories of information are essential for this study, since its main purpose lies in estimating the impact of school readiness on children's learning growth and whether school contextual characteristics can moderate the early learning deficits.

Study Sample

The present study used three waves of data collected in the spring of 1^{st} grade, spring of 3^{rd} grade, and spring of 5^{th} grade. The sample for this study was restricted in three ways. First, it was limited to public schools because the student population and many characteristics of the classrooms and schools may be different in private schools (Magnuson, Ruhm, & Waldfogel, 2007). Second, the sample was restricted to students who 1) had valid information regarding their change of school and 2) had stayed in the same school during the elementary years, 1^{st} through 5^{th} grade. This was necessary, since the primary purpose of this study was to estimate whether students with low readiness would benefit from being placed in schools with high academic intensity and responsibility. If the student was not in a single school for the duration of the elementary schooling years, it was not possible to determine what part of the students' math gain was attributable to a specific school. The sample characteristics between children who stayed in the same school and those who changed schools at least once during the elementary school years were slightly different. Although the difference is small, the children who stayed in the same school scored slightly better (ranging one or two points) in 1^{st}, 3^{rd}, and 5^{th} grade math achievement than students who changed schools. In addition, more children from low family SES, and Black, Hispanic, and Asian racial origins have changed schools at least once during the elementary school years. This suggests that some caution is in order when making inferences from models using math outcome, although the difference is very modest. Yet, almost no difference was found for other indicators, such as three components of school readiness, between children who changed schools and those who stayed in the same school during the elementary school years (see Table 3. 1).

Third, the baseline of math gain was set from the spring of 1st grade (2000) through 5th grade. One issue with the 1st grade fall data is that it includes approximately 30 percent of the sample of children. Kindergarten was excluded from the baseline because this time span includes a transition from kindergarten through elementary school and this makes it difficult to create consistent indicators of school contextual characteristics. This is partly because kindergarten has a different instructional purpose (preparation for school/less academic oriented vs. actual instruction/performance oriented), with some children enrolled only half-day, compared to elementary school, where all students are expected to be ready to learn from the 1st grade. In addition, the transitional time span between the spring of kindergarten through the spring of 1st grade comprises the influence of both kindergarten and elementary school, which leaves it uncertain where to attribute math gain. Similar difficulties occur in estimating growth from 5th through 8th grade, which involves the transition from elementary to middle school. To this end, restricting the sample to the elementary school years within a single school creates a consistent sample with which to estimate the role of the school and the persistence of these associations throughout the school years.

To this end, the final analytical sample consists of 6,201 students and 2,486 teachers from 801 public schools. Although these sample exclusions should be noted when interpreting the findings, the sample appears to be similar to the original full sample in terms of gender and demographic composition. That is, the demographic characteristics between the analytical sample and the full sample , which is based on children who were in public school with valid information whether they had changed school during elementary school years, are very similar, as can be seen in Table 3.1. In addition, a comparison between the base year original sample and the final analytical sample also indicated similar demographic characteristics, although there was a substantial reduction in total sample size. Thus, although the descriptive statistics appeared to be similar between these samples, caution is needed when making inferences from models using the math outcome to the population.

Table 3.1: Comparison of Demographic Characteristics Between Samples

	Base year Original Sample	Full Sample	Changed School Sample	Analytical Sample
	N=16,635	N=8,805	N=2,604	N=6,201
SES	.001	-.1039	-.1407	-.088
Male	51.09%	50.44%	50.30%	50.5%
Black	14.18%	12.88%	14.32%	12.28%
Hispanic	17.34%	19.99%	22.17%	19.07%
Asian	6.25%	7.13%	7.47%	6.98%
Other	5.50%	5.82%	4.77%	6.26%
Single	19.88%	19.23%	21.10%	18.46%
Other parent	3.78%	3.69%	3.60%	3.73%
Non biological parent	9.17%	8.12%	9.32%	7.6%
Number of Siblings	1.524	1.552	1.552	1.553
Math score for 1st grade	61.263	60.853	60.285	61.090
Math score for 3rd grade	99.114	98.225	97.173	98.661
Math score for 5th grade	124.003	122.347	120.995	122.906
Math score for K	26.227	25.701	25.323	25.860
Reading score for K	35.439	34.895	34.578	35.027
Approaches to Learning for K	2.991	3.016	2.968	3.037

Note: The base year sample includes children who attended all types of schools (private, Catholic, among others) and had valid test scores in the spring of 1st grade. Thus, the sample size may be slightly different from the ECLS-K report. The descriptive statistics of the full sample are based on first grade children who were in public school with valid information whether they had changed schools or not. The final analytical sample is the sample size that was used for the present study before multiple imputation was conducted to replace missing values.

From the total analytical sample, in order to retain as many children as possible, multiple imputation (MI) was conducted on children and schools with incomplete data, which replaces missing values with predictions based on all the other information provided in the data set. Unlike single imputation techniques, MI can accommodate many different patterns of missing data by creating several completed datasets. For the present study, five imputed data sets were created. Analyses were performed on each replaced dataset, and then the results were combined across analyses, yielding one final answer (Rubin, 2006). The statistical software package Stata 11 was used to conduct the multiple imputation. The descriptive statistics of the sample before and after imputation are presented in the Appendix, Table A3.2.

Measures

Dependent Variable

The growth of mathematic skills from the spring of 1st grade (2000), to the spring of third grade (2002), to the spring of fifth grade (2004) is the primary outcome of interest. The ECLS-K mathematics assessment frameworks were derived from national and state standards, including those of the National Assessment of Educational Progress (NAEP), the National Council of Teachers of Mathematics. The ECLS-K assessments included items that were specifically created for the study and items from other NCES studies, including items from NAEP, NELS:88, and ELS:2002. In addition, some items were adapted from existing instruments such as the Peabody Individual Achievement Tests-Revised and the Woodcock-Johnson Psycho-Educational Battery-Revised. These assessments included both multiple choice and open-ended questions. The math assessment consisted of 64 items that tested children’s understanding of numbers, geometry, and spatial relations covering five levels of proficiency: (a) identifying one-digit numerals, counting up to 10 objects, and recognizing geometric shapes; (b) reading all one-digit numerals, counting beyond 10, recognizing a sequence of patterns, and using nonstandard units of length to compare objects; (c) reading two-digit numerals, recognizing the next number in a sequence, identifying ordinal positions of objects, and solving a simple word problem; (d) solving simple addition and subtraction problems; and (e) solving simple multiplication and division problems and recognizing more complex number patterns.

Student performances were measured through direct assessment with standardized grade-appropriate test items, administered one-to-one by NCES staff. The achievement tests were conducted in a two-step process. First, children were given a common set of questions as a routing section with 12-20 items covering a broad range of difficulty. The second set of questions differed in regard to difficulty (high, medium, low), with children administered these sections based on their performance on the first set of questions. This approach helped to ensure that children were tested with a set of items most appropriate for their level of achievement and minimized the potential for floor and ceiling effects. Scores were calculated only for children who answered at least 10 questions in both sections of the test. Given that children were not asked the same questions, scores were calculated based on item response theory (IRT). The patterns of right, wrong, and missing answers as well as the difficulty of questions were used to place each child on a continuous ability scale. The final calculated score reflects the number of questions that the child would have correctly answered had he or she taken all available items. The ECLS-K data provided the results of assessment based on five test scores: 1) Number-right scores, 2) Item Response Theory (IRT) scale scores, 3) standardized scores (T-scores), 4) criterion-referenced proficiency-level scores, and 5) proficiency probability scores. For the present study I used the IRT scale scores, because they can be compared longitudinally throughout the school years (NCES, 2004).

For the purpose of this study, students' math learning growth was divided into early gains, from 1st through 3rd grade, and late gains, from 3rd through 5th grade. The average math gain from 1st through 3rd grade was 37.2 (se .301) points, and the average gain from 3rd through 5th grade was 24.3 (se .218) points. A number of previous studies have cautioned against ceiling effects, for high achievers particularly, due to a lack of sufficiently difficult test items (Reardon, 2007). Caution is therefore necessary in interpreting the gap in math growth from the sample, which might be less than the disparity in the actual population.

Main Variables of Analysis

School Readiness

The current study conceptualizes school readiness as a composite of math, reading academic skills, and approaches to learning by the time a child enters kindergarten. This conceptualization is based on a number of empirical studies that have indicated early attention related behaviors and math and reading academic skills are the most predictive factors that need to be considered in constructing school readiness (Duncan et al., 2007). In particular, among the different dimensions of student behavioral measures, early attention related behaviors are consistently indicated as the strongest predictor in estimating later academic achievement, whereas other behavioral problem measures such as externalizing and internalizing behavior problems are inconsistent in their predictive relationship with academic gains. For the purpose of the current study, the conceptualization of school readiness was specifically restricted to measures that are strongly associated with later academic gains.

The standardized IRT Tests of Math and Reading achievement in the fall of kindergarten are employed as a construct of school readiness. The description of the math assessment is described above. The standardized IRT Test of Reading assessment contained 72 questions that assessed knowledge of letters and word recognition, beginning and ending sounds, vocabulary, and passage comprehension. The reading assessments covered five proficiency levels: (a) identifying uppercase and lowercase letters by name, (b) associating letters with sounds at the beginning of words, (c) associating letters with sounds at the end of words, (d) recognizing common words by sight, and (e) reading words in context.

Approaches to learning is a composite scale provided by NCES (2004), based on six items measuring teachers' judgments in the fall of kindergarten on a child's persistence at tasks, eagerness to learn, attentiveness, learning independence, flexibility, and organization. Using teachers' reports of behaviors raises the question of potential teacher biases, particularly with regard to race. Utilizing the same data, however, Downey and Pribesh (2004) found no substantial interaction between student and teacher race in predicting approaches to learning. Nevertheless, the present study acknowledges the possibility that middle-class teachers and/or White teachers may be prejudiced in their judgment of the approaches to learning exhibited by lower SES and minority students, as they could 'misread' the behavior of these students. Furthermore, the construct of 'approaches to learning' developed by the ECLS-K team is highly associated with a more widely used term in the literature, 'student engagement' (NCES, 2004).

Teachers' Academic Intensity and Sense of Responsibility for Learning

Substantial school effects studies suggested that teachers' practices and attitudes are at the heart of children's learning progress (Cohen, Raudenbush, & Ball, 2003). Raudenbush (2005) and Hoffman (1991) highlighted the importance of investigating the specific teacher practices and attitudes that best benefit disadvantaged children, as there was an insufficient amount of information in the literature on the processes schools undergoes in order to become more effective. The researchers indicated there was a paucity of investigations into the connection between teachers and schools that may provide more specific information on how to better promote effective teacher practices and attitudes (Hoffman, 1991).

From this perspective, the extent of teachers' academic intensity and sense of responsibility for learning are the measures of interest to investigate whether the schooling experience can moderate a math learning growth gap. The selection of these two dimensions of school quality was guided by the school effects literature, which suggested these as important contextual characteristics in terms of academic gains.

The composite scale of teachers' academic intensity and responsibility were created based on a principal component measurement model. Although using independent constructs for teachers' academic intensity and responsibility may help to assess the relative importance of each component for math learning gain, the nature of teachers' academic intensity and responsibility is not any particular activity by itself, but rather a concerted set of attitudes and behaviors. In this view, the interest of this study places heavier weight on revealing whether the multi-dimensional nature of teachers' responsibility and academic intensity engenders positive influences on disadvantaged children's learning outcome, rather than assessing which dimension of teachers' sense of responsibility for learning and academic intensity may have the stronger impact. This approach was also preferred for the ease of the model specification and the interpretation of the interaction coefficients with three components of school readiness on each time span (see Table 3.2 for details).

Academic Intensity. Teachers' academic intensity is defined as the amount of time spent on academic instruction. This measure was used to reflect the approximate amount of time in which students are exposed to learning activities within school. This conceptualization is based on accumulated theory and research that indicated that time spent 'on task', specifically the time engaged in learning activities, leads to higher academic gains (Phillips, 1997;

Magnuson, Ruhm, & Waldfogel, 2007). Indeed, according to Hamre and Pianta (2005) early elementary schools vary widely along these important dimensions.

Following this definition, teachers' academic intensity was created based on three variables from the ECLS-K teacher survey: 1) amount of math instruction on a daily basis: four response categories in 30 minute increments, ranging from 1 to 30 minutes through more than 90 minutes, 2) amount of math instruction on a weekly basis: four response categories ranging from once or twice per week through daily, and 3) expected time spent on math homework: four response categories in 10 minute increments ranging from none through more than 30 minutes.

Responsibility. Following the definition of teachers' sense of responsibility for learning from the work of Lee and her colleagues (Lee & Smith, 1996; Lee & Burkam, 2002; LoGerfo, 2004), in this study teachers' sense of responsibility for learning was defined as the willingness of teachers to take responsibility for all their students' learning and to accept that students' success or failure is attributable to the quality of teaching, rather than to outside determinants (Lee & Smith, 1996; Halvorsen, Lee, & Andrade, 2009). Based on this definition, the selection of specific variables to construct teachers' sense of responsibility was guided by Lee and Smith (1996), Lee and Burkam (2002), LoGerfo (2004), and especially from the study of Halvorsen, Lee, and Andrade (2009), which used the same data set, ECLS-K, in determining the impact of teachers' sense of responsibility on children's learning outcomes in kindergarten and 1st grade. Following these studies, the present study mainly constructed teachers' sense of responsibility based on teachers' sense of efficacy, teachers' expectations, and teachers' attitudes to attribute the success or failure of students to their teachers (Lee & Smith, 1996; Lee & Burkam, 2002; LoGerfo, 2004; Halvorsen, Lee, & Andrade, 2009).

The components of teachers' sense of responsibility for learning were drawn from the

ECLS-K teacher survey, each item coded on a four-level Likert scale of 'agreement': 1) teachers can make a difference in children's lives, 2) students are incapable of learning (reverse coded), 3) child's misbehavior interferes with teaching (reverse coded). The responses were in five categories, from 'strongly disagree' to 'strongly agree.'

Yet, in contrast to the study of Halvorsen and her colleagues, which employed more indicators under the construct of responsibility including 'teacher enjoys present teaching job', 'teacher would choose teaching again', and 'paperwork interferes with teaching', the conceptualization of teachers' responsibility in this study concentrated on teachers' sense of responsibility, as it has the most proximal association with student learning and behavior, rather than the more general sense of teachers' sense of responsibility employed in previous studies. For example, 'paperwork interferes with teaching' was not included in the construct of teachers' responsibility, because it is not a cause of interference in teaching practices due to students' abilities or behavior.

Since the primary purpose of this study is to estimate the moderating role of teachers' academic intensity and sense of responsibility for learning for children's math score at the end of 1st grade (intercept), early math gain (1st through 3rd grade), and late math gain (3rd through 5th grade), teachers' academic intensity and sense of responsibility for learning needed to reflect each time span separately. Therefore, instead of using the average math gain across three waves from 1st through 5th grade and creating one measure of teachers' attitudes to estimate both early and late math gain (i.e., Magnuson, Ruhum, & Waldfogel, 2007), a principal component measurement model was employed to create composite measures at the individual teacher level for each of two waves of data collection (1st spring through 3rd spring and 3rd spring through 5th spring). For example, the principal component measurement model was conducted based on six measures (three measures of teachers' responsibility for 1st grade and 3rd grade) to create teachers' sense of responsibility for 1st through 3rd grade. This same procedure was conducted to construct teachers' sense of responsibility for 3rd through 5th grade, and teachers' academic intensity for 1st through 3rd grade and 3rd through 5th grade, all of which are based on six measures that combine the information for the two time spans. After these composite measures were created at the teacher level, they were aggregated into a mean for the school with the aim of characterizing teachers' academic intensity and sense of responsibility as a feature of the school organization (Lee & Smith, 1996; Halvorsen, Lee, & Andrade, 2009).[8] This same approach was taken to create teachers' academic intensity and sense of responsibility for 1st grade. The only difference was that the principal component measurement model was only based on one wave of data collection, the spring of 1st grade (see Table 3.2). This process was conducted after missing values were imputed. Thus, this same procedure was repeated on each of the five imputed data sets.

As a result, I created six measures of the teacher indicators that mirror each time point of the learning outcomes (1st grade, math gain 1st-3rd grade, math gain 3rd-5th grade): (1) teachers' sense of responsibility for 1st grade, (2) teachers' sense of responsibility for 1st through 3rd grade, (3) teachers' sense of responsibility for 3rd through 5th grade, (4) teachers' academic intensity for 1st grade, (5) teachers' academic intensity for 1st through 3rd grade, and (6) teachers' academic intensity for 3rd through 5th grade.[9] The use of separate measures for each time span enables us to estimate the association between teachers' academic intensity and sense of responsibility for

---

[8] Although previous studies use the concept of 'collectivity' by using the aggregated score at the school level, the present study did not adopt the concept of collectivity. This issue is discussed under limitations of the study.

[9] A similar pattern of results was shown in the sensitivity analyses even when teachers' responsibility was constructed based on each grade level and its cross level interaction with school readiness and students' learning growth was examined (see Chapter 4, pg 80). However, this approach was preferred in order to capture the learning environment that students experience throughout their elementary school years.

learning on math gain separately between 1st through 3rd grade and 3rd through 5th grade. In predicting the intercept, which is centered on 1st grade, the aggregated measures of 1st grade teachers' academic intensity and sense of responsibility were employed in the analysis. The result of the principal component measurement model is presented in Table 3.2.

