MATHEMATICS ACHIEVEMENT OF SPANISH-SPEAKING KINDERGARTENERS AND THE IMPACT OF TEACHER CHARACTERISTICS: A MEDIATION HYPOTHESIS

by

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MATHEMATICS ACHIEVEMENT OF SPANISH-SPEAKING

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ABSTRACT

The number of children beginning public school in the United States who speak Spanish as their native language—Spanish-speaking kindergartners (SSK)—continues to increase as the proportional quantity of children from immigrant families rises. SSK academically lag behind their peers in all subjects at the beginning of kindergarten and throughout their educational careers. Among school factors that contribute to achievement differences, teacher characteristics have been shown to contribute significantly to academic achievement differences. The purpose of this study is 1) to describe SSK and compare them to theirs peers in terms of mathematics achievement, socioeconomic status, parental education level, and certain teacher characteristics; 2) to evaluate the impact of three teacher characteristics—a) whether Spanish is used for instruction in the classroom, b) teacher's rating of the importance of knowing English for school readiness, and c) number of years teacher has taught kindergarten—on the mathematics achievement of SSK; 3) to determine whether these direct effects are mediated by the teachers' perception of child's approach to learning; and 4) to establish whether direct and indirect effects vary by levels of SES, mother's education level, and English proficiency. Descriptive statistics, *t*-tests, a non-parametric test, and a series of linear and multiple linear regressions were conducted. Results show that SSK fare a standard deviation lower than their peers in terms of SES and parent education. They score substantially lower in mathematics; and their teachers are more likely to use Spanish in classroom instruction, less likely to perceive English proficiency as important to school readiness, rate SSK as having weaker approach to learning strategies, and have less experience teaching kindergarten. Spanish-use in the classroom was found to account for a

substantial amount of variance (over 4 %) of SSK mathematics achievement during the fall of kindergarten, where Spanish-use was associated with higher scores. Evidence was found to suggest that the direct effect of Spanish inclusion on mathematics achievement was partially mediated (i.e., indirect effect) by teacher's view of child's approach to learning. Sizes of direct and indirect effects were found to vary by SES, level of mother's education, and English proficiency.

Dedicated to those who humbly and diligently work

to make this world a fairer, more peaceful place for all.

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CHAPTER 1

INTRODUCTION

Meaningful psychoeducational and academic related practices within early education contexts occur as policymakers and practitioners are in sync with the relevant sociocultural needs of students they serve. This paper considers the state of educational attainment for one of the fastest growing sections of the U.S. child population, young children of Hispanic immigrant families. It synthesizes the extant research literature of factors that impinge on the academic achievement of Spanish-speaking kindergarteners (SSK). In addition, data from a national longitudinal study of early school achievement and a model that evaluates the impact of teacher characteristics on SSK's mathematics achievement are analyzed. Findings and implications for education policy, practice, and future research are discussed.

Children of immigrant families constitute the fastest growing child population in the United States. Presently, one in five children in the U.S. belongs to an immigrant family. Hispanics are overwhelmingly the largest racial/ethnic group within the immigrant child population. As the Hispanic immigrant child population continues to proportionally increase and spread throughout the country, U.S. schools witness larger concentrations of children entering kindergarten who speak Spanish as their native language. SSK often come from socioeconomically disadvantaged homes in which parents have little formal education. They are intellectually capable; yet, on the whole, they have less experience with academically relevant activities and have particular linguistic and cultural needs. School practitioners and policymakers, therefore, are

challenged with developing curriculum, policy, and instructional practices that recognize and harness the cultural and linguistic strengths and meet the needs of SSKs. Such efforts have the potential of facilitating meaningful, long-lasting educational and academic experiences in school.

This paper focuses on the academic well-being of Spanish-speaking students during the kindergarten year for two reasons: a) the kindergarten year represents an initial exposure to formal schooling for many children and b) academic achievement gains made in early education (K-3) predict later academic successes. SSK are academically "at-risk" due to a number of factors. Contemporary research documents that poor, Hispanic, language minority, and immigrant children whose parents have little formal education—frequent characteristics of SSK—academically lag behind their peers. Further research suggests that processes within and between schools as well as home influences serve as sources of academic achievement discrepancies. In other words, achievement differences are attributable to variations in home as well as school factors. Analyses in this paper consider some ways in which processes within the school—i.e., teacher characteristics—impact SSK's academic achievement.

Empirical evidence and education theory indicate that variations in teacher characteristics—e.g., teaching experience, teacher expectations of students, professional qualifications, attitudinal components, curricular and instructional practices—significantly account for variations in student academic achievement. The amount of teaching experience, for example, has been found to significantly account for academic achievement differences in kindergarten. In addition, specific to the needs of SSK, research studies and psychoeducational theory suggest that teachers who speak Spanish

and recognize the cognitive strengths of SSK, regardless of their inability to speak English, are more likely to promote higher student achievement outcomes. Psychoeducational theory posits that variations in teacher characteristics not only impact student achievement directly, but this direct effect is partially mediated by variations in teachers' perceptions of the child's ability to learn. This paper, therefore, compares SSK to the general body of kindergartners on a number of academically relevant domains; and evaluates the direct effects of three teacher characteristics—a) whether Spanish is used for instruction in the classroom, b) teacher's rating of the importance of knowing English for kindergarten readiness, and c) years teacher has taught kindergarten—on SSK's mathematics achievement score. In addition, a mediation model was conducted to determine whether the direct effects of three teacher characteristics were mediated by their rating of the child's approach to learning. A mathematics score was selected to operationalize academic achievement for two reasons: a) it generally correlates strongly with overall achievement in early education and b) it is a less linguistically loaded measure.

Based on a review of the current literature, empirical evidence, and modern psychoeducational theory, it was hypothesized that

- in comparison to the general body of kindergartners, SSK would demonstrate significantly lower outcomes on measures of SES, parent education level and math achievement;
- variations in teacher characteristics would significantly account for a substantial percentage of SSK mathematics achievement variation (direct effects); and

- direct effects would be partially mediated by the teachers' perception of the child's approach to learning.

Hypotheses were analyzed using a series of linear and multiple linear regressions. Descriptive statistics, a non-parametric test, and *t*-tests were conducted to compare SSK to the general U.S. kindergarten population on a number of relevant measures. Data from this study were taken from the kindergarten cohort of the Early Childhood Longitudinal Study (ECLS-K), conducted by the National Center of Education Statistics (NCES).

CHAPTER 2

LITERATURE REVIEW

Demographic Foundations

Of the 4 million children enrolled in kindergarten in the United States, the number of students entering school as Spanish-speaking, non-English kindergartners (SSK) continues to increase (Jamieson, Curry, & Martinez, 2001; U.S. Census, 2000). National increases of SSK in US public schools are due to increasing immigrant trends, a high proportion of young Hispanics compared to other racial/ethnic groups, and high fertility rates among Hispanic immigrant families (Passel, 2003). In March 2003, the population in the United States included 33.5 million foreign-born, representing 11.7 percent of the U.S. population. As the total U.S. foreign-born population continues to proportionally increase compared to the total U.S. population, the Hispanic share has exponentially increased in comparison to Europeans and Asians over the last three decades (see Table 1). In 2003, over 53 percent of the foreign-born population was from Latin America (not including Puerto Rico, which is a U.S. Territory) (Larsen, 2004). Hernandez (2004) shows that immigration trends of Hispanics appear to be the strongest driving force influencing the ascendant prevalence of young Hispanics in the US. Since 1980, at least 75 percent of the Hispanic population growth in the US has been due to immigrants, by migration or through childbirth of immigrants. Passel (2003) posits that Hispanic immigration trends are not likely to subside in the near future and projects that by 2050 the Hispanic faction will reach 101 million, constituting 24.6 percent of the total US population—double the population representation held in 2000.

Garcia (2001) notes that while today there are proportionately fewer children in the U.S. (children make up 25 percent of the U.S. population today compared to 36 percent in 1960), there has been a rapid increase in the number of children in ethnic or racial minority groups. This is fundamentally due to the burgeoning Hispanic child population. Not only are Hispanics now the largest ethnic minority in the U.S., but they are also the youngest ethnic minority (Montemayor & Mendoza, 2004). Compared to non-Hispanic whites, Hispanics are nearly twice as likely to be under age 5 (see Table 2). This fact is partially attributable to high birth rates within the Hispanic population. Compared to non-Hispanic Whites and Blacks, Hispanic women have higher childbearing rates in the U.S. (Durand, Telles, & Flashman, in press). Over one-third of the Hispanic population are children. As a result, Hispanics are the only racial or ethnic group whose five-and-under group exceeds 10 percent (Hernandez, 2004). Immigrant or foreign-born Hispanic mothers tend to have even higher birth rates than U.S.-born Hispanic mothers. Durand et al. (in press) note that foreign-born Hispanics, on average, bear 3.51 children over their lifetimes while U.S.-born Hispanics bear 2.21 children on average.

Of the 72.1 million children that live in households in the United States in 2000, 11.5 million children lived in households with foreign-born or immigrant parents. Of those children from immigrant families, 77.7 percent (8.9 million) were born in the United States (U.S. Census, 2000). Recent estimates indicate that one in five children in the United States is from an immigrant family, characterized as having one or more foreign-born parent (Hernandez, 2004). Hernandez (2004) establishes that since 1990 the number of children born into immigrant families in the U.S. has expanded about

seven times faster than the number in native-born families as children in immigrant families are the fastest growing segment of the child population in this country. In 1970, children in immigrant families constituted 6.4 percent of K-12 enrollment in the U.S. Whereas in 2000, they comprised 20.1 percent of the K-12 population (see Table 3). As a result, a large number of U.S.-born children are being raised by foreign-born parents, which means that many U.S.- and foreign-born children are being raised in homes where a language other than English is spoken. Indeed, 18 percent of children in the U.S. speak a language other than English at home (Hernandez, 2004).

México continues to be the most dominant source country of immigration to the U.S (Durand et al., in press). Mexico's proportion of the foreign-born population in the U.S. is the largest recorded share any country has held since the decennial census in 1890 when about 30 percent of the foreign-born population was from Germany. México provides the largest source of legal and illegal immigration in the U.S. (Fix, Zimmerman, & Passel, 2001). Over 5.1 million children in the U.S. were children of Mexican immigrant families in 2000, representing 39 percent of the total number of children in immigrant families (Fix & Passel, 2003; Hernández, 2004; Shields & Behrman, 2004). Sixty-two percent of all children of immigrants in 2000 were from Latin America, a dramatic change from 1910 when Latin America's immigrant representation in the U.S. was only 2 percent (see Table 4).

As a result of the above-mentioned trends—high influxes of Latin American (mostly Mexican) immigration, the extreme youthfulness of the Hispanic population, and high birth rates of Hispanic immigrant mothers—across the nation, numerous native Spanish-speaking children are entering public schools. Assuming children of Latin

American immigrant families grow up learning Spanish in their home from birth to age 5 and drawing from Public Use Microdata Sample (PUMS) by the U.S. Census 2000, nearly 13 percent of all kindergartners in the U.S. begin kindergarten as Spanish-speakers (U.S. Census, 2000). From 1980 to 2000, the number school-aged children (5-19) in the U.S. who spoke Spanish at home grew over 100 percent—from 3.4 to 7.1 million (Fix & Passel, 2003). Again, given the previously mentioned trends, the amount and proportion of Spanish-speaking youngsters beginning public school in the U.S. is only going to increase. While issues surrounding the public education of Spanish-speaking children have traditionally been focal concerns of a few select states, public education systems all over the country are witnessing large increases of Hispanic immigrant students in their schools.

Hispanic children of immigrant families in the U.S. traditionally have been concentrated in six states: CA, NY, TX, FL, NJ, and IL (Fix and Passel, 2003; Hernandez, 2004; Passel & Fix, 2001; Schimdley, 2001; Suárez-Orozco, 2001). Prior to 1995, 3 in 4 of the nation's immigrants were found in these states. However, during the late 1990s, many newcomer families dispersed throughout the nation and only 2 in 3 of the nation's immigrants were found in the six traditionally immigrant states by 2000 (Fix & Passel, 2003). States that have experienced large increases in immigrant populations are located principally across the middle of the country, including many from Rocky Mountain, Midwest, and Southeastern states. Arkansas and North Carolina experienced the largest proportional proliferation of immigrant families from 1990 to 2000, each over 300 percent (Guzmán, 2004). Among the many issues that states experiencing abrupt

and exponential arrivals of newcomer families face are how to provide appropriate and equitable education services to SSK students.

Public education systems that serve children with limited English proficiency—contemporaneously referred to as English language learners (ELL) and formally as limited English proficient (LEP) in the literature—are challenged with the task of developing innovative curricula, instructional practices, literacy programs, educational policy, parent-school collaboration efforts, etc., to promote the academic success of linguistically and culturally diverse students. Surely, this is an immensely complex commission that has captivated the attention of scholars, practitioners, and policy-makers for decades (August & Hakuta, 1997). Notwithstanding the attention that has been hereto given, language and racial-minority children continue to academically lag behind their White and language-majority counterparts throughout K-12 public education schools in the U.S. (Donahue, Voelkl, Campbell, & Mazzeo, 1999; Rathbun, West, & Germino-Hausken, 2004).

Making a Case for the Kindergarten Year

The kindergarten year traditionally has been the first formal schooling experience for children in the United States, though children are attending prekindergarten programs at increasing rates. While some children attend private and others attend public programs, and some parents opt to send their children to half- over full-day kindergarten, the kindergarten year represents a period of rapid change in the way children perceive themselves and their environment (Bredekamp & Copple, 1997; Sameroff & McDonough, 1994). Initially established as a mechanism of socialization, the

kindergarten year plays a vital role in the overall development and learning of young children regardless of socioeconomic, racial/ethnic, religious, or familial background (West, Denton, & Reaney, 2001). Public kindergarten also serves as an agent for socially disadvantaged children as public primary education, functioning as a mechanism of social reform that not only improves children's developmental outcomes but also society at large (Roopnarine & Johnson, 1993; Seefedlt & Barbour, 1994). Investment in early education—kindergarten in this case—provides an effective strategy for two reasons: a) financial investment in early education is extremely cost-effective, and b) children are neurologically malleable entities during the early years of education.

The educational and academic achievement of young children throughout the early years of elementary school is predictive of educational, economic, and professional successes later in life. By the end of third grade, for example, educational achievement of children substantially predicts enrollment in postsecondary education and amount of income. Heckman & Masterov (2004) argue that success or failure in social and cognitive skill formation in the early education years leads to success or failure in post-school learning and that early childhood interventions are much more cost-effective than remedies that attempt to compensate for early neglect later in life. That is, early learning produces later learning and early success generates later success. Enriched early childhood programs coupled with parental integration programs have a strong track record for promoting the academic achievement of disadvantaged children, improving their labor market outcomes and reducing crime involvement. Heckman & Masterov note that such programs are likely to generate substantial savings and promote economic growth by enhancing workforce skills. The cost-effectiveness of early educational

intervention is due to the cognitively impressionable nature of young children. Neuropsychological science suggests that the younger the child, the more malleable the brain. Cognitive achievement and positive social skills are more easily acquired and more likely to endure over time when learned early in life (Ramey & Ramey, 1998). Hence, from both economic and neuropsychological perspectives, effective early education is a wise investment.

There has been considerable discussion involving preschool and prekindergarten program access and quality in order to improve educational outcomes (Barnett et al., 2003). While such discussion is seriously needed, preschool cognitive and social gains must be sustained and reinforced throughout the primary years of schooling. Turner and Ritter (2004), for example, found that math and reading cognitive gains children exhibited in a center-based childcare were largely reduced by first-grade. Hence, as discussion regarding access to quality prekindergarten and preschool programs continues, it is imperative that educational researchers, policymakers, and practitioners evaluate how gains can be optimally sustained via effective kindergarten programs.

Academic Achievement of SSK

Although SSK in the U.S. represent an array of national origins and cultures with differing educational experiences at home and at school, extant data suggest that SSK generally begin public school with a profile reflecting several academic risk factors that are salient predictors of low academic achievement in mathematics and reading (Denton-Flanagan & Reaney, 2004; Hodgkinson, 2003; Lee & Burkam, 2002; Rathbun et al., 2004; Reardon, 2003). Salient academic risk factors—each uniquely contribute to low

academic achievement variation in reading and mathematics; for SSK, these factors include socioeconomic status (SES), racial/ethnic minority status, non-English primary home language, level of parental education, and immigration status (Han, 2004; Rathbun et al., 2004; Takanishi, 2004). Recent analyses show that academic risk factors not only predict low achievement at kindergarten entry, but also reveal that achievement gaps persist throughout at least the first four years of school (Lee & Burkam, 2002; Rathbun et al., 2004; Reardon, 2003).

Until the recent availability of national early childhood achievement data from the Early Childhood Longitudinal Study, Kindergarten Cohort 1998-1999 (ECLS-K), compiled by the National Center for Education Statistics (NCES), our knowledge of the ubiquitous influence of academic risk factors on academic achievement in early education was based on speculative inference from studies with small sample sizes (West, 2000). However, with the availability of longitudinal and nationally representative data of children's academic achievement throughout the primary years of schooling, previously supposed inferences regarding early academic achievement have become empirical and scientifically sound knowledge (Rathbun et al., 2004). Here, some of these findings relative to the present analysis of SSK achievement are reviewed.

Socioeconomic Status

Nationwide, low SES, or poverty, uniquely accounts for low academic achievement in early education more than any other factor (Lee & Burkam, 2002). Estimating from only one predictor variable, poor kids in U.S. public schools are more likely than any other school group to score substantially lower across academic areas than their peers.

Though social science and education researchers often include measures of SES in their analyses, ways in which this factor is operationalized tend to fluctuate, depending on the nature of the research (Cirino, Chin, Sevcik, Wolf, Lovett, & Morris, 2002). Education researchers who investigate the impact of SES on K-12 school-related outcomes have traditionally used one factor to measure SES: parental income, education level of parents, or free- or reduced-lunch status as measures of SES. These characteristics, by themselves, are arguably invalid indicators of SES (McMillan, Henry, Crosby, & Dickey, 1995; Entwisle & Astone, 1994). Composite SES scales that take into account a variety of related factors are suggested to be more reliable and valid measures of SES and the specific factors used to develop composite scales depend on the particular research interests of the investigator(s) (Entwisle & Astone, 1994). Entwisle & Astone suggest that factors for research in child development and K-12 schooling ought to include amount of financial, human, and social capitol, the poverty line index, and received subsidized meals at school.

Evaluating knowledge and skills disparities of kindergartners from the ECLS-K database as they begin school, Denton-Flanagan and Reaney (2004) formed an SES composite variable from household income, parents' occupation, and parents' education. They found that kindergartners in the lower SES group were less likely to begin kindergarten with the knowledge and skills that are critical for school success. More specifically, lower SES kindergartners were less likely to know letters, to be familiar with print, and to demonstrate a positive approach to learning (Denton-Flanagan & Reaney, 2004). These trends held true for the lowest SES group compared to the middle SES group, as well as for the middle SES group to the highest SES group comparison.

In a similar yet more extensive ECLS-K analysis of kindergarteners' academic ability at the starting gate of kindergarten in the United States, Coley (2002) highlights a breadth of cognitive school readiness inequities by SES. He found that SES—operationalized by the educational level, income, and occupations of kindergartners' parents or guardians—significantly predicted every reading and mathematics task analyzed in the study. With regards to reading, SES was related to proficiency scores in letter recognition, understanding beginning sounds of words, understanding ending sounds of words, recognizing common words by sight (only 2 percent of all kindergartners succeeded at this task), and reading words in context (only 1 percent of all kindergartners succeeded at this task) tasks. Concerning mathematics competence, SES was related to proficiency scores for identification of numbers and shapes, understanding of relative size, understanding of ordinal sequence, addition/subtraction (only 4 percent of all kindergartners succeeded at this task), and multiplication/division (less than 1 percent of all kindergartners succeeded at this task) tasks. Coley (2002) found that some home educational practices differed by SES: parents in higher SES groups were more likely to read everyday to their children than were parents in low SES groups, racial/ethnic differences in at-home reading disappeared when children were grouped by SES, and kindergarteners in high SES groups were more likely to look at picture books outside of school everyday than were kindergartners in low SES groups. Using the same measure of SES as Coley (2002), Lee and Burkam (2002) found that SES accounts for more unique variation in academic scores of children at the starting gate of kindergarten than any other factor—more than race/ethnicity, family educational expectations, access to quality child care, home reading, computer use, and television habits.

Further analyses of national data highlight that academic achievement gaps by SES not only exist at the initiation of kindergarten; but science, mathematics, and reading achievement gaps by SES persist throughout at least the first four years of school (Denton-Flanagan & Reaney, 2004; Rathbun et al., 2004; Rumberger & Arellano-Anguiano, 2004; Reardon, 2003; West, Denton, & Reaney, 2001). Rathbun et al. (2004) found that the academic knowledge and skills children had at the beginning of kindergarten continued to differ in third grade by a number of family risk factors, the most salient of which being low SES. Additionally, it was found in this study that achievement gaps between higher and lower SES children, in many cases, grew wider over the first four years of attendance.

Investigating whether out-of-school, within-school, and/or between-school processes contribute habitually to the extant academic achievement gap by SES and ethnicity/race (findings regarding ethnicity/race discussed later), Reardon (2003) conducted a multilevel piecewise linear growth model analysis on ECLS-K kindergarten and first grade data. He found that out-of-school processes (i.e., summer time lapse, home environment) played a critical role in gaps by SES and within-school processes played an important role in the growth of SES gaps in kindergarten, where the gaps grew between students enrolled in the same schools. That is to say, on a national level, Reardon (2003) highlights that academic performance differences between students of differing SES levels grew larger from fall to the spring of kindergarten, fundamentally due to processes within classrooms and school environments and structures.

Although there is no available index that explicitly reveals SES trends of SSK in the U.S., it can be assumed that a large and immensely disproportional number of SSK

are grouped within the lowest SES quintile by considering SES trends of Hispanic and immigrant youngsters. From the kindergarten class of 1998-1999, 9 percent of White students were in the lowest SES quintile compared to 29 percent of Hispanic students (Lee and Burkam, 2002). The 2002 National Survey of America's Families (NSAF) shows that 21.5 percent of the nation's 13.5 million children (under 18 years old) of immigrants were likely to be poor compared to 13.5 percent of children of native-born parents in 2002 (Capps et al., 2003). Hence, because SSK are Hispanic and many are children of immigrant parentage, the supposition that large portions of them are found within the lowest SES quintile group seems intuitive. As a feature in this paper, descriptive statistics concerning distribution of SSK into SES quintiles will be offered. Surely the effect SES has on early academic achievement is multifaceted as lower SES children are found in elementary schools of consistent lower quality—defined by overall school student achievement, amount of school resources, amount of teacher qualifications, positive teacher attitudes, neighborhood and school conditions, etc. (Lee & Burkam, 2002).

Race/Ethnicity

Holding constant the influence of SES on academic achievement, race/ethnicity also contributes to low academic achievement. Because SSK fall under the Hispanic construct—though "Hispanic" is not a precise racial/ethnic group because, for example, there are White Hispanics from South America and Black Hispanics from Caribbean countries—extant race/ethnicity academic achievement gaps relevant to SSK are reviewed in this section. The research suggests that, compared to non-Hispanic, white

children, Hispanic children in kindergarten through third grade are at an academic disadvantage in the United States.

As children begin kindergarten, differences in academic competence by race/ethnicity are prevalent (Coley, 2002; Denton-Flanagan & Reaney, 2004; Lee & Burkam, 2002). Denton-Flanagan & Reaney find that Hispanics are less likely than non-Hispanic white children to have essential early literacy skills at the beginning of kindergarten that are critical for shaping future learning and success. Further, their analyses reveal that Hispanic children initiating kindergarten are less likely to know letters, be familiar with print, and demonstrate a positive approach to learning compared to their white peers. Analyses by Coley (2002) demonstrate that Hispanic kindergartners are less likely than Asian and non-Hispanic, white kindergartners to be proficient across mathematics and reading tasks as they begin kindergarten. However, Coley notes that achievement gaps by race/ethnicity substantially decrease after statistically controlling for SES. While acknowledging race/ethnic achievement discrepancies at the beginning of kindergarten diminish after holding SES constant, Lee & Burkam (2002) found that differences persist.

Recent nationally representative research reveals that Hispanics not only academically lag behind their Asian and non-Hispanic white peers at the beginning of kindergarten, but academic achievement gaps by race/ethnicity also persist throughout at least the first four years of school (Denton & West, 2002; Rathbun et al., 2004; Rumberger & Arellano-Anguiano, 2004; West et al., 2001). West et al. released the first report of findings from the ECLS-K study and found academic achievement differences by race/ethnicity during the kindergarten year. Specifically, white and Asian children

were more likely than Hispanics to score in the highest quartile for reading, mathematics, and general knowledge in kindergarten. Denton and West found that these results persisted into kindergarten and Rathbun et al. confirmed that race/ethnicity achievement gaps persisted into third grade as well. That is, Hispanic children continue to academically fall behind their Asian and white counterparts throughout K-3 schooling even after controlling for SES (Lee & Burkam, 2002). In some cases, race/ethnic academic gaps increase. In a study of K-1 academic performance of Hispanics in California, Rumberger and Anguiano (2004) found that in Hispanic/white achievement differences increased from kindergarten to first grade in California.

As research continues to expose academic achievement differences by race/ethnicity even after controlling for SES, questions concerning sources of achievement differences by race/ethnicity rationally arise. Reardon's (2003) analysis offers some insight. He found between-school as well as within-school differences in academic achievement by race/ethnicity. That is, there appear to be processes between- as well as within-schools that contribute to racial/ethnic academic achievement disparities in K-1 schooling in the U.S. Between-school achievement differences may be due to differences in curricula, teacher quality, facilities, resources, peer socialization, etc. among schools. Within-school achievement differences—suggesting that students of diverse racial/ethnic groups within the same school learn at differing rates—may be due to differential treatment because of teacher bias, cultural aspects of schooling, home-school language mismatch, differential preparation for schooling, etc. (Bowles & Gintis, 1976; Ferguson, 2003; Fuligni, 1997; Lareau, 1989).

Non-English home language

The first analysis reporting on findings from the ECLS-K database found that nearly 10 percent of U.S. children in kindergarten in the 1998-1999 school year originated from homes where English was not the primary language (West et al., 2000). The majority of these are Hispanic children. In the same study, 29 percent of Hispanic kindergartners in the U.S. came from homes where Spanish was the primary spoken language at home. Compared to the population of kindergartners where English is the primary home language, children from homes where English is not the primary home language are less likely to score in the highest quartile in reading, mathematics, and general knowledge in kindergarten (West et al., 2000). Rathbun et al. (2004) found that having a non-English primary home language proved to be a family risk factor that impacted academic well-being through the 3rd grade. That is, children from non-English homes made smaller gains and scored lower in mathematics and reading tasks than those who came from homes where English was the primary home language. It is anticipated that subsequent analyses of the ECLS-K will reveal the extent to which having a non-English home language impacts academic performance through the later years of elementary school and into middle school.

Not all language minority groups perform identically in academics during the early years of primary schooling. For example, in a study analyzing reading gains of language-minority and non-language minority kindergartners, Germino-Hausken, Brimhall, & Pollack (2001) found that non-language minority and Asian language minority children at all SES levels made better gains on reading tasks—beginning sounds, ending letter sound relationships, and reading words—than Hispanic language

minority children. Lower reading performance by Hispanic kindergarteners compared to those from Asian language homes appears to be related to the fact that Hispanic children struggle much more than Asian students in acquiring English (Ruiz de Velasco & Fix, 2000). A recent report on California children from the Legislative Analyst's Office found that children from Mandarin, Korean, Cantonese, Vietnamese, Pilipino, Armenian, and Cambodian speaking homes acquired English faster than those from homes where Spanish was the primary spoken language (Legislative Analyst's Office, 2004). The only children to develop English proficiency slower than the Spanish-speaking cohort were those from Hmong speaking homes.

The national discussion on the academic attainment, mode of instruction, and quality program development for English language learners (ELL) during the early years of primary education has given rise to two seemingly polarized camps (Wiese & Garcia, 2006). While the first endorses educational policies that promote the sole use of the English language in instruction, the second—referred to often as bilingual education—advocates for educational policies that sponsor programs that are inclusive of children's non-English home language in classroom instruction. The first faction justifies their stance through debates that English-only policies promote rapid English attainment and the second maintains that bilingual instruction helps children develop academic competence in their native language while promoting English language proficiency. Empirical research suggests that bilingualism offers certain cognitive benefits, especially in metalinguistic abilities (August & Hakuta, 1997). Hence, educational programs that promote early identification and intervention via bilingual language development have

been shown to produce positive effects in improving children's reading skills and overall cognitive abilities (Hakuta & Garcia, 1989; Lesaux & Siegel, 2003).