Table 3.2: Principal Component Measurement Models for Teachers' Academic Intensity and Sense of Responsibility for Learning Across Two Time Spans, from 1st through 3rd Grade, and 3rd through 5th Grade

Academic Intensity for 1st grade	Item Loading	Responsibility for 1st grade	Item Loading
The amount of math instruction on a daily basis (1st grade)	.752	Student is capable of learning (1st grade)	.735
Expected time spent on math homework (1st grade)	.506	Child's misbehavior doesn't interfere with teaching (1st grade)	.739
The amount of math instruction on a weekly basis (1st grade)	.541	Teacher can make a difference (1st grade)	.557
Academic Intensity for 1st - 3rd grade	**Item Loading**	**Responsibility for 1st - 3rd grade**	**Item Loading**
The amount of math instruction on a daily basis (1st grade)	.28	Student is capable of learning (1st grade)	.52
Expected time spent on math homework (1st grade)	.49	Child's misbehavior doesn't interfere with teaching (1st grade)	.57
The amount of math instruction on a weekly basis (1st grade)	.28	Teacher can make a difference (1st grade)	.32
The amount of math instruction on a daily basis (3rd grade)	.61	Student is capable of learning (3rd grade)	.58
Expected time spent on math homework (3rd grade)	.56	Child's misbehavior doesn't interfere with teaching (3rd grade)	.62
The amount of math instruction on a weekly basis (3rd grade)	.31	Teacher can make a difference (3rd grade)	.37
Academic Intensity for 3rd - 5th grade	**Item Loading**	**Responsibility for 3rd - 5th grade**	**Item Loading**
The amount of math instruction on a daily basis (3rd grade)	.51	Student is capable of learning (3rd grade)	.53
Expected time spent on math homework (3rd grade)	.40	Child's misbehavior doesn't interfere with teaching (3rd grade)	.56
The amount of math instruction on a weekly basis (3rd grade)	.23	Teacher can make a difference (3rd grade)	.28
The amount of math instruction on a daily basis (5th grade)	.74	Student is capable of learning (5th grade)	.64
Expected time spent on math homework (5th grade)	.55	Child's misbehavior doesn't interfere with teaching (5th grade)	.66
The amount of math instruction on a weekly basis (5th grade)	.53	Teacher can make a difference (5th grade)	.45

Note: Item loadings for some variables are relatively small, probably because the principal measurement model was conducted across two time points (1st through 3rd grade and 3rd through 5th grade). Yet, when the principal component measurement model was employed at each grade level, all variables indicated acceptable item loadings, which suggests that they form a psychometrically coherent factor (see Table A3.1 in Appendix)

Children are not placed into different school environments totally at random. For example, those in schools with low levels of math instruction (i.e., math instruction on a daily basis) were more likely to be Hispanic (5.11 percent vs. 3.92 percent) and Asian (5.52 percent vs. 4.04 percent) than their counterparts. The disproportion is slightly higher in terms of teachers' responsibility (i.e., not capable of learning), showing a higher a proportion of Hispanic students (14.82 percent vs. 11.56 percent), more Black students (17.08 percent vs. 11.94 percent), and more students from a single parent family (15.85 percent vs. 11.16 percent) than their counterparts. These comparisons suggest that children from social minority groups are more likely to attend schools with a low level of teachers' responsibility and academic intensity, although the magnitude of these differences is relatively small.

Covariates

The selection of control variables for the present study was mainly guided by previous studies that examined the association between school readiness or teachers' sense of responsibility and math learning growth (Magnuson, Ruhm, & Waldfogel, 2007; Halvorsen, Lee, & Andrade, 2009). Of those variables, the final selection of control variables was made according to the results of preliminary analyses of the relationship between the available variables and math learning growth. The analytical focus was on whether each variable has a significant association with achievement independent of other variables. In the final model, most regressions contained child, family background, and school characteristics, such as the following:

SES: A continuous composite measure of socioeconomic status, including parents' education, parents' occupational prestige, and household income.

Black, Hispanic, Asian, Other: Dummy variables; White is the reference group.

Male: Dummy variable; female is the reference group.

Number of siblings: A continuous measure of the number of siblings.

Family structure: 3 dummy-coded variables: single-parent families; non-biological parents, and other families (non-relative care, adoptive parents, remarried parents). Two biological married parents is the reference category.

Retention: Dummy variable; whether the child has been retained at least once from kindergarten through 5^{th} grade.

School average socioeconomic status (SES): An aggregate of the individual SES scores of students in the same school, measured as an aggregate of parental education, occupational prestige, and family income.

Percentage of minority students: Dummy variable; recoded from the school administrator's survey, the percentage of minority students less than 50 percent was coded as the reference group.

Large city/medium city/rural area: Dummy variable; recoded from the location type variable, small town is the reference group.

Other extensive sets of controls for child, family background, health status, educational practices, and teacher/school characteristics were considered in the preliminary analysis, but many of them did not substantially increase the explained variance (R^2), and instead raised the multi-collinearity (i.e., school average math and reading performance) of the model specification. Thus, for the sake of model simplification, the most relevant school demographic characteristics were selected from the analyses. All continuous variables were converted into z-scores (standardized form) to be able to compare the coefficients across variables and models. In addition, all continuous variables included in the equations were grand mean centered.

Descriptive statistics for all variables used in the analyses are presented in Table 3.3.

Table 3.3: Descriptive Statistics of the Variables Included in the Models

Student Level Variables	Student (N=6,201)
	Mean (SD)
SES	-.088 (.779)
Male	.505 (.500)
Black	.122 (.328)
Hispanic	.190 (.392)
Asian	.069 (.254)
Other	.062 (.242)
Single	.184 (.388)
Other parent	.037 (.189)
Non biological parent	.076 (.265)
Number of siblings	1.553 (1.159)
Retained	.105 (.306)
Math score for 1st grade	61.090 (17.971)
Math score for 3rd grade	98.661 (24.875)
Math score for 5th grade	122.906 (25.389)
	School Readiness
Math score, fall of Kindergarten	25.860 (8.773)
Reading score, fall of Kindergarten	35.027 (9.513)
Approaches to Learning, fall of Kindergarten	3.037 (.664)
School Level Variables	School (N=801) Teacher (N=2,486)
School mean SES	-.1144 (.533)
School minority	.4812 (.499)
Urban	.3349 (.472)
Rural	.40279 (.490)

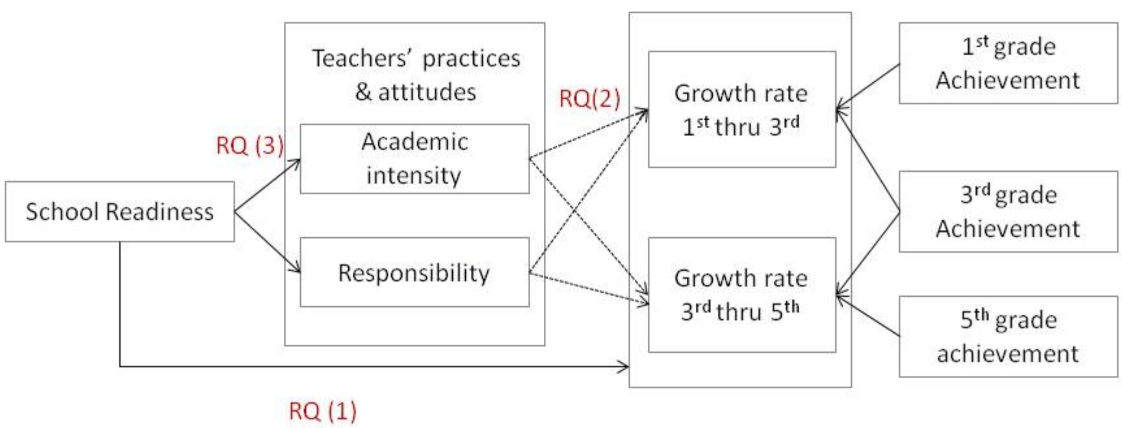
Academic intensity for 1st grade	0.02 (0.83)
Responsibility for 1st grade	-0.06 (0.79)
Academic intensity for 1st – 3rd grades	.041 (.855)
Academic intensity for 3rd – 5th grades	.035 (.808)
Responsibility for 1st – 3rd grades	-.025 (.790)
Responsibility for 3rd – 5th grades	-.021 (.809)

Note: Descriptive statistics of variables before and after imputation are shown in Appendix Table A. 3.2.

Analytical Approach

Model building was carried out in steps that are consistent with the research questions. First, using a multilevel modeling convention based on Hierarchical Linear Modeling (HLM), beginning with a fully unconditional model, two-piece linear growth curve modeling was employed to answer the first research question, whether children demonstrate a different math learning growth trajectory during the elementary school years depending on their level of school readiness at school entry. In order to assess whether the pattern of the relationship between school readiness and math learning growth trajectory continues or attenuates across the schooling years, math gain was divided into early growth (1st through 3rd grade), and late growth (3rd through 5th grade). Second, answering the second research question, whether the learning gap engendered by school readiness may be reduced if students are in a school context that provides a higher level of teachers' academic intensity and sense of responsibility for learning, entailed two steps. First, the influence of teachers' academic intensity and sense of responsibility for learning on average math learning growth was estimated after controlling for student and background characteristics. Then, in order to examine whether teachers' academic intensity and sense of responsibility facilitates or inhibits the learning growth of students depending on their level of school readiness at school entry, the interactive relationship was examined by adding to the equation cross level interaction terms between 1) school readiness × teachers' academic intensity and 2) school readiness × teachers' sense of responsibility for learning. This examines whether teachers' academic intensity and sense of responsibility contributes to raising the math learning growth trajectory for children who enter school with low readiness. Third, in order to address the third research question, whether children's learning experience during the elementary school years is stratified by their level of school readiness, Ordinary Least Squares (OLS) analysis was employed on each aspect of teachers' academic intensity and sense of responsibility for learning, at every grade level (1st, 3rd, and 5th) to verify whether students with different levels of readiness are disadvantaged in terms of school experience during the elementary school years. The conceptual framework is based on these research questions and is shown in Figure 3.1.

Figure 3.1: Conceptual Framework



Note: Learning growth rate is controlled for individual and school background characteristics. Dotted lines indicate interaction effects.

Analytical Methods

Many studies of change are often based on the design of the growth between two time points, usually based on two time points of data collection. Such designs are often inadequate for studying individual growth. This is because the reliability depends on the study's duration and frequency, and thus the frequency and duration of longitudinal studies strongly affect their statistical precision (Raudenbush & Liu, 2000). The development of hierarchical linear growth curve models is one of the adequate techniques, when applied with valid measurements from a multiple time point design that can afford an integrated approach for studying the structure and predictors of individual change (Raudenbush & Bryk, 2002). Thus, this study employed hierarchical linear growth curve modeling to show whether teachers' academic support and willingness to be responsible for their students help to moderate the learning gap engendered by school readiness during the elementary school years. For these analyses, the statistical software package HLM (6.0) was mainly used.

Research Question (1): Do students demonstrate any variation in their learning gains from 1st through 5th grade according to their different level of readiness, after controlling for student and school characteristics? If there is variation, does the association between school readiness and learning gains continue or attenuate across the schooling years?

A hierarchical linear growth curve model was employed to estimate whether teachers' academic intensity and sense of responsibility for learning help to moderate the learning gap engendered by school readiness. For the purpose of analysis, the math gain of students during the first time span includes waves 4 and 5, which covers the change in children's learning from the spring of 1st grade through the spring of 3rd grade. The second piece includes waves 5 and 6, which covers the spring of 3rd grade through the spring of 5th grade. The coding schemes for the two pieces are (0 1 1) (0 0 1), respectively. One advantage of using this type of growth curve model is that it enables measurement of the growth of student progress separately for each time point, and thus independently assesses the impact of teachers' academic intensity and responsibility on each time span. All continuous variables included in the student level model were grand mean centered. The corresponding equation is as shown in the models.

Equation (1)

Level 1: Measurement model

- $Y_{ijk} = \pi_{0jk} + \pi_{1jk}$*(1st thru 3rd) + π_{2jk}*(3rd thru 5th) + ε_{ijk}

Level 2: Student model

- π_{0j} (1st grade math score)= $\beta_{00k} + \beta_{01\,k}$ *(School readiness)

  + β_{02k} *(Student background characteristics) + μ_{0jk}
- π_{1j} (math gain: 1st thru 3rd)= $\beta_{10k} + \beta_{11\,k}$ *(School readiness)

  + β_{12k} *(Student background characteristics) + μ_{1jk}
- π_{2j} (math gain: 3rd thru 5th)= $\beta_{20k} + \beta_{21\,k}$ *(School readiness)

  + $\beta_{22\,k}$ *(Student background characteristics)

Level 3: School model

- $\beta_{00k} = \gamma_{000} + \gamma_{001}$ (School composition/School SES/Location) + ω_{00k}
- $\beta_{10k} = \gamma_{010} + \gamma_{011}$ (School composition/School SES/Location) + ω_{01k}
- $\beta_{20k} = \gamma_{100} + \gamma_{101}$ (School composition/School SES/Location) + ω_{10k}

This model consists of a measurement model at the first level, the individual at the second level, and the school as the third level. Level 1 is a repeated measures model, in which the dependent variable is the math and reading achievement at grade i for student j in school k. The grade variable is centered so that it takes on the value of zero in the 1st grade. π_{0j} is the initial status of the child, which is the expected outcome for that child in the spring of 1st grade. π_{1j} is the learning rate (slope) for child ij during the academic year from 1st through 3rd grade, and π_{2j} is the learning rate from 3rd through 5th grade. At the student level, each level 1 outcome functions as a dependent variable predicted by school readiness, holding constant in the model student background characteristics and school readiness. At the school level, β_{00k} is the school average math score when students were in the first grade, β_{10k} is the school average math learning growth from 1st through 3rd grade, and β_{20k} is the school average math learning growth from 3rd through 5th grade.

The unconditional level-2 and level-3 models were fitted prior to consideration of any explanatory models at either level, to estimate the variability in the individual growth parameters into level-2 and level-3 components. Based on the null model, the X^2 statistics accompanying these variance components showed significant variation among children within a school for initial status (π_{0j}) and academic year learning rates, and significant variation between schools for mean initial status and mean academic year learning rates. The corresponding X^2 test statistics for the hypothesis that there are no individual differences among children's growth rates from 1st through 3rd grade was 8827.455 (df= 5400, $p<.001$), which leads us to conclude that there is a significant variation in the learning rate. Yet, X^2 statistics for 3rd through 5th grade indicated nonsignificance (4975.487, df=5400, $p<.05$), which suggested random effects for 3rd through 5th grades, in the level-2, it should be constrained to zero. At the school level, X^2 statistics showed for both 1st through 3rd and 3rd through 5th, there was significant variation,1684.498 (800, $p<.001$) and1458.362(800, $p<.001$), respectively.

Research Question (2): Do teachers' academic intensity and sense of responsibility for learning help reduce a math learning growth gap, given different levels of academic skills and learning-related behaviors at the entry to school?

In this model, I mainly examined whether teachers' academic intensity and sense of responsibility for learning show any interactive association with the level of the three components of school readiness at school entry. This examination may help to illuminate whether these teachers' indicators moderate the learning growth gap engendered by school readiness. First, the association between teachers' academic intensity and sense of responsibility and children's math learning growth were estimated after controlling for student and school covariates. Retaining the within-school model shown in Equation 1, at the school level, the school average math score when students are in the first grade (β_{00k}), the school average math learning growth from 1st through 3rd grade (β_{10k}), and the school average math learning growth from 3rd through 5th grade (β_{20k}) function as outcome measures predicted by teachers' academic intensity and responsibility after controlling for student and school covariates. In doing so, teachers' academic intensity and sense of responsibility for learning were separately examined on each learning outcome measure: (1) school average math score at the end of 1st grade ($\beta_{00k\ Intercept}$), (2) school average early math learning growth from 1st through 3rd grade (β_{10k}), and (3) school average late math learning growth from 3rd through 5th grade (β_{20k}). These analyses were conducted based on Equations from E2-7.

First, the association between teachers' academic intensity and sense of responsibility for learning and average math score at the end of 1st grade (β_{00k}) was estimated based on the following equation after retaining the measurement and student level model as in Equation (1).

Equation (2)

Level 3: School model

- $\beta_{00k\ \text{(Average math score for 1st grade)}} = \gamma_{000} + \gamma_{001}$ (School composition/School SES/Location) $+ \gamma_{002}$ (Teachers' academic intensity for 1st grade) + γ_{003} (Teachers' responsibility for 1st grade) + ω_{00k}
- $\beta_{10k\ \text{(Average math gain 1st-3rd grade)}} = \gamma_{010} + \gamma_{011}$ (School composition/School SES/Location) + ω_{01k}
- $\beta_{20k\ \text{(Average math gain 3rd-5th grade)}} = \gamma_{100} + \gamma_{101}$ (School composition/School SES/Location) + ω_{10k}

As can be seen in Equation (2), only teachers' academic intensity and sense of responsibility for 1st grade was included in the equation to examine its impact on school average math achievement at the end of 1st grade. After the association between teachers' academic intensity and sense of responsibility and math score at the end of 1st grade was estimated, cross level interaction terms were included in the equation to examine whether teachers' academic intensity and responsibility for learning moderates the math score difference given different levels of school readiness at school entry. Recall that school readiness was constructed based on early math and reading skills and approaches to learning. Thus, the interactive model was repeated for each of the three constructs of school readiness. Retaining the within-school model shown in Equation (1) and the between-school model in Equation (2), the equation is as follows.

Equation (3)

Level 3: Cross-level interaction model

- $\beta_{01k\text{(Math score for 1st grade given school readiness)}} = \gamma_{100} + \gamma_{101}$ (Teachers' academic intensity for 1st grade) + γ_{102}(Teachers' responsibility for 1st grade)

The same process was conducted to estimate the association between teachers' academic intensity and sense of responsibility for learning and early math gain (1^{st} through 3^{rd} grade). In doing so, only teachers' academic intensity and sense of responsibility for 1^{st} through 3^{rd} grade, created based on the principal component measurement model on two waves of data collection (1^{st} and 3^{rd} grades), were included in the equation. Teachers' academic intensity and sense of responsibility for 1^{st} grade were omitted from the equation. The measurement and student level models stay as in Equation (1).

Equation (4)

Level 3: School model

- $\beta_{00k \text{ (Average math score for 1st grade)}} = \gamma_{000} + \gamma_{001}$ (School composition/School SES/Location) + ω_{00k}
- $\beta_{10k \text{ (Average math gain 1st-3rd grade)}} = \gamma_{010} + \gamma_{011}$ (School composition/School SES/Location)

  + γ_{012} (Teachers' academic intensity for 1^{st} -3^{rd} grade) +

  γ_{013} (Teachers' responsibility for 1^{st} -3^{rd} grade) + ω_{01k}
- $\beta_{20k \text{ (Average math gain 3rd-5th grade)}} = \gamma_{100} + \gamma_{101}$ (School composition/School SES/Location)+ ω_{10k}

After examining the association between teachers' academic intensity and sense of responsibility for learning and math gain from 1^{st} through 3^{rd} grade, additional cross level interactive terms were included in the equation to examine whether teachers' academic intensity and sense of responsibility contribute to reducing the gap in learning gain given three different constructs of school readiness. The measurement and student level models stay the same as in Equation (1) and the between school models are as in Equation (4).