Parental Education Level

Hernandez (2004) argues that parental educational attainment is perhaps the most central feature of family circumstances relevant to overall child development and well-being across race/ethnicity and immigrant generation status. He argues that the overall child cognitive development is utterly contingent upon the parent's level of education. Integrated in this overall development is cognitive progression. Following Hernandez's position, level of parental education would intuitively impact the academic achievement of students in early primary schooling. This line of thought submits that parents with more formal education are more likely to create educationally rich environments for their children at home than those with less formal education. Educational stimulation provided by parents or caretakers at home—especially during the early years of development—translates into academic success in the classroom. Recent research analyzing ECLS-K data appears to support this perspective (Coley, 2002; Rathbun et al., 2004; West et al., 2000; West et al., 2001). West et al. (2001) conclude that, similar to when children enter kindergarten, children's specific reading and mathematics knowledge and skills differ by their mothers' educational level at the end of their kindergarten year. That is, children whose mothers have higher levels of education perform better in specific reading and mathematics skill areas than do children whose mothers have less formal education. Furthermore, West et al. (2000) note that though children whose mothers had lower levels of education were more likely to score lower in reading and mathematics quartiles, some kindergartners from the 1998-1999 academic

school year whose mothers had not completed high school scored in the highest quartile (6 percent in reading, 7 percent in mathematics, 5 percent in general knowledge). Rathbun et al. (2004) demonstrate that mother's level of education continues to impact their children's academic success in mathematics and reading throughout elementary school through the third grade. Subsequent reports will reveal how children's academic achievement is impacted longitudinally by their mother's level of education through later grades.

Other analyses have examined specific features of home educational experiences to determine factors that are influenced by lower parental education attainment, which translate into their children's ensuing academic struggles. Specifically, West et al. (2000), found that children whose mothers had lower levels of education were less likely to be read and sung to every day compared to those whose mothers had higher levels of education. Educational practices in the home—such as parents reading regularly to their children—are critical to a child's level of school readiness and subsequent academic performance (Barton & Coley, 1992; Coley, 2002). Coley states that "the extent to which parents read to their children and the extent to which kindergarten children read books or picture books on their own […] are [behaviors] thought to be important to a child's academic development and are […] within the reach of all households, regardless of socioeconomic status". Unfortunately, not all households offer the same amount of educational stimulation in the home.

SSK very often come from households whose parents have less formal education compared to the general population and subsequently are less likely to encounter academically relevant experiences in the home. Before kindergarten, Hispanic children,

including SSK, are less likely to be read to by their parents than non-Hispanic white children (Coley, 2002). Subordinate home educational experiences of Hispanic children and SSK, though likely consequent to an array of influential and interacting events, appear to be related to the low educational attainment of Hispanic immigrant parents (Hernandez, 2004). Indeed, Hispanic and SSK children are much more likely than other racial/ethnic groups to be born into a newcomer or immigrant family and, consequently, to have parents with less formal education. In 2000, nearly 70 percent of children from Mexican immigrant households had a mother and a father who had less than a high school education and 53 percent of children from other Central American immigrant households, compared to 18 percent of children of U.S.-born families (Hernández, 2004). Hence, though children in immigrant families are more likely than those in native-born families to live in two-parent households, SSK are at-risk of low academic achievement because of the low level of their parents' educational attainment.

Immigrant Status

As stated above, SSK are likely to be born into a family with at least one foreign-born parent, an immigrant family. Children of immigrants—including foreign-born as well as U.S.-born children who have at least one foreign-born parent—are rapidly forming a significant portion of the population. As previously mentioned and shown in Table 3, one in five children in the U.S. are from immigrant families (Fix & Passel, 2003). Hispanic children and SSK are even more likely than the general population to reside in immigrant homes. As children in immigrant families are ever-increasing and spreading throughout the nation, it behooves educational researchers, practitioners, and policymakers to understand the academic trajectory of children in immigrant families so

as to gauge their achievement and develop effective strategies to ensure future success in public education.

Relevant to educational success, children in immigrant families possess several strengths. Shields and Behrman (2004) observe that

> Immigrant families generally come to America with many strengths, including healthy, intact families, strong work ethic and aspirations, and for many, a cohesive community of fellow immigrants from the same country of origin. These strengths can help to insulate children of immigrants from various negative influences in American society […].

Furthermore, children of immigrant families are more likely than children of U.S-born parents to live in a two parent household (Fix et al., 2001). Compared to U.S.-born children; children of immigrants have lower infant mortality rates, are reported to experience fewer health problems, and are less likely to engage in risky behaviors such as substance abuse, early sexual intercourse, delinquent or violent activity, and lower school drop out rates (Shields & Behrman, 2004). In a study comparing parental involvement of first- and third-generation children of immigrant families, Pong, Hao, & Gardner (2002) found that parents of first-generation immigrant students were more likely to adopt home-based scholastic involvement—including forging close bonds with their children, knowing their children's best friends and their best friends' parents, talking to their children about school, having high educational expectations for them, and eating dinner with them.

While these strong points help children of immigrant families adapt to and often succeed in U.S. schooling, "[these strengths] are not always sufficient to keep children on pathways to success over time" (Shields & Behrman, 2004). There is an array of challenges unique to children of immigrant families relative to academic and scholastic

success. Children of immigrants are more likely to live in poverty—1 in 4 of the nation's low-income children are new immigrants or children of immigrants in the U.S. (Greenberg et al., 2004; Hernández, 2004). Therefore, children in immigrant families are more likely to suffer economic hardships, which are likely to hinder educational success (Fix et al., 2001; Hernández, 2004). Hérnandez (2004) points out that children from immigrant families, compared to children of U.S.-born parents, are also more likely to live in crowded housing and are less likely to be covered by health insurance. Compared to children of native-born parents in the U.S., children of newcomer families have parents with less formal education, have less access to work programs and federal welfare (largely due to 1996 federal welfare policy reform), have less internet and computer access, are less likely to attend pre-kindergarten and Head Start programs, are more likely to be behind a grade in school, and are more likely to experience home-school language disparities (Fix et al., 2001; Greenberg et al., 2004; Hernandez, 2004; Pérez, 2004; Shields & Behrman, 2004).

The educational experiences and the academic achievement trajectories of children in immigrant families in the U.S. seem to differ by race/ethnicity and country of origin. Van Hook and Fix (2000) report that the academic achievement levels among immigrant children are mixed and highly variable. Though school attendance rates tend to high for immigrant children, the school completion rates of certain immigrant subgroups, such as Asians, far exceed those of Hispanic immigrant subgroups—school completion rates of Asian students in immigrant families actually exceed those of native-born students as well. Immigrant children of Hispanic origins—mostly composed of children from Mexican families—drop out of school two to three times that of native-

born children (Van Hook & Fix, 2000). Analyzing the longitudinal academic achievement of children of immigrant families from kindergarten to first grade, Han (2004) discovered differences by generational status as well as geographic origins. Namely, she found that first- and/or second-generation children from Latin America had significantly lower scores in math and reading compared to third and later generation non-Hispanic white children and first- and/or second-generation children from regions in Russia/Eastern Europe, Asia, and Africa. First- and/or second-generation children from regions in Russia/Eastern Europe, Asia, and Africa scored higher on math and reading tests compared to third and later generation non-Hispanic white children. All first- and second-generation children had significantly lower scores in general knowledge test scores compared to third and later generation non-Hispanic white children. Thus, though some groups of first- and second-generation children in early primary education appear to perform quite well in core academic areas—math and reading—the immigrant status of many SSK appears to be related to their low academic achievement.

Sources of Academic Achievement Gaps

Thus far, this literature review has established that SSK are academically at-risk because of low SES, racial/ethnic attributes, non-English home language, low level of parental education, and immigration status. As the kindergarten year is a time of formative and rapid change and development that impacts successes in later life, it is critical that research continue to investigate particular sources of academic achievement differences—educational inequity. As these sources are highlighted, intervention

strategies at the policy and practice levels can be implemented to improve academic performance for SSK—and for all at-risk student groups.

Sources of academic achievement differences in early education are attributable to individual and environmental characteristics (National Research Council and Institute of Medicine, 2000). Students' individual characteristics that impact academic achievement may include, for example, age, ability, motivation, positive attitudes, engagement toward learning, and pro-social and attentive behavior (Alexander et al., 1993; Burchinal et al., 2002; Shapiro, 2004). Differences in individual characteristics—attributes related to individual factors (e.g., IQ)—contribute partly to academic achievement differences among students. However, documented evidence suggests that the students' environment—a complex source drenched with interacting forces—also impacts the level to which students academically achieve. That is, variation in student academic achievement can be attributed to their ecological surroundings—whether at home, in school, or an interaction between the two. The first to consider ecological sources of educational inequity at a national level and the largest study of school effectiveness ever undertaken, Coleman et al. (1966) found that schools only accounted for 5 to 38 percent of the total variation in student test scores among different grade levels, ethnic groups, and regions of the country (Coleman, 1990). This study suggested that most of the variation in student academic achievement is attributable to differences between students and their families and not between schools. Nonetheless, although the Coleman study points to sources of academic achievement differences outside of school institutions and subsequent research supports this claim, other research clearly indicates that mechanisms contained within the broad school environment—i.e., teacher

characteristics and amount of school resources—strongly impact student academic achievement (Betts, Rueben, & Danenberg, 2000; Darling-Hammond, Berry, & Thorenson, 2001; Gándara, Rumberger, Maxwell-Jolly, & Callahan, 2003; Hanushek, 1997). As previously mentioned, Reardon's (2003) analysis highlights that academic achievement differences by race/ethnicity and SES in kindergarten through first grade can be partially attributed to out-of-school as well as within- and between-group processes. That is, school practices and resources display salient effects on student performance; to name a few, teacher beliefs and practices (Ferguson, 1998; Fuligni, 1997; Lee & Smith, 1999; Phillips, 1997; Steele, 1997), school organization (Lee et al., 1991; Rowan et al., 1991), and parental involvement (Fan & Chen, 2001; Sui-Chu & Williams, 1996) all affect student academic performance.

As numerous environmental components at home and in school impact children's educational achievement through diverse means, it is critical to distinguish how performance is hindered, enhanced, and/or maintained. Specifically in early education, researchers ought to continue to identify key ecological factors in the home and at school that impact educational attainment (Rathbun et al., 2004). Identification of ecological sources of academic achievement disparities is highly relevant to policymakers, researchers, and practitioners who are actively engaged in the remediation of educational circumstances for at-risk children in order to improve educational attainment levels through enlightened and effective policy and practice. In this paper, the impact of teacher characteristics on SSK's mathematics achievement gains from the fall to the spring semester of kindergarten is analyzed.

Impact of the teacher

Among ecological variables in the school context that impact the academic achievement of students is teacher quality. Teacher characteristics—e.g., level and quality of professional training, years of teaching experience, expectations of student, perceptions of student effectiveness, and instructional practices; influence how well students perform academically in the classroom. While there clearly are other ecological factors that impact students' school performance, documented research suggests that teacher quality significantly accounts for variation in student academic achievement. Hanushek, Kain, & Rivkin (1998), for example, found that variations in teacher quality—measured by disentangling 'teacher-specific' components total school impact—proved to be the most important school variable to account for achievement differences. In this study, within-school and between-classroom mathematics and reading achievement gains from 4th to 5th grade were partially accounted for by variations in teacher quality, controlling for student characteristics, curriculum, class size, and measurement error in order to create a pure teacher effect. At least 7 ½ percent—a lower bound estimate—of the total variation in student achievement was accounted for by variations in teacher quality. Authors provided reasons to believe the true percentage was "considerably larger" than 7 ½ percent. In a similarly structured study, Wright, Horn, & Sanders (1997) examined the relative magnitude of teacher quality on student achievement—math total, reading total, language total, social studies, and science in third, fourth , and fifth grades) while simultaneously considering the influences classroom context variables of heterogeneity among students and class size. Results showed that teacher effects were dominant factors affecting student academic

achievement and variables of classroom heterogeneity and size had relatively little influence on achievement. Thus, contemporary quantitative research with multi-level designs on large and representative sample sizes suggest that the teacher matters—teacher quality, as an ecological variable, contributes substantially to academic achievement differences between students.

Critics may posit that 7 ½ percent variance (to quote Hanushek's et al. [1998] finding) of student achievement accounted for by teacher quality is trivial. Considering the many environmental and individual factors that interact to influence a child's level of academic achievement, this amount of unique variance contribution is both statistically significant and meaningful, especially because SSK are more likely to have teachers who are less qualified (Grantmakers for Education, 2002). Because SSK generally attend schools that serve lower SES populations, their teachers tend to be less qualified—and research suggests that high teacher quality leads to high student achievement. Schools in poorer areas are less attractive to teachers and union contracts allow the most qualified teachers to resist placement in these schools, perpetuating the phenomenon of low teacher quality in low SES schools (Crosnoe, 2005; Grantmakers for Education, 2002). But what is it about low teacher quality that predicts low student achievement? Is it that these teachers know less? Do they have less professional training than other teachers? Do they incorporate less effective instructional practices in their classroom? Are they insensitive to the needs (cognitive, cultural, linguistic, etc.) of their students? Is it because these teachers have low expectations and undermining perceptions of their students? These speculations are likely aspects of teacher quality which mediate low

student achievement. In the following paragraphs, literature concerning the impact of teacher perceptions and expectations on student achievement is reviewed.

In a nationally representative study of kindergarten teachers, conducted by the National Center for Educational Statistics (NCES), students' "approach to learning" was analyzed (Denton & West, 2002). Accordingly, teachers provided information on how children in their classroom approached learning. The four-point "approach to learning" scale measured behaviors that affect the ease with which children can benefit from the learning environment. It included six items that rate the child's attentiveness, task persistence, eagerness to learn, learning independence, flexibility, and organization. Denton and West (2002) found that children who exhibited a positive approach to learning—determined by the teacher—at the beginning of kindergarten did better in the spring of kindergarten and in first grade in reading and mathematics than children who exhibited these behaviors less frequently. Children who exhibited a positive approach to learning were more than twice as likely as other children to score in the top 25 percentile in reading and mathematics at the spring of kindergarten and first grade (Denton & West, 2002).