Equation (5)

Level 3: Cross-level interaction model

- $\beta_{11k(\text{Math gain from 1st-3rd grade given school readiness})} = \gamma_{110} + \gamma_{111}$ (Teachers' academic intensity for 1st-3rd grade) + γ_{112} (Teachers' responsibility for 1st-3rd grade)

This same process was repeated to examine the association between teachers' academic intensity and sense of responsibility for 3rd through 5th grade and late math learning growth (3rd through 5th grade) (β_{20k}).

Equation (6)

Level 3: School model

- $\beta_{00k\ (\text{Average math score for 1st grade})} = \gamma_{000} + \gamma_{001}$ (School composition/School SES/Location) + ω_{00k}
- $\beta_{10k\ (\text{Average math gain 1st-3rd grade})} = \gamma_{010} + \gamma_{011}$ (School composition/School SES/Location) + ω_{01k}
- $\beta_{20k(\text{Average math gain 3rd-5th grade})} = \gamma_{100} + \gamma_{101}$ (School composition/School SES/Location) + γ_{102} (Teachers' academic intensity for 3rd-5th grade) + γ_{103} (Teachers' responsibility for 3rd-5th grade) + ω_{10k}

After examining whether teachers' academic intensity and sense of responsibility have a significant association with students' math learning growth from 3rd through 5th grade, additional cross level interaction terms were included in the equation. The measurement and student level models were the same as Equation (1), and the school level model was as in Equation (6).

Equation (7)

Level 3: Cross-level interaction model

- $\beta_{21k\text{(Math gain from 3rd - 5th grade given school readiness)}} = \gamma_{210} + \gamma_{211}$ (Teachers' academic intensity for 3rd-5th grade) + γ_{212} (Teachers' responsibility for 3rd-5th grade)

Research Question (3): Do students experience different levels of academic intensity and responsibility, depending on their level of school readiness at the time of entry to school?

The usual ordinary least squares (OLS) was employed to examine whether children with low readiness experience a lower level of academic intensity and responsibility during the elementary schooling years compared to children with a high level of school readiness. A principal component measurement model for school readiness based on math, reading, and approaches to learning at kindergarten entry was created and then divided into three groups: low, medium, and high. In the analysis, the high group of children was the reference group, so that the coefficients indicate the difference in student experiences within a school between the high group vs. the low or middle group in terms of teachers' responsibility and academic support. Teachers' responses about sense of academic intensity and sense of responsibility for learning were separately estimated when the students were in the 1st, 3rd, and 5th grades to verify whether the schooling experience of children fluctuated across the school years.

CHAPTER 4

FINDINGS

Variance Composition of Math Learning Growth From 1st through 5th Grade

Table 4.1 presents the unconditional model of children's math learning growth trajectory from 1st through 5th grade before examining the association between school readiness and students' math learning growth. By applying the unconditional model, in which predictors are specified at either the student or school level, I partitioned the total variance of math learning growth into within- and between-school variances. This way of partitioning is equivalent to the application of one-way ANOVA with random effects. Recall that the math learning growth trajectory was partitioned into early and late math gain. Table 4.1 shows the results.

Table 4.1: Unconditional and Achievement Gains Model Results

	Coefficient (se)	Percentage of Variance between Schools
Math score at the end of 1st grade	60.285** (.382)	27%
Math learning growth from 1st through 3rd grade	37.204** (.301)	25%
Math learning growth from 3rd through 5th grade	24.325** (.218)	11%

** $p < .01$, * $p < .05$

As shown in Table 4.1, on average, a larger math gain was observed from 1st through 3rd grade, showing 37.204 points, compared to 24.325 points growth from 3rd through 5th grade. This finding indicates that the math gain of children slows down as children proceed through these years of schooling.

Table 4.1 also presents the intra-class correlation, which represents the proportion of variance between schools. The results indicate that 27 percent of the variance at the end of 1st grade lies *between* schools. The intra-class correlation for math gain showed that a larger variance was attributable between schools to the early years, 25 percent, with 11 percent attributable to late growth. This finding aligns with previous studies that suggested that the early elementary school years may be more effective than the later school years.

The Association Between School Readiness and Math Learning Growth

I now turn to the analyses that address the first research question, whether children demonstrate differences in math learning growth trajectory depending on their level of school readiness at kindergarten entry. School readiness is defined as a construct of math skills, reading skills, and approaches to learning measured at kindergarten entry, following the findings of previous studies (Duncan et al., 2007). The result tables are reported with standardized coefficients and standard errors in parentheses.

Table 4.2 presents the parameter estimates of the association between school readiness and math score at the end of 1st grade, early gain, comprising 1st through 3rd grade, and late gain, comprising 3rd through 5th grade, after controlling for student and school background characteristics. As shown in Table 4.2, three constructs of school readiness, math, reading, and approaches to learning, were separately examined for their role in students' math learning growth from 1st through 3rd and 3rd through 5th grade, after holding individual and school covariates constant.

The results suggest that early math skills at school entry was positively associated with math score at the end of 1st grade (10.00, $p<.01$), and math gain from 1st through 3rd grade (1.99, p<.01), after holding constant reading skills, approaches to learning, and other student and school covariates. Reading skills measured at kindergarten entry showed a positive association with 1^{st} grade math achievement (.706, p<. 05), but no significant relationship with math gain from 1^{st} through 3^{rd} grade. Although it is not shown in Table 4.2, when math, reading, and approaches to learning were specified as an additive model, reading skills maintained a positive association with early learning gain, even after holding approaches to learning constant. The significant association of reading skills with early math gain disappeared when math skills at kindergarten entry was specified in the model. The positive association of approaches to learning was indicated both with 1^{st} grade math achievement (1.811, p<.01) and early math gain (1.206, p<.01) and (.681, p<.01), respectively. In contrast to the relationship between reading skills and early math gain, approaches to learning sustained its significant association when math skills at kindergarten entry were held constant.

The relationship between math and reading skills at school entry and math gain, from 3^{rd} through 5^{th} grade, showed the opposite relationship (-1.190, p<.01) and (-.570, p<.05), respectively. The opposite association suggests that students with lower reading and math skills at their entry to school would show faster math gains from 3^{rd} through 5^{th} grade compared to high achievers at school entry. However, approaches to learning showed a consistent positive association with math learning growth from 3^{rd} through 5^{th} grade (.681, p<.01). [10] The different relationships between early academic skills and approaches to learning and math gain from 3^{rd}

---

[10] When school readiness was predicted from overall math learning growth from 1^{st} through 5^{th} grade, before partitioning into early and late math gain, math skills at kindergarten entry showed negative coefficients, which suggests that children who enter with higher math scores tend to show a lower math gain from 1^{st} through 5^{th} grade (i.e., Bodovski, & Youn, 2012). This pattern of result does not hold, however, when children's math learning growth is partitioned into early and late math gain as presented in Table 4.2. That is, children's early math skills at kindergarten entry showed a positive association with early math gain (1^{st} through 3^{rd}), but a negative one with late math gain (3^{rd} through 5^{th}). This pattern of results suggests that the use of overall math learning growth for a long time span may bias the relationship between early academic skills and math learning growth.

through 5th grade may imply ceiling effects for high achievers, due to a paucity of inclusion of sufficiently difficult test items on the child assessment in the ECLS-K data (Reardon, 2007).

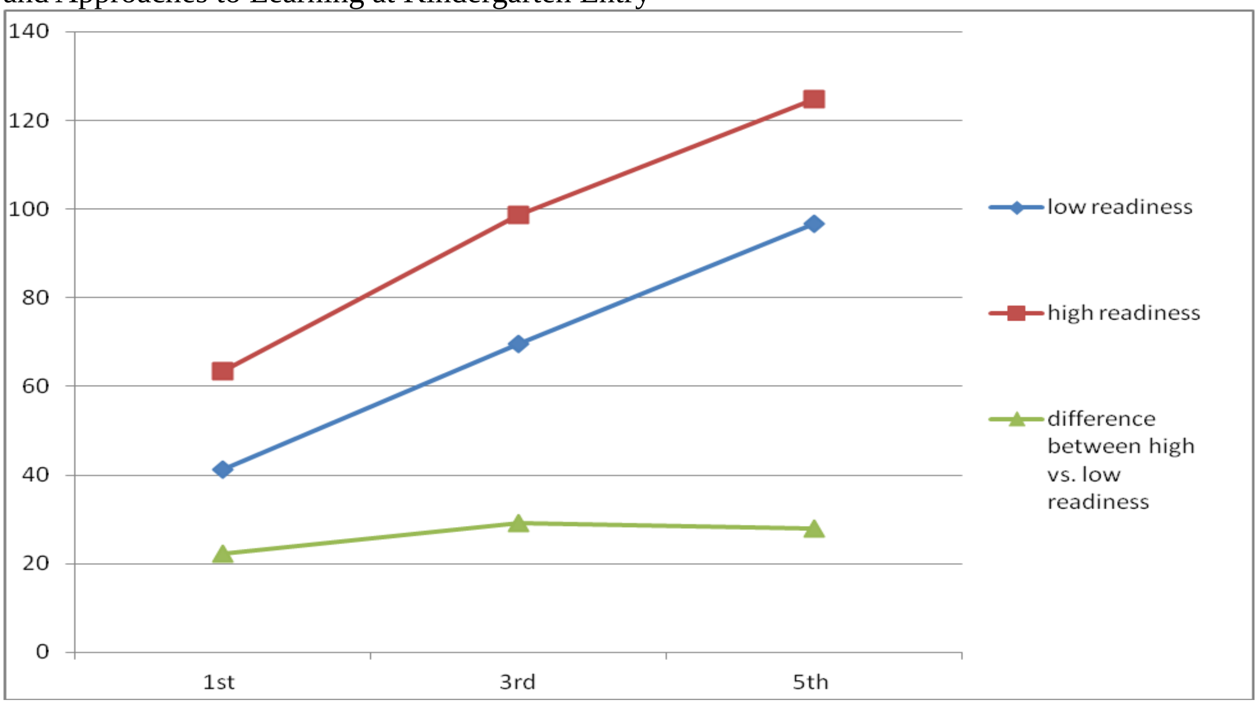
Table 4.2: Parameter Estimates Predicting the Association Between Three Components of School Readiness and Students' Math Learning Growth from 1st through 5th Grade after Controlling for Individual and School Characteristics

	Intercept 1st grade (se)	Math Early Gain 1st through 3rd grade (se)	Math Late Gain 3rd through 5th grade (se)
Intercept	60.497** (.662)	36.795** (.802)	24.114** (.699)
School Readiness			
Math	10.000** (.321)	1.985** (.338)	-1.190** (.266)
Reading	.706* (.282)	-.071 (.289)	-.570* (.245)
Approaches to learning	1.811** (.188)	1.206** (.218)	.681** (.214)
Student Level Variable			
SES	1.311** (.255)	1.279** (.263)	.598* (.235)
Male	2.907** (.323)	3.148** (.381)	.552 (.319)
Black	-4.261** (.561)	-4.744** (.715)	-.714 (.699)
Hispanic	-1.133* (.548)	-1.011 (.634)	1.055 (.544)
Asian	-2.002* (.777)	1.689* (.802)	3.275** (.694)
Other	-2.393** (.690)	-1.701 (.914)	.829 (.708)
Single parent	.818 (.437)	-.594 (.578)	-.188 (.471)
Other parent	-.208 (.835)	-2.780** (.996)	-.227 (.929)
Non biological parent	.392 (.561)	-.322 (.733)	-.280 (.616)
Number of siblings	.249 (.161)	-.473* (.207)	-.305 (.173)
Retained	-8.083** (.509)	-4.797** (.628)	.508 (.661)
School Level Variable			
School SES	.137 (.286)	.696 (.365)	.293 (.315)
Urban	1.163 (.606)	1.308 (.727)	-.145 (.651)
Suburban	.697 (.604)	.712 (.699)	-.578 (.616)
Minority	.140 (.524)	-.089 (.678)	-.403 (.565)

** $p < .01$, * $p < .05$

In terms of the magnitude of the relationship, consistent with previous studies, math skills at kindergarten entry showed the largest effect size, followed by approaches to learning, and then reading. Indeed, math skills at kindergarten entry showed a substantial influence on math score at the end of 1st grade, which is about a .55 SD advantage.[11] In addition, the magnitude of the effect of approaches to learning on math learning gain was substantial, indicating a greater effect size compared to reading skills at kindergarten entry. This effect size is equivalent to or greater than student SES, which suggests the substantial importance of children's behavior on their learning growth during the elementary school years.

Figure 4.1: Predicted Math Learning Growth Trajectory by School Readiness, Math, Reading, and Approaches to Learning at Kindergarten Entry



Note: Children were classified into three levels of school readiness (low, medium, and high). The process of assigning children to the three levels was as follows: First, a principal component measurement model was conducted to create one measure of school readiness. Then, this school readiness score was divided into three different levels. After dividing the children into three levels of readiness (high, middle, and high), they were included in the equation as dummy variables. The high group was the reference group.

[11] I computed *d*-type effect sizes, which is computed as (β × SD*x*)/SDy.

The variation in expected math learning growth depending on school readiness is depicted in Figure 1. For the convenience of the figure, children's school readiness was divided into low, medium, and high groups. As can be seen in Figure 4.1, the gap in math gain persists from 1st through 5th grade by the level of readiness, indicating a larger disparity from 1st through 3rd grade than from 3rd through 5th grade. Although the learning growth trajectory between low vs. high readiness groups appeared to decrease as the children proceeded through the elementary school years, the disparity given school readiness is so substantial that children from the high readiness group maintained a considerable advantage in math achievement at the end of 5th grade. More specifically, students of low readiness demonstrate math achievement at 3rd grade that is almost equivalent to the 1st grade math skill level of those with high school readiness. Moreover, the expected math achievement of students with low school readiness at 5th grade is slightly lower than the math achievement level of students with high readiness at 3rd grade.

After the association between school readiness and math learning growth was examined, the next set of analyses was conducted to estimate whether the influence of school readiness would vary for any particular group of students. In order to investigate which group of students would benefit the most by improving school readiness, interaction terms between school readiness, a principal component composed of three variables, and SES and race/ethnicity were included in the model. The approach of using a principal component measurement model to categorize into different groups was preferred in interaction modeling to ease interpretation and model specification, rather than dividing the data into the three elements (i.e., math, reading, and approaches to learning) of school readiness, which may have created too many subgroups in the model specifications.

Table 4.3: Parameter Estimates Predicting the Interactive Relationship Between Three Components of School Readiness, SES, and Race and Math Learning Growth from 1st through 5th Grade after Controlling for Individual and School Characteristics

Interaction	Intercept 1st grade (se)	Math Early Gain 1st through 3rd grade (se)	Math Late Gain 3rd through 5th grade (se)
Readiness × SES	-.195 (.265)	-1.814** (.235)	-1.439** (.192)
Readiness × Female	1.017* (.390)	-1.22** (.361)	-1.492** (.296)
Readiness × Black	-1.617** (.563)	1.631* (.635)	1.969** (.599)
Readiness × Hispanic	-.774 (.6368)	2.182** (.6245)	-.1607 (.635)
Readiness × Asian	-1.921* (.807)	-0.143 (.714)	.770 (.471)
Readiness × Other	-.455 (.683)	2.071** (.773)	1.140 (.723)

** $p < .01$, * $p < .05$

As shown in Table 4.3, the inclusion of interaction terms between SES*readiness showed a negative significant association, which suggest that students from lower SES families will significantly benefit from improved school readiness in math learning growth. The advantage to low SES students through the improving school readiness was consistent in both early and late growth, (-1.814, p<.01) and (-1.439, p<.01), respectively. Among racial groups, the negative interaction association showed that Black, Hispanic, and Other students will demonstrate higher math learning growth with improved school readiness. In particular, Black students appeared to consistently benefit from improved school readiness, both in early and late growth, (1.631, p<.05) and (1.969, p<.05), respectively, whereas Hispanic and Other students mostly benefitted in math gain from 1st through 3rd grade.

The Moderating Role of Teachers' Academic Intensity and Sense of Responsibility for Learning on Reducing the Gap in Math Learning Growth Engendered by School Readiness

Thus far, as the result suggests, school readiness at school entry is strongly associated with math score gains, specifically indicating that students in the low group of school readiness are substantially disadvantaged in math learning throughout their school years. In this section of findings, I provide the evidence related to the second research question, whether teachers' academic intensity and responsibility can enhance math learning growth for students who enter school with low readiness. To answer this question, the first subsequent analysis examined the associations between teachers' academic intensity and sense of responsibility for learning with students' math growth gains.

Retaining the within-school HLM models shown in Table 4.2, the results confirm the school effects literature and suggest that students attending schools with higher teachers' academic intensity and sense of responsibility showed consistent improvement in math learning gain from 1st through 5th grade. Students attending schools with higher teachers' academic intensity, and responsibility for learning showed a positive association, (.666, $p<.06$) and (.595, $p<.06$), respectively, with math scores at the end of 1st grade. A similar positive relationship was indicated for math gains from 1st through 3rd grade, indicating an advantage of (.998, $p<.05$) and (1.005, $p<.05$) associated with attending a school with higher teachers' academic intensity and responsibility, respectively. The advantages of attending schools that provide higher teachers' academic intensity and responsibility were sustained on math gains from 3rd through 5th grade, (.901, $p<.05$) and (.698, $p<.05$), respectively.

Table 4.4: Parameter Estimates Predicting the Relationship between Teachers' Academic Intensity and Responsibility and Math Learning Growth from 1st through 5th Grade after Controlling for Individual and School Characteristics

	Intercept 1st grade (se)	Math Early Gain 1st through 3rd grade (se)	Math Late Gain 3rd through 5th grade (se)
Intercept	60.493** (.653)	36.814** (.803)	24.120** (.666)
School Readiness			
Math	9.988** (.321)	1.984** (.339)	-1.178** (.276)
Reading	.714* (.282)	-.078 (.289)	-.575* (.264)
Approaches to learning	1.817** (.188)	1.198** (.217)	.666** (.203)
Student Level Variable			
SES	1.312** (.256)	1.279** (.263)	.602* (.234)
Male	2.933** (.322)	3.169** (.381)	.557+ (.325)
Black	-4.260** (.568)	-4.736** (.727)	-.532 (.634)
Hispanic	-1.183* (.548)	-1.212+ (.637)	.987+ (.537)
Asian	-2.027** (.776)	1.613* (.802)	3.263** (.700)
Other	-2.304** (.699)	-1.525+ (.908)	.883 (.763)
Single parent	.834+ (.439)	-.556 (.581)	-.139 (.445)
Other parent	-.175 (.833)	-2.706** (1.000)	-.196 (.946)
Non biological parent	.402 (.560)	-.292 (.728)	-.261 (.636)
Number of siblings	.257 (.160)	-.468* (.207)	-.305+ (.161)
Retained	-8.059** (.507)	-4.783** (.633)	.493 (.574)
School Level Variable			
School SES	.070 (.298)	.559 (.379)	.204 (.317)
Urban	1.139+ (.606)	1.127 (.733)	-.225 (.633)
Suburban	.588 (.603)	.446 (.708)	-.699 (.602)
Minority	.239 (.536)	.261 (.724)	-.299 (.548)

Academic intensity for 1st grade	.666+ (.322)		
Responsibility for 1st grade	.595+ (.332)		
Academic intensity for 1st – 3rd grade		.998* (.407)	
Responsibility for 1st – 3rd grade		1.005* (.414)	
Academic intensity for 3rd – 5th grade			.901** (.286)
Responsibility for 3rd – 5th grade			.698* (.297)

** $p < .01$, * $p < .05$, + $p < .06$

According to this result, the accumulative effect sizes appear to be similar between teachers' academic intensity and responsibility on math learning growth, ranging from .07 to .09 from 1st through 5th grade. [12] This corresponds to an increase for an average child from the 50th to the 54~56th percentile in the math growth distribution associated with attending a school with higher teachers' sense of responsibility for learning and academic intensity. In addition, the magnitude of the relationship between academic intensity and sense of responsibility for learning appears to be slightly stronger for early math gain (1st through 3rd grade), than late math gain (3rd through 5th grade).

Since a significant association was found between teachers' academic intensity and sense of responsibility for learning and both early and late math gain during the elementary school years, the next analyses address the second research question, whether teachers' academic intensity and sense of responsibility for learning moderate the gap in math gains, given school readiness at school entry. Retaining the within- and between-school model shown in Table 4.4, cross-level interaction terms between school readiness and teachers' academic intensity and sense of responsibility for learning were entered into the equations.

[12] They are in *d*-type effect sizes, which is computed as $(\beta \times SDx)/SDy$

Table 4.5 presents results showing that schools with higher teachers' sense of responsibility for learning contributes to reducing the gap in math score at the end of 1st grade, and math gain for both 1st through 3rd grade and 3rd through 5th grade, given children's disadvantages in math, reading, and approaches to learning at school entry. Specifically, the cross level interaction terms between teachers' sense of responsibility for learning, a principal component composed of three observed variables, and math skills at school entry, indicated a significant role in reducing the gap in math score at the end of 1st grade (-.647, $p <.05$), math gain from 1st through 3rd grade (-1.022, $p <.01$), and (-.991, $p <.01$) from 3rd through 5th grade. Similarly, higher teachers' responsibility benefited students with low reading skills at school entry, both on early and late gain, (-.694, $p <.05$) and (-.825, $p <.01$), respectively. A further consistent benefit was found for students with low approaches to learning scores at school entry in schools with higher teachers' sense of responsibility for learning, suggesting that these students would reduce their disadvantage in early math gain, (-.634, $p <.01$), and late gain (-.945, $p <.01$). This pattern of results suggest that children with a low level of school readiness at school entry can reduce the gap in math learning growth trajectory by attending schools with a higher level of teachers' sense of responsibility for students' learning.

However, straying from the conventional wisdom that teachers' academic intensity will benefit students with low school readiness, as shown in Table 4.5, the result failed to suggest the moderating role of teachers' academic intensity on reducing the math learning growth gap engendered by different levels of math, reading, and approaches to learning scores at kindergarten entry. This pattern of results is somewhat consistent with the finding of Magnuson and her colleagues (Magnuson et al., 2007), which indicated that high levels of time spent in instruction did not reduce the initial disparities. This finding will be further discussed in the discussion section.

Table 4.5: Parameter Estimates Predicting the Moderating Role of Teachers' Academic Intensity and Responsibility on Reducing the Learning Growth Gap Engendered by School Readiness after Controlling for Individual and School Characteristics

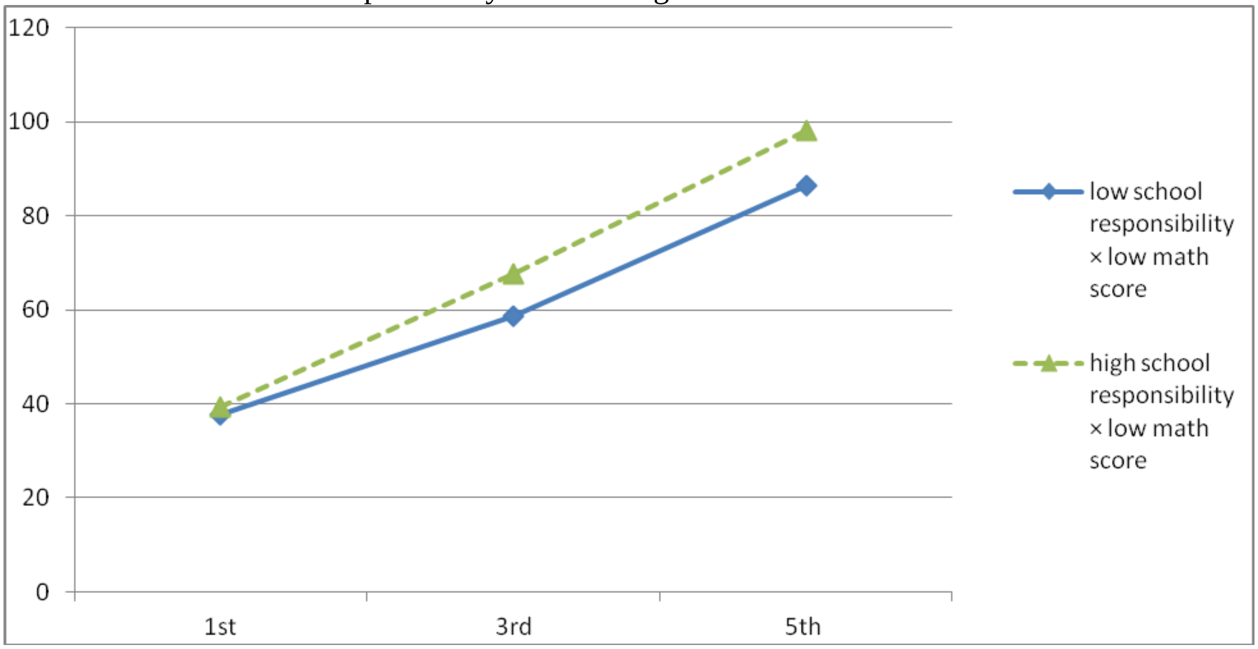
	Math score given Math skills at K (1st grade)	Math gain given Math skills at K (1st-3rd grade)	Math gain given Math skills at K (3rd -5th grade)
Intercept	10.056** (.314)	2.107** (.336)	-1.078** (.273)
Responsibility	-.647* (.265)	-1.022** (.307)	-.991** (.230)
Academic intensity	-.476 (.305)	.424 (.325)	.302 (.220)
	Math score given Reading skills at K (1st grade)	Math gain given Reading skills at K (1st-3rd grade)	Math gain given Reading skills at K (3rd -5th grade)
Intercept	.711* (.280)	-.001 (.294)	-.398 (.268)
Responsibility	-.255 (.255)	-.694* (.278)	-.825** (.279)
Academic intensity	-.513 (.320)	.599 (.313)	.307 (.210)
	Math score given Approaches to learning at K (1st grade)	Math gain given Approaches to learning at K (1st-3rd grade)	Math gain given Approaches to learning at K (3rd -5th grade)
Intercept	1.811** (.187)	1.156** (.219)	.620** (.211)
Responsibility	-.244 (.221)	-.634* (.247)	-.945** (.221)
Academic intensity	-.242 (.275)	.428 (.286)	.404 (.221)

** $p < .01$, * $p < .05$

Note: Standard errors are in parentheses. This table only shows the parameter estimates of cross level interaction terms. For full models see Appendix Table A.4.1, A. 4.2, and A. 4.3.

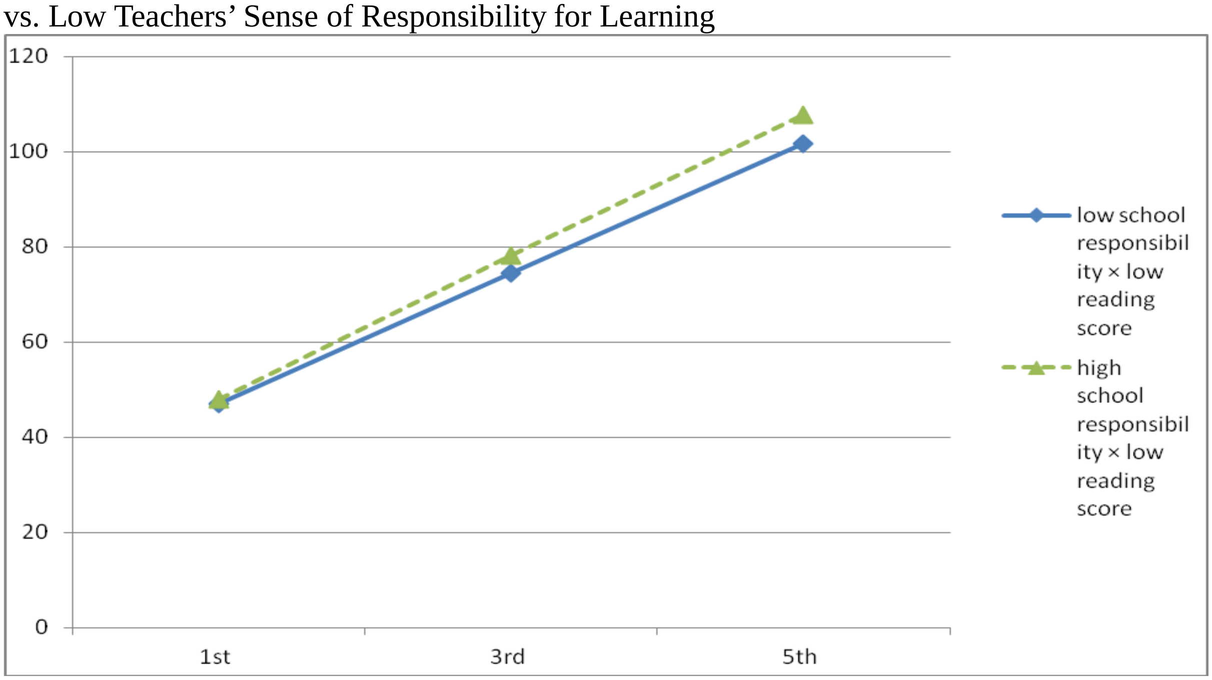
The moderating role of teachers' sense of responsibility for learning for children with low readiness at school entry is illustrated in Graphs 4.2-4.4. As noted in the graphs, the benefits of attending a school with high teachers' responsibility accumulate over time, so that the disparity, given different levels of academic skills, appeared to be reduced throughout the school years.

Figure 4.2: The Difference in Math Learning Growth Trajectory from 1st through 5th Grade Between Students with Low Math Score at Kindergarten Entry Attending Schools with High vs. Low Teachers' Sense of Responsibility for Learning



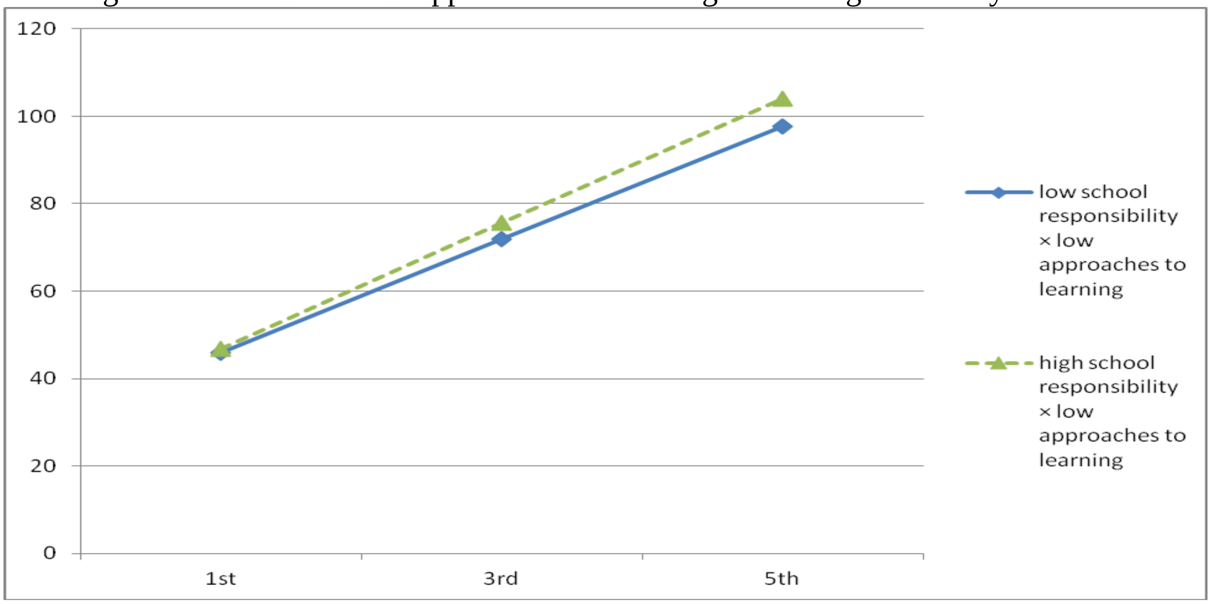
Note: High and low teachers' responsibility for learning are distinguished by one standard deviation above or below the mean. Low math score describes students who are one standard deviation below the average math score at kindergarten entry. The predicted estimates were calculated for the 'average' child in the sample.

Figure 4.3: The Difference in Math Learning Growth Trajectory from 1st through 5th Grade Between Students with Low Reading Score at Kindergarten Entry Attending Schools with High vs. Low Teachers' Sense of Responsibility for Learning



Note: High and low teachers' responsibility for learning are distinguished by one standard deviation above or below the mean. Low math score describes students who are one standard deviation below the average math score at kindergarten entry. The predicted estimates were calculated for the 'average' child in the sample.

Figure 4.4: The Difference in Math Learning Growth Trajectory from 1st through 5th Grade Between Students Attending Schools with High vs. Low Teachers' Sense of Responsibility for Learning of Students with Low Approaches to Learning at Kindergarten Entry



Note: High and low teachers' responsibility for learning are distinguished by one standard deviation above or below the mean. Low math score describes students who are one standard deviation below the average math score at kindergarten entry. The predicted estimates were calculated for the 'average' child in the sample.

In addition to these analyses, the question of whether the academic intensity and sense of responsibility for learning of individual teachers would exert a similar pattern of relationship for children with low school readiness was investigated. This was necessary to verify whether the significant association between teachers' academic intensity and sense of responsibility for learning and math learning growth is not simply reflecting the aggregation of teacher variables at the school level. To address this issue, an analysis was conducted to examine whether the significant pattern of interactive relationship between teachers' academic intensity and responsibility is consistent at the individual teacher level. Therefore, in this analysis, instead of using the aggregated mean scores of the teacher indicators at the school level, the individual teacher academic intensity and sense of responsibility for learning measures were included in the equations. Other than this difference, all other statistical models and construction of variables stay the same, as shown in the Data and Methods section.

According to the analyses, the moderating role of academic intensity and responsibility indicated a similar pattern of relationship for both the individual and the aggregated teacher measures, suggesting that, in general a higher level of these measures helps to increase the math learning growth of children with low school readiness.[13] Although the magnitude of these relationships are somewhat smaller at the individual teacher level, the consistent predictive relationship between the moderating role of the individual teacher practices and attitudes and the aggregated teachers' academic intensity and sense of responsibility for learning implies that the findings presented in this study are less likely to be driven by an aggregation bias (see Appendix Table B.1).

However, some caution is required in extending the interpretation of the finding based on the individual teacher indicators. This is partly because of a limitation of the data set that it does not provide the information about teacher academic intensity and sense of responsibility when the children were in the 2nd and 4th grades. That is, students do not remain with the same teacher and thus, the omission of this information impedes a precise estimation of the association between individual teacher academic intensity and sense of responsibility and math learning growth. This was partly the reason why the present study employed the aggregated mean score at the school level. Although this aggregated measure is not perfect, it was the best measure to capture the learning environment of children during the elementary school years. Despite this limitation of the individual teacher analysis, the consistent pattern of findings suggests that the

[13] One notable finding from the teacher level analyses was that academic intensity × math/reading scores at kindergarten entry showed positive coefficients on late math learning growth, suggesting that children with higher math and reading skills at kindergarten entry will demonstrate a higher math learning growth from 3rd through 5th grade. This finding contradicts the previous literature, which often suggested that an increase in instructional time can benefit academically disadvantaged students. However, some caution is required in interpreting this finding given that teacher information is not provided for the 2nd and 4th grades.

result is less likely to be biased given the use of aggregated variables.

Furthermore, additional sensitivity analyses were conducted to examine whether the measures of teachers' academic intensity and sense of responsibility that were created based on two time spans are robust in estimating their interactive relationship with school readiness and students' math learning growth. As a result, in this sensitivity analysis, instead of using teachers' practices and attitudes variables that combined two time spans (i.e., teachers' responsibility for 1^{st} through 3^{rd} grade and 3^{rd} through 5^{th} grade), I examined the interactive relationship between school readiness and the teachers' attitudes variables for each time point (i.e., teachers' responsibility for 1^{st} grade, teachers' responsibility for 3^{rd} grade, and teachers' responsibility for 5^{th} grade) See Appendix Equation 4.1 through 4.4 for the model specification. For example, in order to estimate the interactive relationship between teachers' sense of responsibility and school readiness and math learning growth for 1^{st} through 3^{rd} grade, instead of using teachers' academic intensity and sense of responsibility for 1^{st} through 3^{rd} grade (see Chapter 3, description of variables), I estimated math gain from 1^{st} through 3^{rd} grade as a function of (1) teachers' responsibility for 1^{st} grade and (2) teachers' responsibility for 3^{rd} grade, independently. This same procedure was repeated for late math gain, by regressing children's math learning growth from 3^{rd} through 5^{th} grade as a function of (1) teachers' responsibility for 3^{rd} grade and (2) teachers' responsibility for 5^{th} grade, independently. Findings based on these model specifications were largely similar to the results presented in Table 4.4, which suggests that the results indicated in this study are less likely to be biased by the use of teachers' attitudes variables created based on two time spans.