Considering the predictive validity of teacher's "approach to learning" ratings on students' academic achievement outcomes, it is meaningful to evaluate variations in teacher ratings. Though parent and teacher ratings of student "approach to learning" expressed some compatibility in another NCES report, there were also differences: parents reported that 92 percent of children were often or very often eager to learn, teachers reported that 75 percent were eager to learn (West et al., 2000). Furthermore, in the sample nationally representative sample, teachers' ratings of students' "approach to

learning" varied by race/ethnicity: white and Asian children were more likely to be seen as eager to learn by their teachers than Black or Hispanic children; teachers were less likely to rate Black children as often or very often persistent at tasks than white and Asian children; and the teachers viewed Black children as less likely than white, Asian or Hispanic children to be able to pay attention (West et al., 2000). In a research synthesis commissioned by NCES, Perry and Meisels (1996) found generally that there is sufficient "evidence indicating that teacher's judgments have satisfactory criterion-related and predictive validity" (pg. 16). The authors contextualized this statement by mentioning that special attention needs to be paid to "the domain in which teachers are being asked to make judgments […] and the characteristics of students targeted". Teachers often have difficulty discriminating particularly between achievement and motivation and less precise estimating performance ability of lower achieving groups (Salvesen & Undheim, 1994; Silverstein et al., 1983). That is, "teachers tend to be better at judging the performance of high achieving students than students who have difficulties in school" (Perry & Meisels, 1996, pg. 30). Given that teachers' ratings of student achievement are potentially inaccurate—especially for academically at-risk and racially diverse students (both attributes of SSK)—it important to consider how teachers' perceptions translate into expectations and impact student academic achievement.

In general, the teacher-child relationship has been found to be play a significant role in student achievement in early education (Pianta, 1994). For example, teachers' expectations have been shown to affect student academic outcomes (Good, 1988). Because the teacher-child relationship is complex—influenced by family, teacher, and school characteristics (Pianta, La Paro, Payne, Cox, & Bradley, 2002)—and contributing

factors are difficult to identify, operationalize, and measure; much of the scholarly work on the impact of low teacher expectations has been theoretical. Two interrelated psychological theories of how teacher expectations develop and subsequently impact student school performance are a) attribution theory and b) self-fulfilling prophecy. Attribution theory is concerned with the ways in which people explain the behavior of others. It explores how individuals "attribute" causes to events and how these cognitive perceptions affect their own as well as others' motivation, perceptions and actions (Heider, 1958). In the context of this study, attribution theory would posit that teachers attribute student achievement levels to either *internal* (dispositional) or *external* (situational) factors that are either *stable* or *unstable* (Weiner, 1992). A teacher's *internal*/*stable* attribution of student achievement represents the teacher's perception of the child's ability to learn and successfully function in academic contexts. These perceptions vary across teachers and tend to be inaccurate, based on false and preconceived notions, and are unconsciously transferred to the child's self-expectations, ultimately affecting his or her school achievement (Rosenthal & Jacobson, 1992). The theoretical process by which the child's self-expectations develop and eventually translate into realities is called self-fulfilling prophecy. Rosenthal and Jacobson report that teacher-expectations (high or low) of student ability can have positive or negative effects through the child's self-fulfilling prophecies. That is, students with teachers who have high achievement expectations of them are more likely to academically succeed than those who have teachers with low expectations. Tauber (1998) proposes a five-step model through which the self-fulfilling prophecy in the school context unfolds (see Table 5). Tauber's model is supported by research findings suggesting that teacher

perceptions, expectations, and behaviors interact with students' beliefs, behaviors, and work habits in ways that influence and perpetuate low student academic achievement (Ferguson, 2003; Stuhlman & Pianta, 2001).

Studies suggest that teacher-child relationships and teachers' expectations and perceptions of students in early education vary by amount of teaching experience. Lin, Lawrence, & Gorrell (2003) found in a nationally representative sample of kindergarten teachers that younger teachers valued higher expectations regarding academic skills than teachers who had more professional experience. Additionally, Stuhlman and Pianta (2001) found that teachers with more than 14 years (the mean in the sample of this study, *N*=50) of teaching experience held belief systems that were more likely to impact the level of sensitivity expressed to the individual needs of students in their class, compared to teachers with less than 14 years of teaching experience. In the present study, the impact of teachers' expectation level ("approach to learning") on SSK's mathematics achievement is analyzed.

In addition to considering the impact of teaching experience on the teacher-child relationship in early education via teacher expectations and perceptions, when studying SSK it also is important to consider how linguistically- and culturally-related teacher characteristics impact such perceptions and the achievement of their students (García, 1991, 2001; Seitzinger-Hepburn, 2004). Indeed, the level of the teacher's sensitivity to the cultural and linguistic status and needs of SSK is likely to influence student achievement. Teachers who are in-tune with—and willing to integrate into the curriculum—students' culturally relevant cognitive styles, language variation, and language-use are more likely to develop accurate perceptions of their students that

circumvent home-school cultural and linguistic "mismatches", helping students to reach their academic potential (Ovando, Collier, & Combs, 2006, pg. 214-218). Teachers who are more familiar with their students' linguistic and cultural practices and customs are more likely to gauge accurately the intellectual strengths and weaknesses of SSK. This hypothesis is compatible with Sternberg's (2004) view that "intelligence cannot be meaningfully understood outside its cultural context". Supposing this argument is correct, SSK teachers who speak Spanish and are familiar with the culture of education of Spanish-speaking nations will be more likely to have accurate perceptions of their students' abilities and better able to catalyze higher SSK student academic achievement. If validated empirically, this hypothesis has the potential for significant impact in schools, since presently there are relatively few pubic school teachers who maintain a proficient level of conversational and academically relevant Spanish (Guerrero, 1997; Johannessen & Bustamante-López, 2002).

The role of Spanish inclusion in the kindergarten classroom indeed can serve to promote academic attainment of SSK and facilitate a school environment in which students feel relaxed and confident (Krashen, 1992). All other pertinent factors held constant, teachers who are linguistically competent in Spanish are more suited than English monolingual teachers to establish learning environments for SSK in which children's strengths are acknowledged, children's struggles are properly assessed, and communication is clear (García, 1991; Genesee, 1994; Krashen, 1992; Reguero de Atiles & Allexsaht-Snider, 2002). Teachers who are unable to communicate with SSK in their native tongue may have more negative perceptions of students that undermine student performance. For example, monolingual English teachers may be less likely to view

native, non-English language (Spanish) communicability as a strength, and more likely to perceive English fluency as an informally valid representation of the child's academic ability—these are notable deliberations as unofficial student assessments impact how teachers interact with students and, subsequently, how well English language learners perform academically (O'Malley & Valdez Pierce, 1996).

Statement of the Problem

Much of the scholarly work on the effects of teacher characteristics on academic outcomes of language minority students has been theoretical and/or based on qualitative data extracted from small samples (e.g., Delgado-Gaitain, 2004; García, 1991; Valdés, 1996; Valenzuela, 1999). While qualitative and ethnographic work are vital to understanding interactions and negotiations among institutions and individuals who contribute to educational outcomes of language minority students, they are criticized for lacking statistical power and generalizability. In like manner, these theories are criticized for lacking empirical support.

Quantitative studies and controlled experiments that evaluate the impacts of teacher variables on student outcomes also introduce certain shortcomings. First, these tend to evaluate teacher impacts on student outcomes without considering differences by student characteristics (e.g., race/ethnicity, geographic attributes, linguistic/cultural background). Second, large scale studies of teacher quality on student outcomes usually fail to evaluate specific teacher characteristics, but develop an overall composite of 'teacher quality". For example, Hanushek (1999) and Hanushek, Kain, and Riukin (1998) estimated teacher quality by controlling for between-school, within-school, and

invidivual variations in student achievement. "Teacher quality" in these studies, therefore, was operationalized as an omnibus, sociological force—particular instructional practices or teacher characteristics that bear more or less influence on levels of student achievement were not evaluated.

Purpose of the Study

Based on the above literature review, Figure 1 represents the conceptualization of the mediation causal model. The purpose of this study, therefore, is:

- to compare SSK to the general body of kindergartners on measures associated with low academic achievement (SES, mother education level, father education level);
- to analyze the direct effect of three teacher characteristics—a) whether Spanish is used for instruction in the classroom, b) teacher's rating of the importance of knowing English for kindergarten readiness, and c) years teacher has taught kindergarten)—on SSK's mathematics achievement;
- to determine whether teachers' perception of the child's approach to learning would partially mediate the direct effects of teachers characteristics on SSK's mathematics achievement score; and
- to establish whether direct and indirect effects vary by levels of SES, mother's education level, and English proficiency.

Each of the teacher characteristic variables included in the model (see Figure 1) is postulated as having an effect on the academic achievement (mathematics in the present

design) of SSK. For example, there is some empirical evidence to suggest that expectations and perceptions of teachers are influenced by their amount of teaching experience—one study found that younger teachers were more likely to hold belief systems that impact the amount of sensitivity to their students (Stuhlman & Pianta, 2001). Additionally, specific to needs of SSK, teachers who effectively integrate Spanish into the curriculum and see that the child communicates in his/her native language in order to communicate needs, wants, and thoughts are more likely to further the academic attainment of their monolingual, Spanish-speaking students (García, 1991; Genesee, 1994; Krashen, 1992; Ovando et al., 2003; Reguero de Atiles & Allexsaht-Snider, 2002)—while those teachers who identify the child knowing English as an important aspect of school readiness are not. However, few studies have empirically assessed the influence these particular teacher characteristics on academic achievement outcomes.

This study, therefore, seeks to provide empirical and quantitative evidence, at the national level, on the effects of a few teacher characteristics on SSK's mathematics achievement. These analyses seek to compliment research in the qualitative and ethnographic fields that have shown ways in which language and culture sensitivity of teachers translate into practices that impact student achievement throughout primary and secondary education. Given the generalizable nature of these results—i.e., data were extracted from a nationally representative sample of kindergartners—findings should be of special interest to policymakers and practitioners who serve concentrated populations of children from Spanish-speaking homes, one of the fastest growing child populations in the country.

Mathematics achievement was selected to operationalize academic achievement for two reasons. First, mathematics achievement scores generally correlate strongly with overall achievement in early education. This score, therefore, is deemed a viable representation and predictor academic achievement across subject domains. Second, mathematics achievement was selected because it is a less linguistically-loaded measure of academic achievement. Reading domains in early education (e.g., letter/word recognition, spelling, applied problems) on the other hand are confounded by native non-English language. That is, a comparison of SSK's reading outcomes to those of native-English-speaking children would be more a function of native language fluency than of academic achievement per se.

CHAPTER 3

METHODOLOGY

Dataset

All data used in this study were collected by the NCES as a part of a nationally representative, longitudinal study of children in the United States who began kindergarten in fall of 1998. This study, the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99, commonly referred to as ECLS-K, is an ongoing effort to accumulate information on children's early school experiences from kindergarten through fifth grade. The ECLS-K provides descriptive information on children's status at school entry, their transition into school, and their progression through fifth grade. The longitudinal nature and nationally representative sample of children (N = 19,173 at base-year), teachers, and schools in the ECLS-K dataset enable researchers to study how a wide range of family, school, community, and individual variables interact with early school performance.

The children in ECLS-K attended full-day and part-day kindergarten programs in both public and private schools. They come from diverse socioeconomic and racial/ethnic backgrounds. Data in the study were obtained from parents, teachers, school administrators, and direct child assessments. Children and their families, teachers, and schools provided information on children's cognitive, social, emotional, and physical development. Information on the children's home environment, home educational

practices, school environment, classroom environment, and classroom curriculum and teacher qualifications also is available.

Since there are literally thousands of variables available for analysis in the dataset, the empirical questions to be posed are virtually limitless. This secondary data analysis incorporated only a few of these variables. First, in order to define the subgroup presently under investigation—SSK—I used variables from parent interview and direct child assessment to identify my sample.

Sample

Definition of SSK Sample

A sample of Spanish-speaking kindergartners (n = 1,185) were characterized by their reported linguistic ability and use. That is, the SSK target sample was identified using two language variables from the database: whether the school indicated that child speaks Spanish at home, and whether parents indicated that child speaks Spanish at home. In addition, only children who were enrolled in kindergarten for the first time and those who had the same teacher in the fall and spring were included in the sample.

Comparison Group

Descriptive statistics and nonparametric tests of SSK measures were analyzed and compared to those of the general population of kindergartners. The comparison group (n = 15,577) was comprised of a mixture of children who spoke mostly English as well as other non-English languages (excluding Spanish) at home. They were also first-time kindergartners and had the same teacher in the fall and spring of kindergarten. This comparison group was developed in order to examine descriptive statistics, independent-

samples *t*-tests, and nonparametric tests to see how SSK fare in a variety of dimensions compared to general body of kindergarten peers in the nation.

Variables

Several variables were used in data analyses. Some were used exclusively to define SSK and comparison samples while others were used in preliminary analyses and/or analyses to test the theoretical model. Detailed information related to these variables is listed in Table 6. Additional information associated with measurement and instrumentation follows. Variables used to define samples are discussed first. Variables used in preliminary analyses are discussed next, followed by variables used in both preliminary analyses as well as analyses of the theoretical model.

Child Speaks Spanish in Home

A combination of two variables was used to determine whether the child spoke Spanish in the home. First, C1SPHOME was derived from school assessment data and P1LANGS1 was taken from the fall parent interview to establish that the child spoke Spanish in the home. The parent interview item read as follows: "What languages other than English are spoken in your home?" Only children who were designated as speaking Spanish in the home by schools and parents were included in the SSK sample.

First Time Kindergartners

In the fall of the kindergarten year, parents were also asked denote whether their child(ren) had been enrolled previously in a kindergarten program. This variable, P1FIRKDG, is dichotomous and is a composite and was derived from a fall interview

question (variable P1WHICHY) which read as follows: "Is this [CHILD]'s first or second year of kindergarten?"

Teacher Identification Number

The teacher identification numbers in the fall (T1_ID) and spring (T2_ID) were used in the definition of the SSK and comparison group samples. That is, only children whose T1_ID was the same as their T2_ID were included in the study.

Socioeconomic Status

The ECLS-K socioeconomic status (SES) composite variable (WKSESQ5) was computed at the household level for the set of parents who completed the parent interview in fall-kindergarten or spring-kindergarten. Created by ECLS-K staff at NCES, this SES variable reflects the status of the household at the time of data collection for spring-kindergarten. The components used for the creation of the SES scale were: a) father or male guardian's level of education, b) mother or female guardian's level of education, c) father or male guardian's occupation, d) mother or female guardian's occupation, and e) household income. Because not all parents or guardians responded to all the questions, there were missing values for some of the components of the SES indicator. However, the amounts of missing data for these variables were relatively small percentages (NCES, 2001, pp. 177-181; Table 7). A hot deck imputation methodology was used to assign data for missing values of all components of SES. Categories of SES are made available in the ECLS-K data set in quintiles, determined by the socioeconomic distribution of parents of the general kindergarten population.