The Relationship Between School Readiness and Teachers' Academic Intensity and Sense of Responsibility for Learning

This section of findings provides the evidence regarding the third research question whether children's schooling experience is stratified by their level of school readiness at school entry. Although a significant moderating role of teachers' academic intensity for the learning growth gap for students with low school readiness was not found, the findings so far suggest that both teachers' academic intensity and sense of responsibility for learning have an important influence on students' learning progress (see Table 4.4). Given the importance of these aspects of the schooling experience, regression analyses were conducted to examine whether students experience a different level of academic intensity and responsibility during the elementary school years, depending on their initial readiness. In doing so, each aspect of teachers' academic intensity and responsibility for every grade level (1^{st}, 3^{rd}, and $5^{th)}$ was examined, to verify whether students with different levels of readiness are disadvantaged not only in terms of learning outcomes but also in their school experience. Given the high group of school readiness as the reference group, the coefficients shown in Table 4.7 are interpreted as the differences in students' experience within a school between the high group vs. the low or middle group.

According to the findings, teachers demonstrated lower academic responsibility for students with lower and middle readiness, compared to the high group of students. Specifically, students with low readiness were conceived as less capable of learning and more likely to interfere in instructional practices given their misbehavior, and as harder to make a difference for, across every grade level. On the other hand, students with low and middle levels of readiness were not disadvantaged in terms of allocated instructional time, frequency of math classes in a week, or expected hours spent on homework, compared to students with a high level of readiness. Indeed, students with low readiness were expected to spend more time on math homework in 1st grade and were exposed to a higher level of math instructional time than students in the high group of school readiness in 5th grade. Although these differences are not substantial and are somewhat inconsistent across grade levels, this pattern of findings suggests that, generally, students with low readiness do not necessarily experience less academic intensity. However, teachers' sense of responsibility toward students with low readiness was substantially lower than that for the high readiness group of students.

Table 4.6: Parameter Estimates Predicting the Relationship Between School Readiness and Teachers' Academic Intensity and Sense of Responsibility for Learning

	Responsibility			Academic Intensity		
1st grade	Student is capable of learning	Low	-.167** (.033)	The amount of math instruction on a daily basis	Low	.003 (.023)
		Med	-.063** (.032)		Med	.021 (.022)
	Child's misbehavior doesn't interfere with teaching	Low	-.153** (.039)	Expected time spent on math homework	Low	.142** (.030)
		Med	-.069** (.037)		Med	.050** (.029)
	Teacher can make a difference	Low	-.050** (.021)	The amount of math instruction on a weekly basis	Low	.031 (.012)
		Med	-.048** (.019)		Med	.039* (.012)
3rd grade	Student is capable of learning	Low	-.103** (.037)	The amount of math instruction on a daily basis	Low	.014 (.030)
		Med	-.033 (.036)		Med	.033 (.030)
	Child's misbehavior doesn't interfere with teaching	Low	-.084** (.040)	Expected time spent on math homework	Low	-.009 (.022)
		Med	-.021 (.040)		Med	.025 (.021)
	Teacher can make a difference	Low	.003 (.024)	The amount of math instruction on a weekly basis	Low	-.012 (.010)
		Med	.022 (.023)		Med	-.009 (.009)
5th grade	Student is capable of learning	Low	-.142** (.035)	The amount of math instruction on a daily basis	Low	.038* (.022)
		Med	-.067** (.035)		Med	.033* (.021)
	Child's misbehavior doesn't interfere with teaching	Low	-.096** (.040)	Expected time spent on math homework	Low	.030 (.030)
		Med	-.064** (.040)		Med	.017 (.030)
	Teacher can make a difference	Low	-.071** (.023)	The amount of math instruction on a weekly basis	Low	.015 (.022)
		Med	-.047** (.022)		Med	.010 (.022)

** $p < .01$, * $p < .05$

CHAPTER 5

DISCUSSION

This study merges two lines of inquiry into how school readiness influences students' learning progress and whether teachers' academic intensity and willingness to take responsibility for their students contribute to the children overcoming their initial learning deficits. In contrast to much of the research on teacher effectiveness, which has focused on the role of the individual teacher interactions with the students, this study adds to the growing body of work documenting ways in which teachers' academic intensity and responsibility for students' learning moderate the learning growth gap of children who enter school with low readiness. Furthermore, unlike the previous studies that mostly concentrated on the effectiveness of early intervention for improving school readiness, the current study provides evidence that the learning experience during the elementary school years, especially the shared efforts of teachers, plays a significant role in reducing the learning growth gap created by different levels of readiness at school entry. Specifically, the present study examined ways in which children with low readiness may be assisted by teachers' academic intensity and responsibility for learning. In doing so, this study first examined the influence of school readiness on children's math learning progress during the elementary school years after controlling for individual and school characteristics. Then, the moderating role of teachers' academic intensity and sense of responsibility for learning was examined to investigate whether a higher level of teachers' academic intensity and sense of responsibility contributes to reducing the gap in learning growth engendered by the level of school readiness at school entry. Given that the attitudes of school members can compensate for the lower level of school readiness at school entry, the question of whether exposure to higher academic intensity and responsibility is stratified by the level of school readiness was examined. Largely due to the lack of data on the quality of the learning experience in the later school years, this set of issues has not been empirically examined.

School readiness within this study is conceptualized as a composite measure of math, reading, and approaches to learning scores at kindergarten entry. This conceptualization is based on evidence that early attention-related behaviors and academic skills are the most predictive factors that need to be considered when assessing school readiness (Duncan et al., 2007). Consistent with these previous studies, students with higher readiness show a substantial advantage in math learning growth from 1st through 5th grade over children with low school readiness at school entry. Indeed, the most notable advantage of higher readiness was observed from 1st through 3rd grade although students with low readiness at school entry demonstrate slightly higher math gains from 3rd through 5th grade, the advantage is too small to confirm a substantial reduction in the achievement gap.

Findings from this study also suggest that teachers' sense of responsibility ultimately benefits students with low readiness (math, reading, and approaches to learning) at school entry. This finding aligns with that of previous studies that teachers' expectations are somewhat more powerful for disadvantaged students, such as African American students (Ferguson, 1998). Indeed, the strongest advantage of teachers' sense of responsibility for learning was found for children with math and reading learning deficits, and this moderating role of teachers' sense of responsibility for math gains appeared to accumulate over time, so that the gap in math achievement between students in schools with high and low levels of teachers' sense of responsibility was reduced as students progressed through their school years.

One way in which a higher level of teachers' responsibility for the learning outcomes of children may exert a positive influence on children with lower academic skills at school entry is through a 'self-fulfilling prophecy', through which teachers' high expectations may increase students' academic self-image, which causes children to place a heavier emphasis and effort on their school work. Another avenue could be that teachers' higher expectation for students' learning may lead teachers to exert higher efforts to raise the academic outcomes of students with disadvantages. As a result, these teachers may develop specific strategies to improve the quality of their instruction for disadvantaged children.

Furthermore, beyond the advantage for children with academic deficits, the current study extends these findings by suggesting that higher expectations and beliefs about a student's capability can be an important school resource in enabling some children to make behavioral changes in early elementary school. Theories seeking to explain this potential mechanism, including work on the student-teacher relationship, suggest that children who see teachers as supportive are more likely to pursue goals valued by teachers, such as engagement in academic activities (Hamre & Pianta, 2001). Yet, this prior work was limited in emphasizing the moderating role of the individual interactions between the teacher and student, whereas the current study adds evidence that the shared beliefs and attitudes of teachers contribute to increasing students' motivation and pursuit of academic goals.

On the other hand, the academic performance of students with low approaches to learning was not significantly moderated by a higher level of academic intensity as some previous studies suggested. This finding is consistent with other work indicating that among children who have displayed difficulties adjusting to the classroom environment, having teachers with specific instructional practices or academic support may not be as important as having teachers who attend to their social and emotional needs (Hamre, & Pianta, 2001; Wentzel, 2002).

Furthermore, teachers' academic intensity did not have a significant moderating effect for students with low academic skills at school entry. A similar pattern was shown in studies conducted by Magnuson and her colleagues (Magnuson et al., 2007), indicating that a preschool-related gap in math skills, unlike reading skills, at school entry was not significantly reduced even when children were placed in high levels of math instruction during the kindergarten and elementary schooling years. This finding suggests that merely increasing the amount of instruction time may not be successful in raising the math learning growth of children with disadvantages. This pattern of results, however, does not undermine the importance of academic intensity for improving student learning outcomes. Caution is required before dismissing the potential benefits of academic intensity, particularly when the results indicate that academic intensity, on average, consistently benefits student learning throughout the elementary school years.

One plausible explanation for this pattern of results can be that these studies have not measured the type and quality of the academic intensity that students with different levels of readiness actually receive within school. Even when the amount of academic intensity does not differ for different groups of students, the type of instruction provided for low readiness students may not boost their learning progress in a way that can be reflected in the ECLS-K assessment. That is, as studies related to high-stakes testing policy suggested, low-achieving students are more likely to spend their time drilling math problems and learning simple computations to improve their basic skills (Oakes, 1985; Darling-Hammond & Wise, 1985; Romberg, Zarinia, Williams, 1989; Shepard & Dougherty, 1991; Smith & Rottenburg 1991; McNeil & Valenzuela, 2001). Yet, the ECLS-K assessment is designed to measure comprehensive math skills, so if students with low readiness received mostly drilling problems and simple computations, it is likely that these instructional activities will not necessarily raise test scores on the ECLS-K math assessment.

Another possibility is that a low quality of academic instruction is tightly connected to teachers' sense of responsibility. As some of the previous studies suggested, teachers demonstrate low expectations for children with low academic skills, children of low income, and African American students (Jussim et al., 1996; Diamond, Randolph, & Spillane, 2004). This low expectation causes students to exert less effort in school, which in turn eventually leads teachers to give certain students less challenging coursework (Farkas et al. 1990). This connection between instructional quality and teachers' sense of responsibility entails the possibility that the body of knowledge presented to students with less academic ability may be qualitatively different from other students, as different theories of hidden curriculum revealed in the 1970's (Bernstein, 1975). That is, teachers' sense of responsibility can be the underpinning factor that drives pedagogical practices and plays a decisive role in constructing the schooling experience, both academically and emotionally, of children. Consequently, by defining and constraining the knowledge to which a student is exposed, teachers determine the educational opportunities that may function as another mechanism that is linked to student achievement (Hallinan, 1988). This in turn suggests that children with low readiness may be 'doubly disadvantaged', both in terms of educational outcomes and processes, given the low expectations of their teachers.

Despite the importance of teachers' expectations, another noteworthy finding from this study is that while teachers appeared to have a lower sense of academic responsibility toward students with low readiness, these students did not in fact experience less academic intensity with their teachers. Previous studies found evidence that teachers' expectations are often lower for children with low achievement, children of low-income, and African American students

(Ferguson, 1988), and it was often thought that these students received less academic support as well. However, the current study provides evidence that academic intensity does not differ among students regardless of their academic capacities. This inconsistency may be in part because, given the increasing popularity of raising academic standards as a policy tool (e.g., accountability policy, high stakes testing policy), there has been incremental pressure to add more instructional time, cover more material, and adopt a better curriculum or more effective teaching methods in public schools (Bishop & Maine, 1999; Roderick & Engel, 2001; Swanson & Stevenson, 2002). Indeed, historically, increasing the amount of academic instruction has been one common approach taken to boost the learning of students with disadvantages (Oakes et al., 1990). If, however, this is why low-skilled students do not experience lower academic intensity, as some accountability advocates claim (Bishop & Mane, 1999), the findings of this study support the claim that the existing efforts to raise academic standards are *not* effective in raising teachers' beliefs and expectations regarding disadvantaged students.

To this end, the findings of the present study suggest that children with low readiness learn much less throughout their elementary school years, and although this difference attenuates from the 3rd through the 5th grades, the difference is substantial in math test scores at the end of 5th grade. In examining whether teachers' academic intensity and sense of responsibility for learning can moderate the math learning growth gap, only teachers' sense of responsibility for the learning of their students appeared to benefit children who enter school with low school readiness. Interestingly, children with low readiness are not necessarily exposed to a lower level of academic intensity, but teachers do hold a substantially lower level of responsibility for learning toward those children with a low level of preparedness at school entry. This suggests that children with low readiness are substantially stratified both in terms of learning outcomes and their schooling experience during the elementary school years.

Implications

Policy Implications

The findings of this study support the notion that the elementary school experience matters for disadvantaged children. Although the effect size provided in this study may be small in conventional terms, evidence from this study contradicts some of the skeptical perspectives about the role of the school in reducing the gap in learning growth. This suggests that the subsequent school experiences, especially teachers' sense of responsibility for learning, may serve to contribute to reducing early disparities and help the positive adaptation of children from disadvantaged families.

From this perspective, as a means of raising teachers' sense of responsibility, some studies suggest that deliberate action from school leaders, such as everyday conversations and professional developments sessions, can redirect teachers' attitudes, which is effective in steering teachers away from a situation of decreased responsibility for student learning (Diamond, Randolph, & Spillane, 2004). Through these practices, teachers can become cognizant of how their beliefs and attitudes construct the learning experience of their students, as well as their tendencies based on the connection between their sense of responsibility and student ability. Furthermore, teachers need to be conscious of the conventional societal beliefs that connect race, ethnicity, class, and intelligence in detrimental ways (Perry et al., 2003). Although this study did not directly examine the relationship among teachers' sense of responsibility, school readiness, and the learning gain disparity in terms of race and ethnicity, according to the preliminary analysis, compared to White children, Black children appeared to receive substantially lower levels of teacher expectation across the elementary school years regardless of their level of school readiness. Thus, even when Black and White children are positioned in the high group of school readiness, teachers hold lower expectations for Black children compared to White children.[14] This pattern of result implies that Black children are being routinely marked down by their teachers, who are unconsciously stereotyping them. Furthermore, this is consistent with the result that the low expectations of teachers are deeply coupled with racial classification and could have been widely influenced by circulating stereotypes (Ferguson, 1998; Diamond, Randolph, & Spillane, 2004). This suggests that there is a need on the part of each individual teacher to be conscious of their societal beliefs.

In addition to the efforts to increase the sense of responsibility at the individual level, systematic reform efforts need to target the school community, so that each individual teacher can naturally learn and develop within that school community. That is, an individual teacher's beliefs and attitudes are tightly connected to the organizationally embedded culture that structures their current beliefs and everyday practices. [15] Indeed, the organizational culture affects the substance of everyday teacher interactions, which accumulate and give direction to the organizationally embedded expectations regarding what is possible for students from particular backgrounds (Diamond, Randolph, & Spillane, 2004). As a result, the realm of influence that an individual teacher may exert on disadvantaged students may be temporary and

[14] Teachers also hold low responsibility for Hispanic and Other students compared to White children even when they are in the high readiness group, but once family SES and family structure variables were taken into account, this difference disappeared. Furthermore, the largest gap in teachers' responsibility was indicated between Black and White children.

[15] Some argue for these organizationally embedded collective expectations and support as 'organizational habitus', which can be defined as 'dispositions, perceptions, and appreciations transmitted to the individual in a common organizational culture' (Horvat & Antonio, 1999; 320).

limited due to the larger school community that shapes the beliefs and attitudes of each individual teacher.

The improvement of the school as a community entails a shift in the nature of teachers' professional roles, such as their professional autonomy in the workplace. Indeed, teachers' empowerment[16] is tightly connected to their sense of efficacy, responsibility, and community (Rosenholtz, 1987; Newman, Rutter, & Smith, 1989; Goddard, Hoy, & Hoy, 2004). In particular, the more a school enables its teachers to exert influence on instructionally relevant school decisions, the more likely it is to be characterized by a robust sense of efficacy and to have a higher level of responsibility (Goddard, 2002). That is, when teachers have the opportunity to influence instructionally relevant decisions, they possess stronger beliefs in the conjoint capability of their faculty's efficacy. On the other hand, when teachers do not have power over their working conditions, they are more likely to see the events around them as outside of their control (Goddard, Hoy, & Hoy, 2004). Accordingly, teachers who feel disempowered become professionally disaffected and demonstrate lower efficacy, have more passive interactions with their colleagues, and are more likely to resort to place blame on poor school conditions rather than on finding solutions. Thus, under challenging circumstances, those teachers who feel disempowered tend to alienate themselves from the students from disadvantaged families and other teachers in order to protect their self-esteem. That is, they shy away from situations in which conclusions about their professional inadequacies may either be publicly or privately drawn. As a result, the general social bonds in the school setting become distorted as the relationships between teachers become objectified, and eventually this deteriorates the sense of collectivity and the feeling of being united educators.

---

[16] Teachers' empowerment can be defined as autonomy within the classroom, or their degree of control over curricular content/pedagogy and their level of influence on school policy (NCES, 1997).

From this perspective, serious concern is being raised that teachers' task discretion and autonomy at the school and classroom level have been greatly curtailed under the highly-regulated, top-down authority structures engendered by the current 'accountability movement' (Hamilton, 2003: Rosenholtz, 1987). A number of studies have now indicated that teachers suffer from reduced control over content and pedagogy as a result of an increasingly structured and controlled curriculum engendered by testing pressure (to see the impact of testing policy on teacher instruction see Shepard & Dougherty, 1991; Koretz, Barron, Mitchell, & Stecher, 1996; Mehrens, 1998; Hamilton, 2003). Teachers are now confronted with explicit instructional guidance in their curriculum content, with the evaluation criteria provided by the state and district. Consequently, teachers have lost their task autonomy and are impaired in their discretion to match appropriate learning objectives to students. The increasing demands regarding what to teach, when to teach, and how to teach have led teachers to abandon their own freedom of pedagogical judgment, a freedom that needs to be exercised in a pedagogical setting that entails the self-fulfillment of their capacities. In this view, the loss of freedom and the simplification of teaching practices entail an estrangement of teachers. Consequently, the labor loses its value as a medium of true self-fulfillment: "The worker therefore only feels himself outside of his work, and in his work feels outside himself. He is at home when he is not working, and when he is working he is not at home" (Marx, 1844, p. 74).

In this view, a policy that intends to motivate teachers in order to lead to positive changes within the school may, ironically, defeat its original intentions by degrading teachers' professional community and their sense of responsibility for learning. From this perspective, there is a serious concern about accountability policies that rely solely on a system of rewards and sanctions.

Implications for Future Research and Theory Building

Identifying the conditions under which experiences in the school setting can enhance the learning trajectory of children with initial disadvantages has important implications for advancing the understanding of the role of the school in reducing educational inequality. Ample evidence has suggested that school readiness at the entry to school has a large consequence for eventual outcomes. Thus, a number of early interventions have gained increasing popularity in the last decades, indicating that high quality early childhood experiences can make a substantial positive difference in children's behavioral and academic school readiness. Nonetheless, there is an absence of work describing the role of the school in improving the learning growth trajectory of children with low readiness at school entry. Indeed some studies examined the role of the school in reducing the gap in learning growth over the course of the elementary school years (i.e., Downey et al., 2004), but there have been few attempts to investigate specifically what type of schooling experience may reduce the learning growth gap. Indeed, those studies that examined the moderating role of the school often focused attention on investigating the interactions of individual teachers, disregarding the importance of teachers' attitudes and behaviors at the school level. To this end, this study aimed to integrate and extend the school *readiness* and *school effects* literature to examine whether a high exposure to teachers' academic intensity and sense of responsibility is associated with enhancing the learning growth of children with low readiness at school entry. Thus, this study provides an important first step in understanding the mechanisms for how elementary schools may promote or hinder the learning progress of students with different levels of academic and behavioral skills, and thus close the gap in learning outcomes given different levels of school readiness.

Future research may extend our understanding of the moderating role of teachers' attitudes towards particular racial and ethnic groups. For example, although the present study failed to find an advantage of higher academic intensity for children with low readiness, the moderating role of teachers' academic intensity for Black and Hispanic children may be prevalent. In particular, as a number of previous studies suggested, since teachers' attitudes are tightly connected to a student's race and early academic skills, there is a possibility that teachers' academic support may enhance the learning progress of Black and Hispanic children to a larger extent than their counterparts. In addition, children from social minority groups are more susceptible to the additional expectations and support that they receive from teachers (Ferguson, 1998). This leads us to hypothesize that children from racial minorities may demonstrate a stronger impact of additional teacher support when compensating for their initial deficits. Indeed, a closer examination into which school contextual conditions may improve the learning growth of African American and Hispanic children with low school readiness may provide an important policy implication for reducing educational inequality. More empirical studies illustrating how the learning experience of children with low readiness at school entry is stratified from the beginning of the school year may provide substantial evidence for developing policy that will benefit students who are behind at the entry of school.

Furthermore, more research is needed that focuses on directly examining the influence of certain educational policies (e.g., reforms focusing on standards and testing) on teachers' sense of responsibility and academic intensity and whether this association engenders a positive influence on the learning outcomes of children who are less prepared at school entry. This is an important question in terms of policy evaluation, especially when the current literature suffers from a lack of empirical evidence for how educational policy influences different aspects of teachers' beliefs and attitudes, and whether this relationship exerts a positive or a negative influence on the learning outcomes of disadvantaged children. Ultimately, this research may contribute to indirectly evaluating and providing implications for current policy efforts to raise disadvantaged students' learning.

Limitations

Several limitations of this study should be noted. First, this study relies on a survey in which teachers describe the time they spend on instruction, raising the *possibility* of a tendency toward overestimation, although teachers self-reported data is generally perceived to be temporally reliable and comparatively valid (Mayer, 1999; Winsler & Carlton, 2003). Moreover, the measurements of teachers do not necessarily imply that children are actually responsive to their teachers. For example, a high level of teachers' academic intensity does not necessarily mean that children will be responsible for the higher demands of that academically intense environment. From this perspective, more data sets of classroom observations are needed to measure the actual interactions between teachers and students, rather than relying solely on teacher surveys.

Second, this study is unable to rule out the possibility of differential selection of school contexts that is not fully accounted for in this statistical method. Thus, the design of this study precludes firm causal inferences. However, this study aimed to provide insights into the type of within school processes that may be beneficial for children who enter the school already disadvantaged. In turn, this study helps to suggest interventions that can be studied experimentally to ascertain which might be most effective. Thus, this is a preliminary step that lays the foundation for more rigorous future research that will address the causality of teachers' responsibility and academic intensity.

Third, the fact that this study was conducted using a large, existing data set, rather than data developed specifically to address the research question may have led to smaller effect sizes than would have been observed in a more highly at-risk sample. Given this problem, it was inevitable to lose some cases when the student changed schools between grades. Those children who did not move scored slightly better than students who changed schools during the elementary school years, likely reflecting a disproportionate attrition of less-skilled children, although the difference was relatively small. Yet, this suggests some caution is in order when making inferences from models using the measure of math outcome. These results may need to be replicated with other low-readiness groups before more conclusive statements regarding the moderating role of academic intensity and responsibility can be made.

Fourth, this study is limited in explaining how the experience in the classroom context moderates initial deficits at school entry. Indeed, exposure to the teachers' sense of responsibility and academic intensity might not be the same at the classroom level, so that the role of the individual teacher might show a different pattern of relationship. That is, we cannot rule out the possibility that, although low-skilled students are attending schools with a high level of academic instruction, the actual emphasis on academic intensity within a specific classroom may be directed toward average students rather than the low achieving students (Booher-Jennings, 2005; Neal & Schanzenbach, 2007; Reback, 2008; White & Rosenbaum, 2007). However, the analysis of the role of the individual teacher within a classroom is particularly difficult when the research aims to assess students' learning progress over a relatively long time span. That is because students do not remain together in the same classroom over these years. Moreover, the ECLS-K collected information for the 1st, 3rd, and 5th grades, so that the classroom and teacher information when the students were in the 2nd and 4th grades is not available. One way to overcome this weakness is to employ the analysis at the school level; while different from the classroom environment, school characteristics are relatively stable across years. For example, school composition, school SES, and school average achievement remain relatively consistent throughout the different waves of data collection. This approach is not perfect, but at least it captures the learning environment that children are exposed to during the elementary school years.

Fifth, in this study, teachers' academic intensity and sense of responsibility for learning was created by aggregating individual teacher responses at the school level based on a small number of teachers within a school. This was inevitable given the inclusion of few teachers per elementary school in the ECLS-K data set. While this approach may not be perfect, previous studies have theoretically and empirically demonstrated that this approach is significant in estimating the effect of teachers' attitudes on students' learning outcomes (Lee & Smith, 1996; Goddard, Hoy, & Hoy, 2004; Halvorsen, Lee, & Andrade, 2009). Indeed, this line of research often conceptualized teachers' sense of responsibility as the 'collective sense of responsibility' by using the aggregated mean score at the school level. The present study, however, recognizes the fact that it is difficult to capture the sense of collectivity of the entire school by simply using the aggregated mean score at the school level based on a few teachers. That is because 'perceived collectivity' is an emergent group-level attribute rather than the sum of members' perceived attitudes (Bandura, 1997). From this perspective, the present study was reluctant to employ the concept of 'collectivity' and instead defined the measure as teachers' sense of academic intensity and responsibility for the learning of students.

Conclusion

The present study examined the gap in math learning growth trajectory among children with different levels of school readiness, and under which school settings the disparity in the learning growth trajectory engendered by school readiness can be reduced. Of particular interest was whether experience with a high level of teachers' academic intensity and sense of responsibility for learning can help to close the gap among children with different levels of school readiness at school entry. Thus, this study incorporated two important but seldom integrated inquiries: the impact of school readiness on children's learning growth trajectory and the role of teachers' academic intensity and sense of responsibility for learning in students' learning progress. Findings from this study suggest that children who enter school with low readiness (measured through math, reading, and approaches to learning scores) demonstrate consistently lower learning gains throughout their elementary school years. In addition, although teachers' academic intensity and sense of responsibility for learning increased the overall learning gain, only the responsibility of teachers appeared to moderate math learning growth trajectory given different levels of school readiness at school entry. In addition, the benefit of school readiness for children with low readiness was cumulative across the elementary school years. Based on this result, the present study indicates a need for continuous support during the schooling years, as well as before the start of school, to compensate for a lower skill level at school entry. Indeed, this study stresses the pivotal role of the beliefs and attitudes of teachers for disadvantaged students. From this perspective, this study suggests paying more attention to the role of school context in conditioning teachers' beliefs and actions, so that individual teachers can naturally learn and develop individual effective attitudes.

References

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., & Horsey, C. (1997). From first grade forward: Early foundation of high school dropout. *Sociology of Education, 70*, 87–107.

Alexander, K. L., Entwisle, D. R., & Kabbani, N. S. (2001). The dropout process in life course perspective: Early risk factors at home and school. *Teachers College Record, 103*, 760-823.

Anderson, C. W., Nagle, R. J, Roberts, W. A., & Smith, J. W. (1981). Attachment to substitute caregivers as a function of center quality and caregiver involvement, *Child Development, 52* (1), 53-61.

Aunola, K., Leskinen, E., Lerkkanen, M.-K., & Nurmi, J. E. (2004). Developmental dynamics of math performance from preschool to Grade 2. *Journal of Educational Psychology, 96*, 699–713.

Barnett, W.S. (2011). Effectiveness of early education intervention. *Science, 333*, 975-977.

Bandura, A. (1997). *Self efficacy: The exercise of control*. New York: W. H. Freeman and Company.

Bernstein, B. (1975). *Class, codes, and control. Vol.3: Towards a theory of educational transmissions*. Long: Routledge & Kegan Paul.

Birch, S., & Ladd, G., (1996). Interpersonal relationships in the school environment and children's early school adjustment: The role of teachers and peers. In K. Wentzel, J.H. Juvonen (Eds.), *Social motivation: Understanding children's school adjustment* (pp. 199–225). *Cambridge University Press*, New York.

Bishop, J. H., & Mane, F. (Winter 1999). *The New York state reform strategy:* The incentive effects of minimum competency exams. Philadelphia: National Center on Education in Inner Cities.

Bodovski, K., & Farkas, G. (2007). Mathematics growth in early elementary school: The roles of beginning knowledge, student engagement and instruction. *The Elementary School Journal*, 108(2), 115–113.

Bodovski, K., & Youn, M. (2011). Students' behavior and academic achievement: Longitudinal approach. *Journal of Early childhood research, 9*(1), 1-16.

Bodovski, K., & Youn, M. (2012, forthcomming). Students' mathematics learning from kindergarten through 8th grade. International Journal of Sociology of Education.

Booher-Jennings, J. (2005). Below the bubble: Educational triage and the Texas accountability system. *American Educational Research Journal, 42*(2), 231-268.

Bourdieu, P., & Passeron, J. (1977). Reproduction in education, society, and culture. Longon, England: Sage.

Bowman, B. T., Donovan, M. S., & Burns, M. S. (Eds.) (2001). *Eager to learn: Educating our preschoolers*. Washington, DC: National Academy Press.

Bryk, A., & Driscoll, M. (1988). *The high school as community: Contextual influences and consequences for students and teachers*. Madison: University of Wisconsin, National Center on Effective Secondary Schools.

Bryk, A. S., Holland, P. B., Lee, V. E., & Carriedo, R. A. (1984). *Effective Catholic schools: An* *exploration*. Washington, DC: National Catholic Education Association.

Carneiro, P., & Heckman, J. J. (2003). Human capital policy. In J.J. Heckman, A.B. Krueger, & B.M. Friedman (Eds.), *Inequality in America: What role for human capital policies?* (pp. 77-239). Cambridge, MA: The MIT Press.

Central Advisory Council for Education (England). (1967). *Children and their primary schools (The Plowden Report)*. London: HMSO.

Chtterji, M. (2005). Achievement gaps and correlates of early mathematics achievement: evidence from the ECLSK-first grade sample. *Education Policy Analysis Archives, 13*(46). Retrieved December 8, 2010, from http://epaa.asu.edu/ojs/article/view/151

Cohen, D. K., Raudenbush, S. W., & Ball, D. L. (2003). Resources, Instruction, and Research. *Educational Evaluation and Policy Analysis*, *25*(2), 119-142.

Coleman, J. S., Campbell, E. Q., Hobson, C. J., McPortland, J., et al. (1966). *Equality of Educational Opportunity, US Department of Education*. Washington, DC:USGPO

Coleman, J.S., Hoffer, T., & Kilgore, S.B. (1982a). Cognitive outcomes in public and private schools. *Sociology of Education, 55*, 65-76.

Coleman, J. S., Hoffer, T., & Kilgore, S. (1982b). *High school Achievement*. New York: Basic Books.

Committee for Economic Development. (2002). *Preschool for all: Investing in a productive and just society.* New York: Committee for Economic Development.

Connor, C. M., Morrison, F. J., & Petrella, J. N. (2004). Effective reading comprehension instruction: Examining child by instruction interactions. *Journal of Educational Psychology, 96*(4), 682-698.

Cunha, F., Heckman, J. J., & Schennach, S. M. (2010). Estimating the technology of cognitive and noncognitive skill formation. *Econometrica, 78*(3), 883-931.

Cunha, F., Heckman, J. J., Lochner, L. J., & Masterov, D. V. (2006). Interpreting the evidence on life cycle skill formation. In E.A. Hanushek F. Welch (Eds.), *Handbook of the Economics of Education* (pp. 697-812). Amsterdam: North-Holland.

Currie, J., & Thomas, D. (2000). School quality and the longer-term effects of Head Start. *Journal of Human Resources, 35*, 755-774.

Darling-Hammond, L., & Wise, A. E. (1985). Beyond standardization: State standards and school improvement. *Elementary School Journal*, *85*, 315-336.

Diamond, J. B., Randolph, A., & Spillane, J.P. (2004). Teachers' expectations and sense of responsibility for student learning: The importance of Race, Class, and Organizational Habitus. *Anthropology & Education Quarterly, 35*(1), 75-98.

Dockett, S., & Perry, B., eds (2001). *Beginning School Together: Sharing Strengths.* Watson, ACT: Australian Early Childhood Association.

Downey, D. B., & Pribesh, S. (2004). When race matters: Teachers' evaluations of students' behavior. *Sociology of Education, 77*(4), 267-282.

Downey, D. B., von Hippel, P. T., & Broh B. A. (2004). Are schools the great equalizer? Cognitive inequality during the summer months and the school year. *American Sociological Review, 69*, 613-635.

Dreeben, R. (1968). *On What is Learned in school. Reading*, Mass: Addison-Wesley.

Duncan, G. J., Claessens, A., Huston, A. C., Pagani, L. S., Engel, M., Sexton, H., et al. (2007). School readiness and later achievement. *Developmental Psychology, 43*(6), 1428–1446.

Duncan, G., & Magnuson, K. (2009, November19-20). *The nature and impact of early skills, attention, and behavior.* Presented at the Russell Sage Foundation conference on Social

Inequality and Educational Outcomes.
Entwisle, D.R., & Alexander, K.L. (1988). Factors affecting achievement test scores and marks of black and white first graders. *Elementary School Journal, 88*, 449-471.
Entwisle, D. R., & Alexander, K. (1999). Early schooling and social stratification. In R.C. Pianta & M.J. Cox (Eds.), *The transition to Kindergarten*. Baltimore: Paul H. Brookes.
Entwisle, D. R., & Alexander, K. L. (1993). Entry into School: The beginning school transition and educational stratification in the United States. *Annual Review Sociology, 19*, 401-423.
Farkas, G. (1996). *Human Capital or Cultural Capital? Ethnicity and Poverty Groups in an Urban District*. New York: Aldine de Gruyter.
Farkas, G., Grobe, R., Sheehan, D., & Shaun, Y. (1990). Cultural resources and school success: Gender, ethnicity, and poverty groups within an urban District. *American Sociological Review*, *55*, 127-142.
Ferguson, R. (1998). Teacher perceptions and expectations and the Black-White test score gap. In C. Jencks & M. Phillips, (Eds.), *The Black-White test score Gap* (pp.273-317). Washington, DC: Brookings Institution Press.
Finn, J. D., Pannozzo, G. M., & Voelkl, K. E. (1995). Disruptive and inattentive-withdrawn behavior and achievement among fourth graders. *The Elementary School Journal, 95*(5), 421–425.
Gamoran, A. (1986). Instructional and institutional effects of ability grouping. *Sociology of Education, 59*, 185-198.
Garet, M. S., & Delany, B. (1988). Secondary school tracking and educational inequality. *Sociology of Education, 61*, 61-77.
Goddard, R. D. (2002). Collective efficacy and school organization: A multilevel analysis of teacher influence in schools. *Theory and Research in Educational Administration, 1*, 169-184.
Goddard, R. D., Hoy, W., & Hoy, A. W. (2004). Collective efficacy beliefs: Theoretical developments, empirical evidence, and future directions, *Educational Researcher, 33*(3), 3-13.
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.
Hallinan, M.T. (1987). *The social organization of schools: New conceptualizations of the learning process*. New York: Plenum.
Hallinan, M. T. (1988). Equality of educational opportunity. *Annual Review of Sociology, 14*, 249-268.
Halvorsen, A., Lee, V. E., & Andrade, F. H. (2009). A mixed-method study of teachers' attitudes about teaching in urban and low-income schools. *Urban Education, 44*(2), 181-224.
Hamilton, L. (2003). Assessment as a policy tool. *Review of Research in Education*, *27*, 25-68.
Hamre, B. K., & Pianta, R. C. (2001). Early teacher-child relationships and the trajectory of children's school outcomes through eighth grade. *Child Development, 72*, 625-638.
Hamre, B. K., & Pianta, R. C., (2005). Can instructional and emotional support in the first-grade classroom make a difference for children at risk of school failure? *Child Development, 76*(5), 949-967.
Hanushk, E. (1997). Assessing the effects of school resources on student performance: An update. *Educational Evaluation and Policy Analysis*, *19*, 141-164

Hawley, W. D. (2008). NCLB and contentious school improvement. In G.L. Sunderman (Ed.), *Holding NCLB accountable: Achieving accountability, equity, &school reform* (pp. 173-189). Thousand Oaks, CA: Corwin Press.

Heckman, J. J. (2008). Schools, skills and synapses. *Economic Inquiry, 46*(3), 289-324.

Heckman, J. J. (2011). Effective child development strategies. In Zigler, E., Gilliam, W. S., Barnett, W. S. (Eds), *The Pre-K Debates* (pp. 2-8). Paul H. Brookes Publishing.