Parent Educational Level

A composite variable of the mother's (WKMOMED) and father's (WKDADED)

highest attained education levels were separately compiled from six parent interview questions in the fall and spring of their child's kindergarten year. Nine ordinal parent education levels were developed: a) 8th grade or below, b) 9th - 12th grade, c) high school diploma or equivalent, d) vocational or tech program, e) some college, f) bachelor's degree, g) graduate/professional school with no degree, h) master's degree, and i) doctoral or professional degree.

Spanish Instruction

The variable A2CSPNH was used to assess whether Spanish was used for instruction in the classroom was obtained from an item on the spring teacher questionnaire. This item read as follows: "What languages are used for instruction in your class(es)?" The question is followed by a list of eight non-English options. Option B is Spanish.

Importance Child Knows English

The teacher rating of importance that a child knows English for school readiness was taken from question 7g of part B of the self-administered teacher questionnaire. Question 7 read: "How important do you believe the following characteristics are for a child to be ready for kindergarten?" Thirteen different items of readiness, school climate, and environment were then listed. The teacher rated each item on a five point Likert scale (1 = not important, 5 = essential). The seventh item (question 7g) states "knows the English language". Question 7g (B1ENGLAN), therefore, is operationalized as a measure of teachers' perceived level of importance that a child knows English as a component of school readiness in this study.

Years Taught Kindergarten

Teachers' years of experience teaching kindergarten (B1YRSKIN) was taken from question 19 from part B of the self-administered teacher questionnaire. This question reads: "Counting this school year, how many years have you taught each of the following grades and programs?". Ten items of grades and school programs are then listed below, including 19b, "kindergarten (including transitional/readiness kindergarten and transitional/pre-1st grade)".

Approach to Learning

The teachers' rating of child's "approach to learning" represents one of five subscales taken from the Social Rating Scale (SRS), which was developed by the National Center for Education Statistics (NCES, 2001). The SRS is a 24-item questionnaire completed by both parents and teachers who report on how often the student demonstrates a social skill or behavior, rated on a Likert scale of 1 (Never) to 4 (Very often). Teachers rated individual students as part of a self-administered questionnaire. Factor analyses (both exploratory and confirmatory factor analyses using LISREL) were used to confirm the five scales: a) approach to learning, b) self-control, c) interpersonal, d) externalizing problem behaviors, and e) internalizing problem behaviors. The "approach to learning" subscale consists of 6 items (see Table 8) and was completed by teachers during fall and spring semesters of the children's kindergarten year. It measures behaviors that affect the ease with which children can benefit from the learning environment. In essence, the "approach to learning" construct represents the parent's and teacher's perspective or expectation level of the child's ability to socially adapt to and effectively learn from the schooling context. The reliability for

the teacher SRS scales was high for all five subscales, and was .89 for the "approach to learning" subscale during both the fall and spring semesters of the kindergarten year (NCES, 2001, p. 3-20).

Mathematics Achievement

The dependent variable in the model is a measure of children's mathematics achievement scores during the fall semester of their kindergarten year. As mentioned previously, the mathematics achievement measure was selected for two reasons: a) it tends to correlate strongly with overall academic achievement in early education, and b) it is a less linguistically loaded measure than other academic achievement measures (i.e., reading domains). The content of the mathematics tests were identical to those used in the "Mathematics Framework for the 1996 National Assessment of Educational Progress (NAEP)" (NAGB, 1996) and included the developmentally appropriate items. During the kindergarten year, children engaged in standardized tasks associated with the identification of numbers and shapes, counting, size relativity, and ordinal patterns. This test was given orally and language skills were minimally requisite—if SSK were found to not be proficient in English, the test was given in Spanish. Direct assessments during the fall semester of kindergarten were carried out over a 14-week period that began in September and ended in early December (NCES, 2001, p. 123).

The mathematics Item Response Theory (IRT) score (C1MSCALE) was selected because these tend to be more valid than raw scores. IRT scores use a pattern of right, wrong, and omitted responses to the items—it also controls for difficulty level, discriminating validity, and "guess ability" of each item to place each child on a continuous ability scale (NCES, 2001, section 3-2). Therefore, the math IRT score is a

more accurate assessment of a child's actual mathematics proficiency level than raw number-correct scoring because it compensates for low performing students guessing several hard items correctly. Omitted items on the IRT procedures are less likely to distort scores, on condition that enough items have been answered right or wrong to establish a consistent pattern. Unlike raw scoring, which treats omitted items as if they were answered incorrectly, IRT procedures use the pattern of responses to estimate the probability of correct responses for all test questions. The dependent IRT measure of mathematics achievement, therefore, is a continuous variable that has a maximum of 60 points.

English Proficiency

Variable C1SCTOT was used and recoded to create a dichotomous variable indicating whether each SSK was proficient in English. This information was taken from the *Oral Language Development Scale* (OLDS)—a subset of tests from the PreLas 2000 which is an assessment of oral language proficiency in young children (Duncan & DeAvila, 1998). The tests making up the OLDS were the following:

- "Simon Says" measured listening comprehension of simple directives—i.e., asking a child to do things such as touch ear, pick up paper, or knock on table.
- "Art Show" was a picture vocabulary assessment where children are asked to name pictures they are shown. This assessed child's oral vocabulary.
- "Let's Tell Stories" was used to obtain a sample of a child's natural speech by asking the child to retell a story read by the assessor. The child was read two different stories and asked to retell it in his or her own words using pictures as

prompts. Scores were based on te complexity of the child's sentence structure and vocabulary in his or her retelling of the story.

The first two subtests consisted of ten items each, scored one point per item. The Let's Tell Stories subtest was scored 0 to 5 points for each story and weighted at four times the Simon Says and Art Show items, for a total of 60 points possible on the OLDS. Those who scored 37 or higher were considered proficient while those who scored below 37 were not considered proficient in English. The English proficiency variable in this study was dichotomous; those who scored below 37 were coded with a "0" and considered not proficient, and those who scored 37 or higher were coded with a "1" and considered English proficient.

Data Analyses

Before statistically testing the previously prescribed theoretical model, descriptive statistics, *t*-tests, and a nonparametric test were conducted to determine how SSK compared to the general kindergarten population on eight dimensions.

Data Preparation

Negative levels were assigned in the ECLS-K database to indicate why data were not collected for certain individuals on certain items. Negative level values that were coded as missing include the following: -9 = "not ascertained"; -8 = "don't know"; -7 = "refused"; and -1 = "not applicable". Before analyses could be conducted, variables were recoded so that negative levels (i.e., -9, -8, -7, -1) were coded as missing and would not interrupt analyses and interpretation.

Descriptive Analyses and T-Tests

Descriptive statistics and *t*-tests were first conducted on seven ordinal/continuous dimensions: a) socioeconomic status, b) mother's level of education, c) father's level of education, d) teacher perception of importance that child knows English to be ready for kindergarten, e) years teacher has taught kindergarten, f) teacher rating of child's "approach to learning", and g) mathematics achievement score in the fall of the kindergarten year. Subsequently, means from the SSK population were contrasted to those of the comparison group via independent-samples *t*-tests.

Nonparametric Comparison

A nonparametric test was conducted to determine the distributional allocation and descriptive differences between the SSK and comparison group on the variable that indicated whether Spanish was used in instruction in the classroom (a dichotomous measure). To do this, a Mann-Whitney *U* test was conducted to evaluate differences in medians.

Testing the Theoretical Model

The theoretical model was tested in two phases. The first phase tested the direct effects of teacher characteristics on mathematics achievement. The second evaluated the mediation (or indirect effects) hypothesis as described in Baron & Kenny (1986). This was done using a series of linear regression models.

The first multiple linear regression model was conducted to determine whether the three teacher characteristic variables substantially predicted variation in SSK mathematics academic achievement. Three separate standardized regression coefficients ($\tau'_{1,2,3}$ in Figure 1)—one for each teacher characteristic—and their respective effects

sizes (r^2) were computed. In a mediation framework, these regression coefficients are referred to as direct effects (MacKinnon, 2000).

The test of partial mediation was subsequently conducted following steps outlined in MacKinnon (2000). That is, the mediating (or indirect) effect of teacher "approach to learning" rating was tested through the estimation of two regression equations for each predictor (teacher characteristic). First, the coefficient in the model relating the mediator to the criterion was estimated (ß in Figure 1). Second, coefficients relating teacher characteristics to the mediator variable were computed ($\alpha_{1,2,3}$ in Figure 1). The product of these parameters (αß, $\alpha_{1,2,3}$ß) represent the mediated or indirect effects. To ascertain the extent to which "approach to learning" mediates each direct effect, the indirect effects (αß) was subtracted from the direct effect—if the difference is equal to zero, "approach to learning" would have completely mediated the effect of the multiple regression model. Alpha (α) and beta (ß) coefficient estimates for each independent variable (teacher characteristic) were computed, analyzed, and compared to determine the extent to which the each direct effect was mediated by teachers' rating of child's "approach to learning".

As mentioned, this series of linear and multiple linear regressions evaluated direct and indirect effects associated with conceptual model; remarkable direct and indirect effects—those that held substantial r^2 values—were subsequently analyzed by levels of SES, mother's education level, and English proficiency. Because mothers of SSK were unequally distributed into educational attainment levels, these categories were adjusted slightly so that cell sizes at each level were large enough to provide sufficient

statistical power (see Table 9). Sample distribution by SES and English Proficiency are shown in Tables 10 and 11, respectively.

Assumptions

Like any research method, this statistical procedure makes certain assumptions of the sample and data in relation to the population. These are the same three assumptions associated with all fixed-effects regression models. First, it is assumed that the dependent variable is normally distributed in the population for each level of the independent variable. Second, it is assumed that the population variances of the dependent variable are the same for all levels of the independent variable—this is known as the assumption of homoscedasticity. Third, it is assumed that the cases in the study are a random sample from the population and that the scores are independent from each other.

In addition to these assumptions, multi-co-linearity is also a concern when running multiple regression analyses. To address this, bivariate correlations were computed among independent variables (see Table 12).

Sampling

Due to complex sampling methods prior to data collection, the present regression analyses are robust against the third assumption typically associated with fixed-effects regression models. That is, sampling methods for the ECLS-K employed a multistage probability sample design to select a nationally representative sample of children attending kindergarten in 1998-1999. The first sampling stage (primary sampling units—PSUs) were geographic regions consisting of counties or groups of counties. The

second-stage units were schools (public and private) within sampled PSUs, and the third and final stage units were students within schools.

Weights

Three weights were applied to analyses in order to have strong external validity so that findings in the sample reflect accurate estimates in the population (Thomas & Heck, 2001). The first weight (BYCPTW0) is the sample weight and was applied to descriptive tests, *t*-tests, and regression analyses associated with the theoretical model. The second weight is the stratum weight (BYCPTSTR) associated with public/private school stratification and the third weight (BYCPTPSU) accounts for variance error associated with PSU clustering. The latter two weights were applied to the series of regression analyses conducted to evaluate empirical support for the theoretical model.

CHAPTER 4

RESULTS

Descriptive Analyses and *T*-tests

Independent-samples *t*-tests were conducted to compare SSK to the general body of kindergartners on seven domains known to impact early academic achievement. Results from descriptive statistics and mean comparison tests are shown in Table 13. Because a large number of cases were included in the comparisons, all seven *t*-tests were statistically significant. Cohen's *d* was used as an effect size for each *t*-test (Cohen, 1988; Rosnow & Rosenthal, 1991, 1996). The test comparing groups by socioeconomic status was significant and the size difference was large, $t(391,252) = 635.21$, $p < .001$, $d = 1.00$; SSK had a significantly lower SES mean score. The test comparing groups by mother's level of education was significant and the size of this difference was large, $t(364,605) = 544.38$, $p < .001$, $d = .98$; the mother's of SSK, on average, had significantly lower levels of education. The test comparing groups by father's level of education was significant and the size of this difference was large, $t(317,360) = 512.94$, $p < .001$ $d = .96$; fathers of SSK, on average, had significantly lower levels of education. The test comparing groups by teacher perception of the importance that the child knows English to be ready for kindergarten was significant and the size of this difference was large, $t(346,822) = 442.74$, $p < .001$, $d = .91$; SSK had a significantly lower teacher rating on this measure compared to the general body of kindergarteners. The test comparing groups by years teacher has taught kindergarten was significant and the size of this difference was small, $t(345,764) = 150.40$, $p < .001$, $d = .27$; SSK, on average,

had teachers who reported less years of experience teaching kindergarten. The test comparing groups by teacher rating of child's "approach to learning" was significant and the size of the effect was small, $t(365,440) = 96.58$, $p < .001$, $d = .18$; teachers rated SSK significantly lower on the "approach to learning" dimension. Finally, the test comparing groups by mathematics achievement score in the fall of the kindergarten year was significant and the size of the effect was large, $t(426,116) = 557.38$, $p < .001$, $d = .79$; SSK had a significantly lower mean score on mathematics achievement.

Nonparametric Comparison

A Mann-Whitney *U* test was conducted to evaluate whether SSK were more likely to have a kindergarten teacher who used Spanish in classroom discussion. The result of this test was significant and in the expected direction, $z = -50.30$, $p < .001$ (see Table 14). SSK were more likely than the comparison group to be in a class in which Spanish was used during instruction. Specifically, 55.3% of SSK and 7.2% of the comparison group were in a class that used at least some Spanish during classroom instruction.

Theoretical Model

As mentioned previously, the theoretical model was tested in two phases. The first phase tested the direct effects of teacher characteristics on mathematics achievement. The second evaluated the mediation (or indirect effects). This was done using a series of linear regression models. Results of direct and indirect effects are summarized in Table 15.

Before analyzing regression models, bivariate correlations among teacher characteristics were assessed in order to evaluate concerns surrounding multi-colinearity among independent variables (see Table 12). Results indicated weak relationships between teacher ratings of the importance child knows English before entering kindergarten and years of teaching kindergarten (.075) and between Spanish used for instruction in the classroom and years of teaching kindergarten (.143); and a medium-sized relationship between Spanish used for instruction in the classroom and teacher ratings of the importance child knows English before entering kindergarten (.382). The small to moderate size of these relationships suggests that each teacher characteristic is unique in its variation. Thus, the following regression equations where each teacher characteristic was included as a unique predictor of mathematics achievement were conducted.

The first multiple linear regression model was conducted to determine whether the three teacher characteristic variables substantially predicted variation in SSK mathematics academic achievement. A scatter plot analysis supported the use of a linear model (as opposed to a cubic, quadratic, or other curvilinear relationship). The linear combination of teacher characteristics was significantly and substantially related to SSK's fall semester mathematics achievement score, $F(3, 258{,}775) = 4{,}038.24$, $p < .001$. The multiple correlation coefficient was .21, indicating that approximately 4.5 percent of the variance of SSK mathematics achievement could be accounted for by the linear combination of teacher characteristic measures. Indices indicating the relative strength (standardized parameter coefficients and partial r^2) of the individual predictors in this model are shown in Table 15. Of the three, the only significant and substantial predictor

was the variable that measured whether Spanish was used for instruction in the classroom. This variable alone accounted for 4.1% of the variance of SSK mathematics achievement.

The second multiple linear regression model was conducted to determine whether the three teacher characteristic variables substantially predicted variation in teacher ratings of SSK's approach to learning. A scatter plot analysis supported the use of a linear model (as opposed to a cubic, quadratic, or other curvilinear relationship). The linear combination of teacher characteristics was significantly related to SSK's teacher ratings of SSK's approach to learning, $F(3, 258{,}160) = 450.98$, $p < .001$. However, the size of the effect was not substantial. The multiple correlation coefficient was .072, indicating that approximately .5 percent of the variance of teacher ratings of SSK's approach to learning could be accounted for by the linear combination of teacher characteristic measures.

The third linear regression model was conducted to determine whether teacher ratings of SSK's approach to learning substantially predicted variation in SSK's fall mathematics achievement score. A scatter plot analysis supported the use of a linear model (as opposed to a cubic, quadratic, or other curvilinear relationship). This predictor was significantly and substantially related to SSK's fall mathematics achievement score, $F(1, 301{,}379) = 39{,}860.97$, $p < .001$. The correlation coefficient was .342, indicating that approximately 11.7% of the variance of SSK mathematics achievement could be accounted for by teacher ratings of SSK's approach to learning.

In order to determine the strength of the indirect or mediated effects—i.e, determine the extent to which the each direct effect was mediated by teachers' rating of

child's approach to learning—the product of alpha (α) and beta (ß) coefficient estimates for each independent variable (teacher characteristic) was computed (see Table 15). The variable that measured whether Spanish was used for instruction in the classroom was the only teacher characteristic that substantially predicted SSK's mathematics achievement in the fall; therefore, this was the only direct effect evaluated for mediation. However, this same teacher characteristic did not substantially predict variations in teacher rating of SSK's approach to learning and, therefore, the indirect (or mediated) effect is slight. Specifically, 8.9% of the direct effect of Spanish being used for instruction in the classroom on SSK mathematics achievement was mediated by teacher's rating of SSK's approach to learning (see Table 15).

Within SSK Group Differences

Next, the impacts of remarkable direct and indirect effects were analyzed by SES quintiles, mother's level of education, and English proficiency. That is, the direct effect of whether Spanish was used for instruction in the classroom on SSK's mathematics achievement as well as the indirect effect of teacher's rating of the child's approach to learning was analyzed by SES, mother's education level, and English proficiency. This was done by repeating the previously described series of linear regressions for each level of the five levels of SES, five levels of mother's education level, and two levels of English proficiency.

Descriptive Statistics

SES

Descriptive statistics of SSK's mathematics achievement and approach to learning teacher ratings by SES quintiles are found in Table 16. As shown, means and standard deviations of mathematics achievement increase from the lowest SES quintile to the highest. Means of approach to learning ratings by teachers across SES quintiles increase slightly from lowest to highest but do not substantially differ. Table 17 shows the frequency of Spanish use in classroom instruction by SES quintiles. As revealed, SSKs in the lowest SES quintile are the most likely to be in a classroom where Spanish is used for instruction (65.7%), while those in the highest SES quintile are the least likely to be in a classroom where Spanish is used for instruction (20.9%).

Mother's level of education

Descriptive statistics of SSK's mathematics achievement and approach to learning teacher ratings by mother's level of education are found in Table 18. As shown, means and standard deviations of mathematics achievement increase from the lowest level of mother's education to the highest. Means of approach to learning ratings by teachers across mother's education level increase slightly from lowest to highest but do not substantially differ. Table 19 shows the frequency of Spanish use in classroom instruction by mother's level of education. As shown, SSKs in the lowest level are the most likely to be in a classroom where Spanish is used for instruction (69.0%), while those in the highest level are the least likely to be in a classroom where Spanish is used for instruction (33.0%).

English proficiency

Descriptive statistics of SSK's mathematics achievement and approach to learning teacher ratings by English proficiency are found in Table 20. As shown, means and standard deviations are greater for English proficient than non-English proficient SSK. Means of approach to learning ratings by teachers did not substantially differ. Table 21 shows the percentage of SSK for whom Spanish was used for classroom instruction by levels of English proficiency. As shown, SSKs not proficient in English are more likely to be in a classroom where Spanish is used for instruction (69.8%) than those English proficient SSKs (33.2%).

Subgroup Direct and Indirect Effects

For each of the subgroups, the direct effect of Spanish-use in the classroom on mathematics achievement was evaluated first. Next, using the same method as described previously, the indirect effect of teacher rating of child's approach to learning was evaluated for each subgroup using a series of linear regression models. Results of direct and indirect effects subgroups by SES, mother's level of education, and English proficiency are found in Tables 22, 23, and 24, respectively.

SES

Regarding the direct effects of Spanish-use in the classroom on mathematics achievement by SES, it appears that SSK in higher SES quintiles experience a larger effect (see Table 22). That is, for SSK in the first SES quintile, the correlation coefficient was .078; for SSK in the second SES quintile, the correlation coefficient was .131; for SSK in the third SES quintile, the correlation coefficient was .212; for SSK in the fourth SES quintile, the correlation coefficient was also .212; and for SSK in the fifth

SES quintile, the correlation coefficient was .022. In other words, the size of the direct effect was largest for the third and fourth SES quintiles in which, for both subgroups, approximately 4.5% of the variance of mathematics achievement could be accounted for by the linear effect of Spanish-use for instruction in the classroom. The direct effect at the highest SES quintile may have been undermined by the small number of subjects (n = 59) in this cell as well as the lower percentage (20.88) of SSK in this subgroup who had access to Spanish instruction in the classroom.

In order to determine the extent to which direct effects were mediated by teachers' rating of child's approach to learning, alpha ( ) and beta (ß) coefficients were computed at each SES quintile (see Table 22). These were subsequently multiplied together to generate the estimate of the indirect effect (ß). Because the direct effect of Spanish-use in the classroom was negligible at the highest and lowest SES quintile, the size of the indirect effect for these subgroups was not interpretable and, therefore, not reported. However, slight mediated (or indirect effects) were found for the second and third SES quintile, and a substantial mediated effect was found for the fourth. That is, 8.0% of the direct effect (r = .131) of Spanish-use in the classroom on mathematics achievement was mediated by teacher's rating of SSK's approach to learning at the second SES quintile, 5.0% of the direct effect (r = .212) at the third SES quintile, and, most notably, 41.3% of the direct effect (r = .212) at the fourth SES quintile.

Mother's level of education

Regarding the direct effects of Spanish-use in the classroom on mathematics achievement by mother's level of education, it appears that SSK whose mothers have higher levels of educational attainment experience a larger effect (see Table 23). That is,

for SSKs whose mothers have an 8th grade education or less, the correlation coefficient was .112; for SSKs whose mothers have a 9th to 12th grade education, the correlation coefficient was .028; for SSKs whose mothers have completed high school, the correlation coefficient was .189; for SSKs whose mothers have some college or vocational/technical program, the correlation coefficient also was .226; and for SSKs whose mothers have a college degree (BA, MA, or Doctorate), the correlation coefficient was .183. In other words, the size of the direct effect was largest for SSKs whose mothers have completed high school or more. For SSKs whose mothers have completed but not gone beyond high school, approximately 3.6% of the variance of mathematics achievement could be accounted for by the linear effect of Spanish-use for instruction in the classroom. For those SSKs whose mothers have some college and/or a vocational/technical program, approximately 5.1% of the variance of mathematics achievement could be accounted for by the linear effect of Spanish-use for instruction in the classroom. And finally, for those SSKs whose mothers held a college degree (BA, MA, or Doctorate), approximately 3.4% of the variance of mathematics achievement could be accounted for by the linear effect of Spanish-use for instruction in the classroom.

In order to determine the extent to which direct effects were mediated by teachers' rating of child's approach to learning, alpha ( ) and beta (ß) coefficients were computed at each level of mother's education (see Table 23). These were subsequently multiplied together to generate the estimate of the indirect effect (ß). Because the direct effect of Spanish-use in the classroom was negligible at the 9th to 12th grade level, the size of the indirect effect for these subgroups was not interpretable and, therefore, not

reported. However, a slight mediated (or indirect effect) was found for SSKs whose mothers completed some college and/or vocational/technical program, and substantial mediated effects were found for SSKs whose mothers had an 8th grade education or less, completed high school, and held a college degree. That is, 4.0% of the direct effect (r = .226) of Spanish-use in the classroom on mathematics achievement was mediated by teacher's rating of SSK's approach to learning for SSKs whose mothers completed some college and/or vocational/technical program; 26.6% of the direct effect (r = .112) for SSKs whose mothers had an 8th grade education or less, 21.6% of the direct effect (r = .189) for SSKs whose mothers had completed high school, and a whopping 59.3% of the direct effect (r = .183) for those SSKs whose mothers held a college degree (BA, MA, or Doctorate).

English proficiency

Regarding the direct effects of Spanish-use in the classroom on mathematics achievement by English proficiency, it appears that English proficient SSKs experience a larger effect (see Table 24). That is, for English proficient SSKs, the correlation coefficient was .155 while it was .029 for those SSKs who did not demonstrate English proficiency. In terms of effect size, for English proficient SSKs, approximately 2.4% of the variance of mathematics achievement could be accounted for by the linear effect of Spanish-use for instruction in the classroom. For SSKs not proficient in English, on the other hand, no substantial variance of mathematics achievement could be accounted for by the linear effect of Spanish-use for instruction in the classroom (< 1%).

Because the direct effect of Spanish-use in the classroom was negligible for SSKs not proficient in English, the size of the indirect effect for these subgroups was not

interpretable and, therefore, not reported. For SSKs proficient in English, however, alpha ( ) and beta (ß) coefficients were computed to determine the extent to which this direct effect was mediated by teachers' rating of child's approach to learning (see Table 24). These were subsequently multiplied together to generate the estimate of the indirect effect (ß). No substantial indirect effect was found. That is, less than 1.0% of the direct effect (r = .155) of Spanish-use in the classroom on mathematics achievement was mediated by teacher's rating of SSK's approach to learning for SSKs who were proficient in English.

CHAPTER 5

DISCUSSION

Results from this study offer certain insights into the complex reality of disadvantage in the early education of the largest language minority population in the United States: Spanish-speaking youngsters. In addition, it suggests ways to improve—even if modestly—early academic outcomes for Spanish-speaking kindergartners (SSKs). Namely, it shows that teachers and classroom factors play a role in the variation of early mathematic achievement of SSK. In this final section I interpret research findings from this study, discuss how they apply to the improvement of practice and policy in early education, and offer brief recommendations for further research in this area. I conclude by discussing limitations to this study, and by summarizing key issues raised in this paper.

Interpreting Results

Preliminary Findings

Preliminary analyses (i.e., descriptive statistics and mean comparisons; Table 13) reveal stark differences between SSKs and their peers in terms of socioeconomic status and parents' self-reported education level. Specifically, there is an approximate difference of an entire pooled standard deviation between the two groups on measures of SES, mother's level of education, and father's level of education. This finding is quite informative because language minority students' social background has been shown to play a very powerful role in terms of early achievement (Paret, 2006). Thus, we would

expect the academic achievement (mathematics in this study) of SSKs to be lower than that of their peers. And it is—the mathematics achievement of SSKs during the fall semester of kindergarten was found to be approximately four-fifths of a pooled standard deviation lower than that of their peers. This standardized mathematics test was administered in Spanish to those SSKs who did not demonstrate proficiency in English, and was not linguistically loaded; therefore, this difference in achievement does not appear to be an artifact of language development, but rather appears to be genuine.

What does this mean to educators serving young Hispanic children learning English as a second language? For starters, it shows that achievement differences are present at the starting gate of kindergarten—there appear to be differences in school readiness. This is already a well-documented finding (Lee & Burkam, 2002; Rathbun et al., 2004; Reardon, 2003). Practitioners and policymakers, therefore, should not be surprised by low academic achievement of Spanish-speakers in early education or necessarily attribute them to programmatic characteristics. However, at the same time, it suggests that early intervention—even before kindergarten—is a critical and intuitive pursuit. As more emphasis is being placed on early intervention via pre-kindergarten programs (Gormley, Gayer, Phillips, & Dawson, 2005; Love et al., 2005), special attention should be given to increasing and sustaining academic outcomes of Hispanic children whose home language is Spanish. Empirical, multilevel strategies that leverage the cultural and linguistic context and abilities of ELL children need to be designed, tested, and implemented (Miller, 1995, pp. 369-372). Unfortunately, little is being done in this regard, which is at least partially due to the fact that the infrastructure to fund research and development of empirically designed and tested strategies (e.g., Success For

All model; Slavin, Madden, Karweit, Donald, & Wasik, 1992; Slavin & Madden, 2001) for subpopulations of education disadvantage is almost non-existent (Miller, 1995, pp. 340-342).

The next set of notable findings is the differences in teacher characteristics and ratings between teachers of SSKs and those in the general population (Table 13). First, teachers of SSKs are less likely than other teachers to perceive English proficiency as a requisite to school readiness—the difference between groups was .91 of a pooled standard deviation, a "large" difference by Cohen's (1988) description. Because we conceive teachers' perceptions of students' abilities to be important in terms of their academic engagement and achievement (Ferguson, 2003; Stuhlman & Pianta, 2001), it seems to be a positive thing that teachers of SSKs deem English proficiency as less important to school readiness. That is, a lack of English proficiency is not indicative of the absence or presence of the cognitive structure necessary to attend, encode, store, and retain information taught in kindergarten.