Hoffman, J. V. (1991). Teacher and school effects in learning to read. In R. Barr, M.L. Kamil, P.B. Mosenthal, & P.D. Pearson (Eds.), *Handbook of reading research* (Vol. 2, pp. 911-950). New York: Longman.

Hooper, S. R., Roberts, J., Sideris, J., Burchinal, M., & Zeisel, S. (2010). Longitudinal predictors of reading and math trajectories through middle school for African American versus Caucasian students across two samples. *Developmental Psychology*, 46(5), 1018-1029.

Horn, W. F., & Packard, T. (1985). Early identification of learning problems: A meta-analysis. *Journal of Educational Psychology, 77*(5), 597–607.

Horvat - McNamara, E., & Antonio, A. N. (1999). "Hey those shoes are out of uniform": African American girls in an elite high school and the importance of habitus. *Anthropology and Education Quarterly, 30*(3), 317-342.

Jencks, C. (1972). *Inequality*. New York: Harper Books.

Jencks, C. (1985). How much do high school students learn? *Sociology of Education, 58*,128-135.

Jencks, C., & Phillips, M. (1998). The black-white test score gap: An introduction. In C. Jencks & M. Phillips (Eds.). *The black-white test score gap*. Washington, DC: Brookings Institution Press.

Jordan, N. C., Kaplan, D., Ramineni, C., & Locuniak, M. N. (2009). Early math matters: Kindergarten number competence and later mathematics outcomes. *Developmental Psychology, 45*(3), 850-867.

Jussim, L., Eccles, J., & Madon, S. (1996). Social perception, social stereotypes, and teacher expectations: Accuracy and the quest for the powerful self-fulfilling prophecy. In M.P. Zanna (Ed.), *Advances in Experimental Social Psychology* (Vol. 27, pp. 281–288). New York: Academic Press.

Kilgore, S.B. (1991). The organizational context of tracking in schools. *American Sociological Review, 56*, 189-203.

Knapp, M. S. (Ed.).(1995*). Qualitative reading inventory-II.* New York: Teachers College Press.

Kohn, M., & Rosman, B. L. (1974). Social-emotional, cognitive, and demographic determinants of poor school achievement: Implications for strategy of intervention. *Educational Psychology, 66*(2), 267–276.

Koretz, D. M., Barron, S., Mitchell, K., & Stecher, B. (1996). *The perceived effects of the Kentucky Instructional Results Information System* (KIRIS) *(Publication MR-792-PCT/FF).* Santa Monica, CA: The RAND Corporation.

Kowaleski-Jones, L., & Duncan, G. J. (1999). The structure of achievement and behavior across middle childhood. *Child Development, 4,* 930-943.

Ladd, G. W., & Burgess, K. B. (2001). Do relational risks and protective factors moderate the linkages between childhood aggression and early psychological and school adjustment? *Child Development*, *72*, 1579-1601.

LaParo, K. M., & Pianta, R. C. (2000). Predicting children's competence in the early school years: A meta-analytic review. *Review of Educational Research*, *70*(4), 443-484.

Lareau, A. (2003). *Unequal Childhoods: Class, race, and family life*. Berkeley: University of

California Press.
Lee, V.E., & Burkam, D.T. (2002). *Inequality at the starting gate: Social background differences in achievement as children begin school*. Washington, DC: Economic Policy Institute.
Lee, V. E., & Loeb, S. (2000). School size in Chicago elementary schools: Effects on teachers' attitudes and student achievement. *American Educational Research Journal, 37*(1), 3-32.
Lee, V. E., & Smith, J. B. (1996). Collective responsibility for learning and its effects on gains in achievement for early secondary school students. *American Journal of Education, 104*(2), 103-147.
Lee, V. E., Smith, J. B., & Croninger, R. G. (1997). How high school organization influences the equitable distribution of learning in mathematics and science. *Sociology of Education, 70*(2), 128-150.
Leland, C., & Harste, J. (2005). Doing what we want to become: Preparing new urban teachers. *Urban Education, 40*(1), 60-77.
Lin, H., Lawrence, F. R., & Gorrell, F. (2003). Kindergarten teachers' views of children's readiness for school, *Early Childhood Research Quarterly, 18*(2), 225-237.
LoGerfo, L.F. (2004). *Who takes responsibility and to what effect?* Examining the development and influence of teachers' collective responsibility for student learning. Unpublished doctoral dissertation. University of Michigan, Ann Arbor.
Magnuson, K.A., Meyers, M.K., Ruhm, C.J., Waldfogel, J. (2004). Inequality in preschool education and school education and school readiness. *American Educational Research Journal, 41*(1), 115-157.
Magnuson, K. A., Ruhm, C., & Waldfogel, J. (2007). The persistence of preschool effects: Do subsequent classroom experiences matter? *Early Childhood Research Quarterly, 22*, 18-38.
Marx, K. (1844). Economic and Philosophic Manuscripts of 1844. From *The Marx-Engels Reader. Second Edition*. Norton. pp 66-125.
Mayer, D. P. (1999). Measuring instructional practice: Can policymakers trust survey data? *Educational Evaluation and Policy Analysis, 21*, 29-45.
McClelland, M. M., Morrison, F. J., & Holmes, D. L. (2000). Children at risk for early academic problems: The role of learning-related social skills. *Early Childhood Research Quarterly, 15*(3), 307–329.
McNeil, L., & Valenzuela, A. (2001). The harmful impact of the TAAS system of testing in Texas: Beneath the accountability rhetoric. In M. Kornhaber and G. Orfield. (Eds.), *Raising Standards or Raising Barriers? Inequality and High Stakes Testing in Public Education* (pp. 127-150). New York: Century Foundation.
Mehrens, W. A. (1998). Consequences of assessment: What is the evidence? *Education Policy Analysis Archives, 6*(13). Retrieved December 17, 2019, from http://epaa.asu.edu/epaa/v6n13.html
Miles, S. B., & Stipek, D. (2006). Contemporaneous and longitudinal associations between social behavior and literacy achievement in a sample of low-income elementary school children. *Child Development, 77* (1), 103–117.
Mintrop, H. (2008). Low-Performing schools' programs and state capacity requirements. In G. L. Sunderman (Ed.), *Holding NCLB accountable: Achieving accountability, equity, & school reform* (pp. 137-151). Thousand Oaks, CA: Corwin Press.
Morrison, F. J., & Connor, C. M. (2002). Understanding schooling effects on early literacy: The

good news and the bad. *Educational Psychologist, 33*, 195-206.

National Center for Education Statistics (NCES) (1997). *Teacher professionalization and teacher commitment: A multilevel analysis.*(NCES Publication No 97-069).

National Center for Education Statistics (NCES) (2004). *User's Manual for the ECLS-K third grade public-use data file and Electronic Code Book* (NCES Publication No. 2004-001).

Neal, D., & Schanzenbach, D. W. (2007). Left behind by design: Proficiency counts and test-based accountability. *NBER working paper series.* Retrieved from January 6, 2010, from http://www.nber.org/papers/w13293.

Newman, F. M., Rutter, R. A., & Smith, M. S. (1989). Organizational factors that affect school sense of efficacy, community and expectations. *Sociology of Education, 62*, 221-238.

Nye, B., Konstantopolulos, S., & Hedges, L. (2004). How large are teacher effects? *Educational Evaluation and Policy Analysis*, 26, 237-257.

Oakes, J. (1985). *Keeping Track: How Schools Structure Inequality.* New Haven, CT: Yale University Press.

Oakes, J., Ormseth, T., Bell, R., & Camp, P. (1990). *Multiplying Inequalities: The effects of race, social class, and tracking on opportunities to learn mathematics and science.* Santa Monica, CA: The RAND Corporation.

O'Connor, E., & McCartney, K. (2007). Examining teacher-child relationships and achievement as part of an ecological model of development. *American Educational Research Journal, 44* (2), 34-369.

Palardy, G. J., & Rumberger, R. W. (2008). Teacher effectiveness in First Grade: The importance of background qualifications, attitudes, and instructional practices for student learning. *Educational Evaluation and Policy Analysis, 30*(2), 111-140.

Peisner-Feinberg , E. S., & Burchinal, M. R. (1997). *Relations between preschool children's childcare experiences and concurrent development*: The cost, quality, and outcomes study. *Merrill-Palmer Quarterly, 43*, 451–477.

Phillips, M. (1997). What makes schools effective? A comparison of the relationships of communitarian climate and academic climate to mathematics achievement and attendance during middle school. *American Educational Research Journal, 34*(4), 633-662.

Phillips, M., Crouse, J., & Ralph, J. (1998). Does the black-white test score gap widen after children enter school? In C. Jencks & M. Phillips (Eds.), *The black-white test score gap* (pp. 229–272). Washington, DC: Brookings Institution.

Pianta, R. C., La Paro, K., Payne, C., Cox, M. J., & Bradley, R. (2002). The relation of kindergarten classroom environment to teacher, family, and school characteristics and child outcomes. *Elementary School Journal, 102*(3), 225-238.

Pianta, R., La Paro, K., & Hamre, B. K. (2005). *Classroom Assessment Scoring systems (CLASS).* Unpublished measure, University of Virginia, Charlottesville, VA.

Pungello, E. P., Kuperschmidt, J. B., Burchinal, M. R., & Patterson, C. (1996). Environmental risk factors and children's achievement from middle childhood to adolescence. *Developmental Psychology, 32,* 755–767.

Purkey, S.C., & Smith, M.S. (1983). Effective schools: A review. *The Elementary School Journal, 83*, 427-452.

Raudenbush, S. W. (2005). How NCLB testing can leave some schools behind. *Preschool matters, 3*(2).

Raudenbush, S.W., &Bryk, A.S. (2002). *Hierarchical linear models: Applications and data*

analysis methods (2nd ed.). Newbury Park, CA: Sage.
Raudenbush, S.W., & Liu, X. (2000). Statistical power and optimal design for multisite randomized trials. *Psychological Methods*, *5*(2), 199-213.
Raudenbush, S. W., Kidchanapanish, S., & Kang, S. J. (1991). The effects of preprimary access and quality on educational achievement in Thailand. *Comparative Education Review, 35*(2), 255-273.
Raudenbush, S. W., Rowan, B., & Cheong, Y. F. (1992). Contextual effects on the self-perceived efficacy of high school teachers. *Sociology of Education, 65*, 150-167.
Raver, C. C., & Zigler, E. F. (2004). Public policy viewpoint. Another step back? Assessing readiness in Head Start. *Young Children, 59, 58-63.*
Reardon, S. (2007). *Thirteen ways of looking at the black-white test score gap* (working paper). Stanford, CA: Stanford University.
Reardon, S. F., & C. Galindo. (2009). The Hispanic-White Achievement Gap in Math and Reading in the Elementary Grades. *American Educational Association Journal*, *46*(3), 853-891.
Reback, R. (2008). Teaching to the rating: School accountability and the distribution of student achievement. *Journal of Public Economics, 92*, 1394-1415.
Rimm-Kaufman, S. E., Pianta, R., & Cox, M. (2000). Teachers' judgments of success in the transition to kindergarten. *Early Childhood Research Quarterly, 15*(2), 147-166.
Rist, R. (1970). Student social class and teacher expectations: The self-fulfilling prophecy in ghetto education. *Harvard Educational Review, 70*, 257-302.
Roderick M., & Engel, M. (2001). The grasshopper and the ant: Motivational responses of low 39 achieving student to high-stakes testing. *Educational Evaluation and Policy Analysis, 23*(3), 197-227.
Romberg, T. A., Zarinia, E. A., & Williams, S. R. (1989). *The influence of mandated testing on mathematics instruction: Grade 8 teachers' perceptions*. Madison: National Center for Research in Mathematical Science Education, University of Wisconsin-Madison.
Roscigno, V. J. (1998). Race and the Production of Educational Disadvantage. *Social Forces, 76*, 1033-1060.
Roscigno, V.J., & Ainsworth-Darnell, J.W. (1999). Race, cultural capital, and educational resources: Persistent inequalities and achievement returns. *Sociology of Education, 72*, 158-178.
Rosenholtz, S.J. (1985). Effective schools. Interpreting the evidence. *American Journal of Education, 93*, 352-388.
Rosenholtz, S. J., (1987). Education reform strategies: Will they increase teacher commitment? *American Journal of Education*, *95*(4), 534-562.
Rosenthal, R., & Jacobson, L. (1968). *Pygmalion in the Classroom*. New York: Holt, Rinehart, and Winston.
Ross, S. M., Smith, L. J., Slavin, R. E., & Madden, N. A. (1997). Improving the academic success of disadvantaged children: An examination of Success for All. *Psychology in the Schools, 34*(2), 171-80.
Rubin, D.B. (2006). *Matched sampling for causal effects*. New York: Cambridge University Press.
Rutter, M., & Maughan, B. (2002). School effectiveness findings 1979-2002. *Journal of School Psychology, 40*, 451-475.
Schaefer, B. A., & McDermott, P. A. (1999). Learning behavior and intelligence as explanation

for children's scholastic achievement. *Journal of School Psychology, 37,* 299–313.

Sewell, W. H., Haller, A. O., & Portes, A. (1969). The educational and early occupational attainments process, *American Sociological Review. 34*, 82-92.

Sewell, W. H., Haller, A. O., & Ohlendorf, G. W. (1970). The educational and early occupational attainment process: Replication and revision. *American Sociological Review, 35*, 1014-1027.

Sewell, W. H., & Hauser, R. M. (1975). *Education, Occupation and Earnings*. New York: Academic Press.

Shepard, L. A., & Dougherty, K. C. (1991, April). *Effects of high-stakes testing on instruction.* Paper presented at the annual meeting of the American Educational Research Association and National Council on Measurement in Education, Chicago.

Smith, J. R., Brooks-Gunn, J., & Klebanov, P. K. (1997). Consequences of living in poverty for young children's cognitive and verbal ability and early school achievement. In G. J. Duncan & J. Brooks-Gunn (Eds.), *Consequences of growing up poor* (pp.132–189). New York: Russell Sage Foundation.

Smith, M. L., & Rottenberg, C. (1991). Unintended consequences of external testing in elementary schools. *Educational Measurement: Issue and Practice, 10*(4), 7-11.

Snow, C. E., Burns, M. S., & Griffin, P. (Eds.). (1998). *Preventing Reading Difficulties in Young Children*. Washington, DC: National Research Council, National Academy Press.

Stevenson, H. W., & Lee, S. Y. (1990). Contexts of achievement: A study of American, Chinese and Japanese children. *Monographs of the society for research in child development, 221*(55).

Stevenson, H. W., & Newman, R. S. (1986). Long-term prediction of achievement and attitudes in mathematics and reading. *Child Development, 57*, 646–659.

Stipek, D. J., & Ryan, R. H. (1997). Economically disadvantaged preschoolers: Ready to learn but further to go. *Developmental Psychology, 33*, 711–723.

Sunderman, G. L., & Orfield, G. (2008). Massive responsibilities and limited resources: The state response to NCLB. In G. L. Sunderman (Ed.), *Holding NCLB accountable: Achieving accountability, equity, &school reform* (pp. 121-136). Thousand Oaks, CA: Corwin Press.

Swanson, C., & Stevenson, D. L. (2002). Standards-based reform in practice: Evidence on state policy and classroom instruction from the NAEP state assessments. *Educational Evaluation and Policy Analysis*, *24*(1), 1-27.

Tramontana, M. G., Hooper, S. R., & Selzer, S. C. (1988). Research on the preschool prediction of later achievement: A review. *Developmental Review, 8*, 89–146.

Wang, J., & Goldschmidt, P. (2003). Importance of middle school mathematics on high school students' mathematics achievement. *Journal of Educational Research*, *97*(1), 3-19.

Wentzel, K. (2002). Are effective teachers like good parents? Teaching styles and student adjustment in early adolescence. *Child Development*, *73*(1), 287-301.

Wharton-McDonald, R., Pressley, M., & Hampston, J. M. (1998). Outstanding literacy instruction in first grade: Teacher practices and student achievement. *Elementary School Journal, 99*, 101–128.

White, K. W., & Rosenbaum, J. E. (2007). Inside the blackbox of accountability: How high-stakes accountability alters school culture and the classification and treatment of students and teachers. In A. Sadvonick, J. O'Day, G. Bohrnstedt, and K. Borman. (Eds.), *No Child Left Behind and the reduction of the achievement gap*: *Sociological* *perspectives on federal education policy*. Routledge.

Winsler, A., & Carlton, M. P. (2003). Observations of children's task activities and social interactions in relation to teacher perceptions in a child-centered preschool: Are we leaving too much to chance? *Early Education and Development*, *14*(2), 153-178.

Wolfe, B., & Scrivner, S. (2003). Providing universal preschool for four-year-olds. In I. Sawhill (Ed.), *One Percent for the Kids*. Washington, DC: Brookings Institution Press.

Woodhead, M. (1988). When psychology informs public policy: The case of early childhood intervention. *American Psychologist, 43*, 443-454.

Hoy, A., & Spero, R.B., (2005). Changes in teacher efficacy during the early years of teaching: A comparison of four measures. *Teaching and Teacher Education, 21*, 343-356.

Yen, C. J., Konold, R. R., & McDermott, P. A. (2004). Does learning behavior augment cognitive ability as an indicator of achievement. *Journal of Psychology, 42*, 157-169.

Zhai, F., Raver, C. C., & Jones, S. M. (2012). Academic performance of subsequent schools and impacts of early interventions: Evidence from a randomized controlled trial in Head Start settings. *Children and Youth Services Review, 34*, 946-954.

Zigler, E., & Styfco, S. (1994). Head Start: Criticisms in a constructive context. *American Psychologist*, *49*,127-132.