Second, teachers of SSKs have less experience teaching kindergarten than those of the comparison group. The average difference of experience teaching kindergarten between the two groups was 2.11 years (Table 13). This suggests that SSKs, compared to their peers, are more likely to be taught by a teacher who, on average, is less qualified in terms of pedagogical experience with kindergarteners. This is consistent with Crosnoe's (2005) broad-based analysis of ECLS-K data which found that children from Mexican immigrant families were overrepresented in schools with a wide variety of problematic characteristics, even after controlling for family backgrounds. Less teaching experience represents one of these problematic characteristics. Further research is

needed to evaluate factors that contribute to this phenomenon, and what might be done to ameliorate such differences. Indeed, if SSKs should be expected to improve academic outcomes, and sustain these outcomes over time, it is necessary that they be allotted equivalent opportunities to their peers; namely, they should have teachers with comparable qualifications. This will not likely occur unless teachers are offered some form of incentive.

Third, teachers of the focal sample, on average, rated SSKs as having weaker "approach to learning" strategies than those of the general population (Table 8; Table 13). The difference between the two groups was significant and the size of the difference was "small" by Cohen's (1988) standards (s.d. = .18). This difference may be explained in different ways. One hypothesis might be the teachers ratings are accurate and simply reflect the fact that SSKs simply score lower than their peers. However, this particular hypothesis is questionable given the weak bivariate correlation between teachers' rating of "approach to learning" and mathematics achievement (r = .342; Table 25). A stronger correlation would be expected if the teachers' rating of "approach to learning" was truly a reflection of SSKs' lower academic performance. A second hypothesis is that this difference is indicative of lower teacher expectations which subsequently impact achievement. This study showed that teachers' "approach to learning" ratings slightly mediate the impact of certain teacher characteristics on SSKs' math achievement scores; it does not provide insight into the process by which this occurs. If teachers do have lower academic achievement expectations for SSKs than for the general body of kindergarteners, it will be important to determine why this occurs as well as how the process of learning is affected.

Finally, the non-parametric test offers insight on the number and percentage of SSKs who receive at least some instruction in their native language compared to their peers. According to data in Table 14, SSKs were significantly more likely than their peers to be in a class in which Spanish was used during instruction. Specifically, 55.3% of SSKs and 7.2% of the comparison group were in a class that used at least some Spanish during instruction. While the general difference between groups is not surprising—one would expect and hope to see this distinction—the prevalence of Spanish-use in classroom instruction for SSKs is arguably low. That is, in broad terms, roughly half of children who speak Spanish as their first language are not receiving any native language instruction in kindergarten. Thus, many SSKs begin their formal schooling years not understanding the teacher, information, or instruction offered in the classroom. Since these data were collected in 1998, legislation in California, Arizona, and Massachusetts has explicitly limited the incorporation of non-English language instruction (Weise & García, In press). Therefore, it is likely that the percentage of SSKs not receiving any instruction in their native language has increased. Available research suggests that English-only legislation stunts the academic achievement of English Language Learners (ELLs; Rolstad, Mahoney, & Glass, 2005) and that ELLs perform best in early education when their native language is integrated into course curriculum and instruction.

The Theoretical Model

As shown in Figure 1, the theoretical model was tested in two phases. First, a series of multiple linear and linear regressions were conducted to evaluate the direct effects of teacher characteristics on SSKs' mathematics achievement. Indirect effects

were evaluated in the second phase to determine the extent to which the direct effects were mediated by teachers' overall rating of child's "approach to learning". These mediation effects were assessed using a series of linear regression equations in an analytic method prescribed by MacKinnon (2000). Parameter coefficients and effect sizes of direct and indirect effects are summarized in Table 15. In terms of direct effects, the only remarkable effect found was the impact of Spanish inclusion in the classroom—over 4% of SSKs' variations in fall mathematics achievement scores were accounted for by whether Spanish was used in classroom instruction. Amount of kindergarten teaching experience and teachers' rating of importance of English proficiency to school readiness did not account for remarkable variance in SSKs' fall mathematics achievement score over and above Spanish-use in classroom instruction.

Several points are made to contextualize findings associated with direct effects. First, analyses in this study only involved mathematics performance in the few first months of kindergarten. Longitudinal analyses are necessary to determine the extent to which the impact of Spanish inclusion in classroom instruction continues to influence achievement patterns beyond this time. It also would be important to assess whether teacher characteristics such as those explored in this study affect and/or interact with other markers of teacher quality to predict achievement patterns of SSKs and of young children educationally at-risk.

Second, previous studies have shown that the vast majority of the variation in achievement scores during the fall semester of kindergarten are due to out-of-school processes (Coley, 2002; Lee & Burkam, 2002; Reardon, 2003), including whether the child was enrolled in some type of preschool program (García, Jensen, Miller, & Huerta,

2005). Thus, it would be valuable to assess ways in which and the extent to which teacher characteristics interact with out-of-school processes—e.g., literacy practices in the home, parent-child interactions, involvement in educational activities in the community—to influence variations in early achievement.

Third, analyses in this study remind us of the well-documented reality that specific attributes of teacher quality, and the influence they bear on student outcomes, are difficult to measure. Past studies finding the role of teacher quality to impact substantially student achievement patterns operationalized "teacher quality" in a broad-based manner. That is, Hanushek, Kain, & Rivkin (1998) measured teacher quality by creating a statistical composite, which disentangled "school impact" variables from "teacher and classroom specific" measures. They did this by controlling for student characteristics, curriculum, class size, and measurement error in order to create a pure teacher effect. While this sociological study demonstrated that at least 7.5% of student achievement could be accounted for by "teacher quality", it does not shed light on specific teacher or classroom characteristics that comprise this factor. In terms of inductive, a priori, and inferential models, identifying specific teacher characteristics and finding significant and substantial effects can prove challenging, especially considering that less than 10% of the variation in student academic performance is accounted for by overall teacher quality. Nonetheless, if research is to translate into enlightened policy and practice, it is necessary, among several other domains, to continue investigating specific teacher attributes—e.g., level and quality of professional training, years of teaching experience, expectations of student, perceptions of student effectiveness, instructional practices, outreach to and inclusion of parents—that bear on academic

outcomes and interact with out-of-school and school variables throughout the schooling process.

Fourth, the substantial direct effect of Spanish-use in the classroom has several implications for research, policy, and practice. In terms of research, this finding calls our conception of the "starting gate" of kindergarten into question. That is, several studies analyzing data from the ECLS-K study (Coley, 2002; Denton-Flanagan & Reaney, 2004; Lee & Burkam, 2002; Rathbun et al., 2004; Reardon, 2003; Rumberger & Arellano-Anguiano, 2004; West, Denton, & Reaney, 2001) used direct assessment measures in reading and mathematics in the fall of kindergarten to assess school readiness—differences in achievement at the beginning of kindergarten. Within this approach lies the embedded assumption that differences in achievement scores at the "starting gate" are due to processes external to the school—e.g., poverty, participation in a preschool program, educational practices in the home. However, analyses presented in this study suggest that this is not the case entirely. Namely, this paper demonstrates that academic achievement differences found during the fall semester of kindergarten are at least partially attributable to variations in teacher quality. This finding is probably related to the fact that mathematics assessments during the fall semester of kindergarten were administered between September and December of the kindergarten year, with more than four-fifths of kindergartners in the entire sample took the test during either October or November (NCES, 2001). Studies that operationalize fall achievement scores as measures of school readiness, therefore, should control the actual assessment dates in order to discount the influence of school process on achievement. Some researchers have done this (e.g., Reardon, 2003).

In this study it was found that over 4% of SSKs variations in mathematics achievement was accounted for by whether the Spanish language was used (at least minimally) as a medium of instruction in the classroom. In other words, Spanish-use in the classroom was significantly associated with higher scores in mathematics achievement. While 4% of the overall variability in mathematics achievement may seem inconsequential, when taken in the context of research by Hanushek et al. (1998), it is a significant and meaningful finding. Considering the size of the estimate of the impact overall teacher quality on student achievement (7.5%), it is extraordinary that one variable of teacher quality—Spanish-use in the classroom—could account for over 4% of achievement variation alone. Beyond the relative size of the effect, the immediacy of the effect of Spanish-use, making an impact on math achievement within 1-3 months, is also extraordinary.

This finding has several implications for research, policy, and practice. Namely, it suggests that SSKs benefit cognitively from native language inclusion in early education. Moreover, states that prohibit, limit, or do not facilitate dual or non-English language instruction in the early education (PK-3) classrooms of ELLs should be wary that they are meeting the academic needs of their children. It is suggested, therefore, that more early educators develop proficiency in the native language of the students and families they serve. As a part of the endorsement to teach ELLs, policy-makers should include a requirement associated with proficiency in a non-English language (the native language of the student population whom teachers will serve). Early education teachers-in-training should be provided plenty of opportunities and incentives to develop the linguistic skills necessary to communicate with parents, interact with children, and,

where needed, provide native language instruction to ELLs. Further research is needed to determine how much non-English language development is needed for early educators, the best ways to develop this proficiency, and the extent to which this training translates into improved pedagogical practices and achievement scores for their students.

The latter phase of analysis of the theoretical model tested the extent to which the direct effect of Spanish-use in the classroom on mathematics achievement was mediated by the teacher rating of the child's "approach to learning". Following the analytical approach put forward by MacKinnon (2000) a slight mediation effect was found. That is, nearly 9% of the direct effect was mediated by teachers' perspectives of the child's approach to learning. This suggests that psychological processes within the teacher-child relationship are at work at the beginning of the kindergarten year and may affect academic achievement. In this study, Spanish-use in the classroom was associated with higher teacher ratings of children's approach to learning and higher mathematics achievement scores. Further research should investigate how teachers' conceptions of child's approaches to learning are developed, why they vary, and ways in which they are perceived, understood, and internalized by children. In addition, it also is important to assess how such perceptions held by teachers translate into student academic achievement.

Within SSK Group Differences

Next, descriptive statistics and direct and indirect effects found to be meaningful in the omnibus model were analyzed by SES quintiles, mother's level of education, and English proficiency. The direct effect of whether Spanish was used for instruction in the

classroom on SSK's mathematics achievement as well as the indirect effect of teacher's rating of the child's approach to learning was analyzed by SES, mother's education level, and English proficiency. This was done by repeating the previously described series of linear regressions for each level of the five levels of SES, five levels of mother's education level, and two levels of English proficiency.

Becker's (1994) theory of human capital is a useful way to discuss within group differences by SES, mother's education level, and English proficiency. Numerous definitions are offered to explain the concept of human capital; in the context of this discussion, human capital is characterized by unique capabilities and expertise of individuals that are productive in an economic context. In the U.S. economy, educational attainment and English proficiency are highly valued and, thus, very powerful indicators of human capital (Becker, 1994). Moreover, English proficiency and educational attainment are strongly associated with socioeconomic status, as demonstrated in this study (see Table 25). Individuals with low levels of human capital tend to earn less annual income and confront the social challenges and risks that accompany poverty. Moreover, because individuals and the general public benefit from the general increase of human capital, the quality of public education is crucial. Indeed, Becker (1994) explains that public education ought to serve as an equalizer, leveraging economic and social opportunities for the poor. Robust and strategic educational programs can serve this purpose. In fact, Heckman & Masterov (2004) show that early education programs can produce large relative and cost-effective academic outcomes for children from disadvantaged backgrounds, thereby increasing human capital potential. Our notion of human capital, therefore, should be fluid, guiding research and policy in

ways to improve opportunities for economically disadvantaged groups. In this study, SSKs at the lowest SES quintile, whose mothers had little formal education, and who have not yet developed proficiency in English are considered to be the most economically disadvantaged, to live in homes with lower levels of human capital.

Descriptive Differences

Descriptive differences in SSKs' mathematics achievement, teachers' rating of children's "approach to learning", and frequency of Spanish-use in the classroom by human capital indicators (i.e., SES, mother's level of education, and English proficiency) are shown in Tables 16-21. Particular trends were found by comparing means, standard deviations, and frequency distributions. First, not surprisingly, SSK with lower levels of human capital scored lower in mathematics than those with higher levels in the fall of kindergarten. Interestingly, the variance of mathematics performance was greater for SSKs in higher human capital brackets. For example, the group of SSKs with the most amount of human capital had a greater amount of variation in their mathematics score than those with the least amount. This suggests that, in terms of mathematics achievement, not all SSKs benefit the same from higher amounts of human capital.

Second, SSKs with higher levels of human capital were rated by teachers as possessing slightly better "approach to learning" strategies. It is not clear whether higher ratings were actually associated with higher student achievement.

Finally, descriptive statistics interpreted in the context of human capital distinctions suggest that SSKs with lower levels of human capital are more likely to receive Spanish instruction in class while SSKs with greater human capital are less likely to receive Spanish instruction in the classroom—an interesting finding given that SSKs

with higher levels of human capital are more likely, in terms of mathematics achievement, to benefit from Spanish inclusion (see below).

Direct and Indirect Effects by Subgroups

The extent to which the strength of direct and indirect effects fluctuated by levels of human capital also was assessed. More specifically, the direct effect of Spanish-use in the classroom on mathematics achievement and the mediating effect of teacher rating of child's approach to learning were evaluated by levels of SES, mother's level of education, and English proficiency, found in Tables 22, 23, and 24, respectively. A summary of these findings—including sizes of direct and indirect effects—is provided in Table 26.

Several trends emerged when direct and indirect effects across human capital indicators were examined. First, there are substantial differences in the sizes of indirect and direct effects by levels of SES, mother's education, and English proficiency. This suggests human capital potential plays a role in the strength of the impact of Spanish-use in the classroom on SSKs fall mathematics achievement, and the extent to which teachers' view of the child's approach to learning mediates this impact.

Second, in terms of math achievement, there is evidence to suggest that SSKs with access to higher levels of human capital benefit more from Spanish inclusion than those with lower levels. Namely, for SSKs in the lowest SES quintile, less than 1% of the variation in SSKs math achievement was accounted for by Spanish-use in the classroom; for SSKs in the third and fourth SES quintile, 4.5% was accounted for by Spanish-use—the negligible direct effect (i.e., <1%) at the highest SES quintile may be due to the small sample size of SSKs within this cell (i.e., $n = 59$). Differences in this

direct effect across human capital indicators could be associated with school readiness, where SSK from lower human capital levels necessitate more time to benefit from Spanish inclusion. Longitudinal analyses would be helpful to assess this hypothesis.

Third, while differences in the size of indirect effects varied by levels of human capital indicators, there does not appear to be a linear trend. In this analysis, differences in indirect effects—i.e., the extent to which teachers' rating of approach to learning mediates the impact of Spanish-use in the classroom on mathematics achievement—do not appear to be linearly related with levels of human capital. Further analyses are needed to understand the nature and direction of the relationship between academic achievement, teacher characteristics (e.g., native language instruction, expectations, perspectives), and levels of human capital for young language-minority children.