APPENDIX

Table A. 3.1: Principal Component Measurement Models for Teachers' sense of Responsibility and Academic Intensity for Each Grade

	Responsibility	Item loading	Academic Intensity	Item loading
1st grade	Student is capable of learning	.735	The amount of math instruction on a daily basis	.752
	Child's misbehavior doesn't interfere with teaching	.739	Expected time spent on math homework	.506
	Teacher can make a difference	.557	The amount of math instruction on a weekly basis	.541
3rd grade	Student is capable of learning	.762	The amount of math instruction on a daily basis	.772
	Child's misbehavior doesn't interfere with teaching	.745	Expected time spent on math homework	.463
	Teacher can make a difference	.556	The amount of math instruction on a weekly basis	.591
5th grade	Student is capable of learning	.748	The amount of math instruction on a daily basis	.754
	Child's misbehavior doesn't interfere with teaching	.782	Expected time spent on math homework	.596
	Teacher can make a difference	.597	The amount of math instruction on a weekly basis	.563

Table A. 3.2: Descriptive Statistics of Variables Before and After Multiple Imputation

Student level variables	N=6,201		
	Imputed sample Mean	Raw-sample Mean	Missing rate
SES	-.101 (.780)	-.088 (.779)	6.71%
Male	.505 (.500)	.505 (.500)	
Black	.1228 (.328)	.122 (.328)	.08%
Hispanic	.191 (.393)	.190 (.392)	.08%
Asian	.070 (.255)	.069 (.254)	.08%
Other	.062 (.242)	.062 (.242)	.08%
Single	.1885 (.388)	.184 (.388)	8.01%
Other parent	.0384 (.190)	.037 (.189)	8.01%
Non biological parent	.0784 (.265)	.076 (.265)	8.01%
Number of siblings	1.5627 (1.160)	1.553 (1.159)	8.01%
Retained	.105 (.309)	.105 (.306)	.003%
Math score for 1st grade	61.091 (17.971)	61.090 (17.971)	1.02%
Math score for 3rd grade	98.662 (24.875)	98.661 (24.875)	1.24%
Math score for 5th grade	122.906 (25.390)	122.906 (25.389)	.85%
School readiness			
Math score for K	25.658 (8.774)	25.860 (8.773)	11.22%
Reading score for K	34.386 (9.513)	35.027 (9.513)	17.34%
Approaches to Learning	3.033 (.664)	3.037 (.664)	9.0%
School Level			
Social minority	.4816 (.50)	.4812 (.499)	1.69%
School mean SES	-.114 (.533)	-.114 (.533)	.47%
Urban	.336 (.49)	.335 (.472)	.63%
Rural	.4014 (.50)	.403 (.490)	.63%
Math Homework (1st grade)	1.341	1.287	11.56%
Time (1st grade)	2.309	2.315	16.97%
Often Weekly (1st grade)	4.891	4.940	11.53%
Math Homework (3rd grade)	1.850	1.786	18.66%

Time (3rd grade)	2.398	2.392	20.34%
Often Weekly (3rd grade)	4.810	4.874	17.67%
Math Homework (5th grade)	2.362	2.359	12.29%
Time (5th grade)	2.378	2.415	8.98%
Often Weekly (5th grade)	4.774	4.849	5.68%
Capable of Learning (1st grade)	3.949	3.964	12.3%
Misbehavior (1st grade)	3.661	3.677	12.24%
Make Difference (1st grade)	4.507	4.514	11.21%
Capable of Learning (3rd grade)	3.861	3.889	17.61%
Misbehavior (3rd grade)	3.607	3.642	17.34%
Make Difference (3rd grade)	4.322	4.333	17.19%
Capable of Learning (5th grade)	3.797	3.823	4.48%
Misbehavior (5th grade)	3.481	3.524	4.40%
Make Difference (5th grade)	4.309	4.320	4.53%

**p < .01, *p < .05

Table A. 4.1: Parameter Estimates Predicting the Moderating Role of Teachers' Academic Intensity and Responsibility on Reducing the Math Score Gap Engendered by School Readiness at the End of 1st Grade after Controlling for Individual and School Characteristics

Variables	Math Score at the end of 1st Grade			
	Model 1 Main Effect	Model 2 Interaction with Math at K	Model 3 Interaction with Reading at K	Model 4 Interaction with Approaches at K
Intercept	60.493** (.653)	60.516** (.653)	60.509** (.654)	60.502** (.653)
School readiness				
Math	9.988** (.321)	10.056** (.314)	9.993** (.320)	9.989** (.321)
Reading	.714* (.282)	.691* (.281)	.711* (.280)	.713* (.282)
Approaches to Learning	1.817** (.188)	1.799** (.187)	1.813** (.188)	1.811** (.187)
Student level variable				
SES	1.312** (.256)	1.314** (.257)	1.135** (.255)	1.307 (.275)
Male	2.933** (.322)	2.926** (.322)	2.946** (.322)	2.931** (.321)
Black	-4.260** (.568)	-4.252** (.570)	-4.281** (.569)	-4.273** (.571)
Hispanic	-1.183* (.548)	-1.145* (.548)	-1.185* (.548)	-1.190* (.548)
Asian	-2.027** (.776)	-1.993* (.781)	-1.990* (.778)	-2.039** (.777)
Other	-2.304** (.699)	-2.216** (.707)	-2.265** (.705)	-2.280** (.700)
Single parent	.834+ (.439)	.860+ (.440)	.843+ (.0439)	.834+ (.439)
Other parent	-.175 (.833)	-.174 (.837)	-.193 (.838)	-.162 (.837)
Non biological parent	.402 (.560)	.426 (.562)	.409 (.562)	.398 (.562)
Number of siblings	.257 (.160)	.256 (.160)	.256 (.160)	.255 (.161)
Retained	-8.059** (.507)	-7.970** (.512)	-8.043** (.506)	-8.046** (.509)
School level variable				
School SES	.070 (.298)	.112 (.298)	.091 (.298)	.081 (.298)
Urban	1.139+ (.606)	1.130+ (.607)	1.099+ (.609)	1.136+ (.606)
Suburban	.588 (.603)	.632 (.605)	.598 (.605)	.601 (.603)
Minority	.239 (.536)	.217 (.534)	.213 (.532)	.227 (.534)

Academic intensity for 1st grade	.666+ (.322)	.648* (.320)	.648* (.317)	.665* (.320)
Responsibility for 1st grade	.595+ (.332)	.505 (.328)	.557+ (.331)	.579+ (.330)
Cross-Level Interaction				
Responsibility for 1st grade × Math at K		-.647* (.265)		
Academic intensity for 1st grade × Math at K		-.476 (.305)		
Responsibility for 1st grade × Reading at K			-.255 (.255)	
Academic intensity for 1st grade × Reading at K			-.513 (.320)	
Responsibility for 1st grade × Approaches to learning				-.244 (.221)
Academic intensity for 1st grade × Approaches to learning				-.242 (.275)

*p < .05 **p < .01 + < .06

Table A. 4.2: Parameter Estimates Predicting the Moderating Role of Teachers' Academic Intensity and Responsibility on Reducing the Math Gain Gap Engendered by School Readiness from 1st through 3rd Grade after Controlling for Individual and School Characteristics

Variables	Math Learning Gain from 1st through 3rd Grade			
	Model 1 Main Effect	Model 2 Interaction with Math at K	Model 3 Interaction with Reading at K	Model 4 Interaction with Approaches at K
Intercept	36.814** (.803)	36.880** (.803)	36.838** (.800)	36.855** (.801)
School readiness				
Math	1.984** (.339)	2.107** (.336)	2.003** (.335)	2.019** (.339)
Reading	-.078 (.289)	-.080 (.290)	-.001 (.294)	-.080 (.289)
Approaches to Learning	1.198** (.217)	1.170** (.215)	1.171** (.228)	1.156** (.219)
Student level variable				
SES	1.279** (.263)	1.283** (.263)	1.285** (.278)	1.294** (.264)
Male	3.169** (.381)	3.153** (.382)	3.150** (.391)	3.139** (.382)
Black	-4.736** (.727)	-4.611** (.726)	-4.685* (.778)	-4.672** (.727)
Hispanic	-1.212 (.637)	-1.086 (.636)	-1.097 (.654)	-1.200 (.638)
Asian	1.613* (.802)	1.578* (.799)	1.647 (.853)	1.612* (.804)
Other	-1.525 (.908)	-1.386 (.908)	-1.425 (.920)	-1.482 (.909)
Single parent	-.556 (.581)	-.549 (.580)	-.552 (.586)	-.571 (.581)
Other parent	-2.706** (1.000)	-2.710** (.995)	-2.760* (1.105)	-2.707** (.981)
Non biological parent	-.292 (.728)	-.302 (.730)	-.308 (.780)	-.281 (.722)
Number of siblings	-.468* (.207)	-.459* (.206)	-.467* (.214)	-.465* (.208)
Retained	-4.783** (.633)	-4.638** (.631)	-4.699** (.716)	-4.704** (.633)
School level variable				
School SES	.559 (.379)	.597 (.380)	.580 (.380)	.560 (.378)
Urban	1.127 (.733)	1.217 (.733)	1.221 (.746)	1.146 (.729)
Suburban	.446 (.708)	.498 (.707)	.495 (.707)	.437 (.705)
Minority	.261 (.724)	.320 (.727)	.312 (.689)	.278 (.724)

Academic intensity for 1st – 3rd grade	.998* (.407)	1.055** (.401)	1.062* (.409)	1.005* (.405)
Responsibility for 1st – 3rd grade	1.005* (.414)	.885* (.414)	.945* (.408)	.968* (.412)
Cross Level Interaction				
Responsibility for 1st – 3rd grade × Math at K		-1.022** (.307)		
Academic intensity for 1st – 3rd grade × Math at K		.424 (.325)		
Responsibility for 1st – 3rd grade × Reading at K			-.694* (.278)	
Academic intensity for 1st – 3rd grade × Reading at K			.599 (.313)	
Responsibility for 1st – 3rd grade × Approaches to learning				-.634* (.247)
Academic intensity for 1st – 3rd grade × Approaches to learning				.428 (.286)

**p < .01, *p < .05

Table A. 4.3: Parameter Estimates Predicting the Moderating Effect of Teachers' Academic Intensity and Responsibility on Reducing the Math Gain Gap Engendered by School Readiness from 3rd through 5th Grade after Controlling for Individual and School Characteristics

Variables	Math Learning Gain from 3rd through 5th Grade			
	Model 1 Main Effect	Model 2 Interaction with Math at K	Model 3 Interaction with Reading at K	Model 4 Interaction with Approaches at K
Intercept	24.120** (.666)	24.233** (.686)	24.228** (.684)	24.205** (.687)
School readiness				
Math	-1.178** (.276)	-1.078** (.273)	-1.196** (.269)	-1.139** (.266)
Reading	-.575* (.264)	-.523* (.246)	-.398 (.268)	-.555* (.246)
Approaches to Learning	.666** (.203)	.638** (.215)	.636** (.215)	.620** (.211)
Student level variable				
SES	.602* (.234)	.587* (.237)	.605** (.234)	.597* (.235)
Male	.557 (.325)	.563 (.318)	.559 (.318)	.519 (.318)
Black	-.532 (.634)	-.437 (.711)	-.511 (.709)	-.457 (.709)
Hispanic	.987+ (.537)	1.105* (.545)	1.096* (.543)	.987 (.543)
Asian	3.263** (.700)	3.231** (.698)	3.298** (.692)	3.260** (.695)
Other	.883 (.763)	.951 (.700)	.974 (.695)	.905 (.706)
Single parent	-.139 (.445)	-.163 (.471)	-.137 (.472)	-.144 (.473)
Other parent	-.196 (.946)	-.203 (.926)	-.244 (.919)	-.166 (.913)
Non biological parent	-.261 (.636)	-.261 (.614)	-.271 (.612)	-.203 (.619)
Number of siblings	-.305 (.161)	-.294 (.172)	-.300 (.172)	-.297 (.172)
Retained	.493 (.574)	.657 (.662)	.625 (.659)	.624 (.663)
School level variable				
School SES	.204 (.317)	.287 (.323)	.272 (.320)	.222 (.320)
Urban	-.225 (.633)	-.170 (.644)	-.225 (.644)	-.251 (.648)
Suburban	-.699 (.602)	.681 (.603)	-.704 (.602)	-.737 (.607)
Minority	-.299 (.548)	-.333 (.561)	-.334 (.559)	-.330 (.559)

Academic intensity for 3rd – 5th grade	.901** (.286)	.957** (.275)	.924** (.277)	.928** (.278)
Responsibility for 3rd – 5th grade	.698* (.297)	.596* (.298)	.622* (.292)	.709* (.292)
	Cross Level Interaction			
Responsibility for 3rd – 5th grade × Math at K		-.991** (.230)		
Academic intensity for 3rd – 5th grade × Math at K		.302 (.220)		
Responsibility for 3rd – 5th grade × Reading at K			-.825** (.279)	
Academic intensity for 3rd – 5th grade × Reading at K			.307 (.210)	
Responsibility for 3rd – 5th grade × Approaches to learning				-.945** (.221)
Academic intensity for 3rd – 5th grade × Approaches to learning				.404 (.221)

**p < .01, *p < .05

Table A. 4.4: Parameter Estimates Predicting the Moderating Effect of Individual Teacher Academic Intensity and Responsibility on Reducing the Learning Growth Gap Engendered by School Readiness after Controlling for Individual and School Characteristics

	Math score given Math skill at K (1st grade)	Math gain given Math skill at K (1st-3rd grade)	Math gain given Math skill at K (3rd -5th grade)
Intercept	10.062** (.307)	2.058** (.342)	-1.110** (.267)
Responsibility	-.539** (0.189)	-.485* (.189)	-.559** (.183)
Academic intensity	-.429* (.208)	.401 (.223)	.332* (.158)
	Math score given Reading skill at K (1st grade)	**Math gain given Reading skill at K (1st-3rd grade)**	**Math gain given Reading skill at K (3rd -5th grade)**
Intercept	.699* (.281)	-.038 (.292)	-.444 (.268)
Responsibility	-.292 (.176)	-.211 (.250)	-.486* (.201)
Academic intensity	-.297 (.211)	.348 (.237)	.291* (.137)
	Math score given Approaches to learning at K (1st grade)	**Math gain given Approaches to learning at K (1st-3rd grade)**	**Math gain given Approaches to learning at K (3rd -5th grade)**
Intercept	1.804** (.186)	1.191** (.217)	.655** (.214)
Responsibility	-.157 (.160)	-.361+ (.184)	-.376* (.173)
Academic intensity	-.217 (.185)	.349 (.241)	.115 (.161)

** $p < .01$, * $p < .05$, + $p < .055$

Equation A. 4.1

Level 3: School model

- $\beta_{10k\ \text{(Average math gain 1st - 3rd grade)}} = \gamma_{010} + \gamma_{011}$ (School composition/School SES/Location) + γ_{012} (Teachers' academic intensity for 1st grade) + γ_{013}(Teachers' responsibility for 1st grade) + ω_{01k}

Level 3: Cross-level interaction model

- $\beta_{11k\text{(Math gain from 1st - 3rd grade given school readiness)}} = \gamma_{110} + \gamma_{111}$ (Teachers' academic intensity for 1st grade) + γ_{112} (Teachers' responsibility for 1st grade)

Equation A.4.2

Level 3: School model

- $\beta_{10k\ \text{(Average math gain 1st - 3rd grade)}} = \gamma_{010} + \gamma_{011}$ (School composition/School SES/Location) + γ_{012} (Teachers' academic intensity for 3rd grade) + γ_{013}(Teachers' responsibility for 3rd grade) + ω_{01k}

Level 3: Cross-level interaction model

- $\beta_{11k\text{(Math gain from 1st - 3rd grade given school readiness)}} = \gamma_{110} + \gamma_{111}$ (Teachers' academic intensity for 3rd grade) + γ_{112} (Teachers' responsibility for 3rd grade)

Equation A. 4.3

Level 3: School model

- $\beta_{20k\text{(Average math gain 3rd – 5th grade)}} = \gamma_{100} + \gamma_{101}$ (School composition/School SES/Location) + γ_{102} (Teachers' academic intensity for 3rd grade) + γ_{103} (Teachers' responsibility for 3rd grade) + ω_{10k}

Level 3: Cross-level interaction model

- $\beta_{21k\text{(Math gain from 3rd - 5th grade given school readiness)}} = \gamma_{210} + \gamma_{211}$ (Teachers' academic intensity for 3rd grade) + γ_{212} (Teachers' responsibility for 3rd grade)

Equation A. 4.4

Level 3: School model

- $\beta_{20k\text{(Average math gain 3rd – 5th grade)}} = \gamma_{100} + \gamma_{101}$ (School composition/School SES/Location) + γ_{102} (Teachers' academic intensity for 5th grade) + γ_{103} (Teachers' responsibility for 5th grade) + ω_{10k}

Level 3: Cross-level interaction model

- $\beta_{21k\text{(Math gain from 3rd - 5th grade given school readiness)}} = \gamma_{210} + \gamma_{211}$ (Teachers' academic intensity for 5th grade) + γ_{212} (Teachers' responsibility for 5th grade)

Note: The measurement and student level models stay the same as in Equation (1).

Min-Jong Youn
Assistant Research Professor
National Institute for Early Education Research (NIEER)
Rutgers University
73 Easton Avenue
New Brunswick, NJ08901
(848) 932-3147
myoun@nieer.org

Education

Ph.D. Educational Theory and Policy, Pennsylvania State University (2012).
Dissertation: *Inequality from the first day of school: The influence of teachers' academic intensity and responsibility on the learning growth gap.*
Minor: Comparative & International Education.

M.S., Sociology of Education, Chung-ang University, Seoul, Korea (2003-2006).
Thesis: *An Analysis of Private and Public School Effects in South Korea*.

B.S., Education, Chung-ang University, Seoul, Korea (1999-2002).

Research Experience

2011-present	Assistant Research Professor. National Institute for Early Education Research (NIEER), Rutgers University.
2010-2011	Research Consultant to Dr. Daphne Hernandez, Human Development and Family Study, Pennsylvania State University.
2010-2011	Research Assistant, Regional Education Lab, Pennsylvania State University.
2009-2010	Statistical Fellowship, Population Research Institute, Pennsylvania State University.
2007-2009	Research Graduate Student Fellowship, Educational Theory and Policy, Pennsylvania State University.
2003-2005	Research Assistant, Sociology of Education, Chungang University.

Peer- reviewed Publications

Lee, K. Leon, J. & Youn, M.J. (forthcoming). What to do next: An exploratory study of the post-secondary decisions of American students. *Higher Education.*

Bodovski, K. & Youn, M.J. (2012). Students' mathematics learning from kindergarten through 8^{th} grade. *International Journal of Sociology of Education.*

Youn, M.J. & Leon, J. (2011). The influence of maternal employment on children's learning growth and the role of parental involvement. *Early Child Development and Care*.

Bodovski, K. & Youn, M.J. (2011). The long term effects of early acquired skills and behaviors on young children's achievement in literacy and mathematics. *Journal of Early Childhood Research*.

Bodovski, K. & Youn, M.J. (2010). Love, discipline, and elementary school achievement: The role of family emotional climate. *Social Science Research.* , 39(4): 585-595.