However, data from this study found that interventions targeted at at-risk populations may be disproportionately beneficial. That is, they might prove more advantageous for some groups and less for others. In this study it was found that SSKs in lower strata of SES, parent education, and English proficiency were less likely to benefit from Spanish-use in the classroom in terms of mathematics achievement after a short period of school. Conversely, those who demonstrated English proficiency and came from middle and upper-middle class homes in which parents had at least some college education appear to benefit much more from the inclusion of Spanish in instruction. This is problematic because the majority of SSKs is not proficient in English (59.8% of SSK population not proficient, Table 11) and come from poor homes (56.6% of SSK population in lowest SES quintile, Table 10) in which parents have little formal education (48.4% less than a high school education, Table 9). Of course, these findings

must be considered in the context of this study. Several limitations are introduced by the database as well as the statistical design employed in this study. For example, as previously mentioned, the finding that SSKs from lower human capital levels do not benefit, in terms of math achievement, from Spanish inclusion may be associated with school readiness. Longitudinal analyses would be helpful in this regard, to assess the impact of Spanish inclusion in the classroom on academic achievement over time.

Limitations

In this section I discuss limitations to this study—these imply the need for additional inquiry vis-à-vis mixed method (i.e., qualitative and quantitative designs) data collection, coalition, and analysis. First I discuss limitations to the statistical approach selected to assess the conceptual model (Figure 1): bivariate and multivariate linear regression models. Second, I discuss limitations inherent in the measures used. Finally, I discuss the investigative short-comings inherent in the research design.

Due to the complex nature of the relationships between direct, indirect, and outcome variables in this study, a structural equation model may have been preferable to analyze the directional effects among them. Specifically, a path analysis would have been useful to assess the fit of the mediation model (see Figure 1). Path analysis is a structural analytic method that can assess the simultaneous impacts of direct effects (i.e., paths), indirect effects (i.e., meditation effects), spurious associations, and disturbances (Kline, 2005, pp. 66-69). Moreover, this method allows conceptually-driven models to be tested and compared to others in order to find which best explains co-variances among variables—this is often referred to as "goodness of fit" (Kline, 2005). In contrast,

a series of linear regression equations is less able to assess goodness of fit and comparisons among similar models.

Concerns related to measurement also could have imposed certain limitations to this study. More specifically, the strength of the mediation (or indirect) effects may have been hampered by the low variation in the approach to learning measure. This variable was a scale score, composed of 5 items (see Table 8) from a questionnaire on which teachers rated students' behaviors on a Likert scale from 1 (never) to 4 (very often). Most teachers rated children with scores of 3, with little variability within or between groups (see Table 13). Thus, the finding that indirect effects were mostly small, unremarkable, and/or non-existent may have been related to the minimal variation in the approach to learning measure. Subsequent studies which analyze the mediating effects of teachers' views of child's ability, behavior, or approach to learning should incorporate scales that have greater and more normally distributed variability.

Measures associated with language in this study also presented certain limitations. First, the variable concerning Spanish inclusion in the classroom was very simplistic. The question posed to teachers stated, "What languages are used for instruction in your class(es)?, and provided "Spanish" in the list of options. Hence, the only information related to native language inclusion in the classroom was whether or not Spanish was used. We do not know, for example, how much Spanish was used in proportion to English, in which contexts it was used, for which academic areas, or the extent to which children were allowed and encouraged to respond in Spanish. These are only a few aspects in need of additional investigation in order to understand more thoroughly the role of Spanish and native language inclusion in early education.

Another element of language the ECLS-K does not report on is the oral Spanish proficiency of all Spanish speakers. Oral Spanish proficiency was only tested on those Spanish speakers who did not pass the English oral proficiency exam; Spanish proficiency was not tested for those Spanish speakers who demonstrated English proficiency. This is unfortunate because a lack of data related to the oral bilingual proficiency for all Spanish speaking children prevents analyses involving the intersection of cognitive and linguistic attributes between languages and cross-language transfer of cognitive skills (Slavin & Cheung, 2005). It also would be useful to have more information related to the level of bilingual language proficiency of the parents, as well as the amount and quality of linguistic interactions with their young children. Further research examining the interplay of Spanish and English as well as the role of parent-child interactions should implement thorough, mixed method designs. These will prove most useful to the accurate assessment of dual-language ability, and will help to form viable approaches to enhancing linguistic and cognitive outcomes that integrate parents.

This study focused primarily on outcomes of SSK, and only minimally alluded to process. It is critical to understand academic achievement differences between groups (e.g., mathematics achievement disparities between SSK and their peers). However, it is just as imperative to evaluate the contextual process that contribute to, minimize, and/or exacerbate such differences. For example, it is not enough for us to know that Spanish-use in the classroom partially sustains early mathematics achievement of SSK—we need more data and analysis on process. What is it about native language inclusion that nourishes early academic success? Is the process social, emotional, cognitive, or linguistic in nature? Or is it a combination of each? Indeed, further research and mixed

method designs are needed to thoroughly understand process, not just the prevalence of differences. These data will be especially important and enlightening to policy and practice in early education.

Summary and Concluding Comments

Results from this study offer certain insights into the complex reality of disadvantage in early education of the largest language minority population in the United States: Spanish-speaking youngsters. Stark differences in mathematics achievement between SSK and the general kindergarten population at the beginning of formal schooling are documented in this study. Analyses show that the role of teachers during kindergarten can significantly contribute to and/or diminish such differences in achievement. Namely, results suggest that the inclusion of Spanish in instruction can serve to augment—even if modestly—the mathematics achievement of SSK. Moreover, analyses in this paper show some evidence that the effect of Spanish-use in classroom instruction is partially mediated by the teacher's view of the child's approach to learning; and that the strength of the effects of Spanish inclusion and teacher's perceptions on mathematics achievement vary by indicators of human capital, i.e., SES. mother's level of education, English proficiency. That is, SSK from higher SES strata, whose mother's have a higher level of educational attainment, and who speak English proficiently appear to be more likely to benefit from the use of Spanish in class, in terms of math achievement during the fall semester of kindergarten—this may be due to the fact that SSKs from lower human capital levels are less ready for school and, therefore, necessitate more time to demonstrate an effect. Teacher perceptions, on the other hand,

do not appear to be linearly related to human capital levels. Further analyses are needed to assess in greater detail the interacting effects of teacher characteristics, children's human capital potential, and academic outcomes; and future studies also will need to consider how these concepts relate and shift longitudinally, over time.

Teachers of SSK and those of the general population demonstrate different qualifications. In this study, it was found that teachers of SSK, on the whole, are more responsive to the particular linguistic needs of their students. However, these same teachers have less experience teaching kindergarten and, therefore, may be less qualified on the whole. Further research is needed to investigate the impact of teacher characteristics on the educational well-being of SSK, and other educationally at-risk groups. This work should inform and be done in conjunction with efforts to improve the quality and training of early educators. It also is recommended that policies be developed to offer incentives to qualified teachers who work in low-performing, at-risk schools.

Furthermore, educational research and school reform initiatives cannot disregard the role of parents and the home. In the context of early education, academic achievement differences by SES and parent education level are largely attributable to educational practices outside of school—in the home and/or other child-care settings outside of school. Moreover, the inclusion of parents and the home educational environment into the equation necessitates validating familial strengths as well as their shortcomings. Indeed, Hispanic immigrant families "come to America with many strengths, including healthy, intact families, strong work ethic and aspirations, and for many, a cohesive community of fellow immigrants from the same country of origin"

(Shields & Behrman, 2004). Children of immigrant families are more likely than children of U.S-born parents to live in a two parent household, have lower infant mortality rates, are reported to experience fewer health problems, and are less likely to engage in risky behaviors such as substance abuse, early sexual intercourse, and delinquent or violent activity (Fix, Zimmerman & Passel, 2001; Shields & Behrman, 2004). The key is to find strategic ways for schools and teachers to integrate Spanish-speaking, Hispanic immigrant families—leveraging their strengths in order to generate positive educational outcomes in early education. We must continue to include concepts of parent involvement and cultural responsiveness in our ongoing efforts to improve schooling and, therefore, leverage the human capital potential for Spanish-speaking kindergartners and other at-risk populations. In this view, it is critical that educational research assess the complex role of processes outside the school, the multi-level nature of schools themselves, and ways in which these intersect to generate child outcomes. Moreover, our focus on leveraging the human capital potential for disadvantaged groups should not obfuscate the importance of cultural capital. Further theoretical work is needed to understand the intersection between these two capitals in diverse economies and cultures.

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Table 1

European, Hispanic , and Asian Immigrants with U.S. Total and Foreign-Born Population: 1970-2003 (in thousands)

			U.S. Foreign-Born Populations*		
Year	U.S. Total	U.S. Foreign-Born	Hispanics	Asians	Europeans
2003	290,809	33,500 **(11.7%)**	17,856 **(53.3%)**	8,375 (25.0%)	4,590 (13.7)
2000	281,421	28,379 **(10.1%)**	14,477 **(51.0%)**	7,246 (25.5%)	4,255 (15.3%)
1990	248,791	19,767 **(7.9%)**	8,407 **(42.5%)**	4,979 (25.1%)	4,350 (22.0%)
1980	226,546	14,079 **(6.2%)**	4,372 **(31.0%)**	2,539 (18.0%)	5,149 (36.6%)
1970	203,210	9,619 **(4.7%)**	1,803 **(18.7%)**	2,489 (25.9%)	5,740 (59.6%)

* Percentages of the U.S. total foreign-born population

Sources: Gibson, C., & Lennon, E. (1999). *Historical Census Statistics on the Foreign-born Population of the United States*. U.S. Census Bureau, Population Division, Washington, D.C.: U.S. Government Printing Office; Larsen, L. (2004). *The foreign-born population in the United States: 2003*. Current Population Reports, P20-551, U.S. Census Bureau, Washington, D.C.: U.S. Government Printing Office; U.S. Census Bureau (2000). *Current Population Survey*: *Statistical Abstract of the United States, 2000*. Ethnic and Hispanic Statistics Branch, Population Division, U.S. Census Bureau, Washington D.C.: U.S. Government

Table 2

Population dispersal by age, Hispanic origin, and race, March 2002 (in thousands)

	Total		Race			
			Hispanic		Non-Hispanic, White	
Age	Number	Percent	Number	Percent	Number	Percent
Total	282,082	100.0	37,438	100.0	194,822	100.0
Under 5 years	19,428	6.9	3,841	**10.3**	11,560	**5.9**
5 to 9 years	20,026	7.1	3,766	**10.1**	11,964	**6.1**

Source: U.S. Census Bureau (2003). *The Hispanic Population in the United States: March 2002Detailed Tables* (PPL-165). U.S. Dept. of Commerce, Economics and Statistics Administration, Bureau of the Census.

Table 3

Immigrant and Native Children Enrolled in K-12 Schooling in US: 1970-2000 (in thousands)

Year	K-12 Enrollment				Percentage of Immigrant Enrollment in Total K-12 Population
	Children of Immigrants*		Children of Native Parents	Total K-12 Enrollment	
	Foreign-born (1st generation)	U.S.-Born (2nd generation)			
1970	770 (24.8%)	2,334 (75.2%)	45,676	48,780	**6.4%**
1980	1,506 (32.2%)	3,169 (67.8%)	41,621	46,296	**10.1%**
1990	1,817 (31.6%)	3,926 (68.4%)	35,523	41,266	**13.9%**
1995	2,307 (29.2%)	5,590 (70.8%)	41,451	49,348	**16.0%**
2000	2,700 (25.7%)	7,800 (74.3%)	44,200	54,700	**20.1%**

*Percentages of total children of immigrant population

Sources: Fix, M., & Passel, J. (2003). *U.S. immigration: Trends and implications for schools*. Washington DC, The Urban Institute.;Van Hook, J., & Fix, M. (2000). A Profile of the Immigrant Student Population. In J. R. DeVelasco, M. Fix and T. Clewell (Eds.), *Overlooked and underserved: Immigrant children in U.S. secondary schools.* Washington D.C.: The Urban Institute Press.

Table 4

Percent of children in immigrant families by region of origin, 2000

Region	Year	
	1910	2000
Europe	87%	12%
North America	10%	2%
Latin America	**2%**	**62%**
Asia	1%	22%
Africa	>1%	2%
Oceania	>1%	1%

Source: Hernandez, Donald J. (2004). *Demographic change and the life circumstances of immigrant families*. Foundation for Child Development. University of Albany, SUNY.; U.S. Census Bureau (2000). *Current population survey, Public Use Microdata sample (PUMS) files*. U.S. Census Bureau, Washington D.C.: U.S. Government

Table 5

Tauber's (1998) Five-Step Model: How Self-Fulfilling Prophecy Develops in School

1.	The teacher forms expectations.
2.	Based upon these expectations, the teacher acts in a differential manner.
3.	The teacher's treatment tells each student (loud and clear) what behavior and what achievement the teacher expects.
4.	If this treatment is consistent, it will tend to shape the student's behavior and achievement.
5.	With time, the student's behavior and achievement will conform more and more closely to that expected of him or her.

Table 6

ECLS-K Variables Used in Analyses.

Variable Name	Variable Description	Variable Source	Variable Type
C1SPHOME	child speaks Spanish in home	fall direct assessment	dichotomous (Yes/No)
P1LANGS1	child speaks Spanish in the home	fall parent interview	dichotomous (Yes/No)
P1FIRKDG	first-time kindergartners	fall parent interview	dichotomous (Yes/No)
T1_ID	fall teacher identification number	n/a	string
T2_ID	spring teacher identification number	n/a	string
WKSESQ5	socioeconomic status	parent composite	ordinal
WKMOMED	mother's educational level	Parent composite	ordinal
WKDADED	father's educational level	Parent composite	ordinal
A2CSPNH	Spanish used for instruction	spring teacher questionnaire A	dichotomous (Yes/No)
B1ENGLAN	importance that child knows English	fall teacher questionnaire B	ordinal
B1YRSKIN	years taught kindergarten	fall teacher questionnaire B	continuous
T1LEARN	teacher rating of child's "approach to learning"	fall teacher questionnaire SRS	ordinal
C1MSCALE	IRT mathematics achievement score	fall direct assessment	continuous
C1SCTOT	Total OLDS score	fall direct assessment	continuous

Table 7

Missing data for SES variables

Variable	Number Missing	Percent
Mother's Education	414	2.1%
Father's Education	756	3.8%
Mother's Occupation	2256	11.3%
Father's Occupation	2252	11.3%
Household Income	5630	28.2%

Table 8

Items from the "approach to learning" subscale of the teacher Social Rating Scale (SRS).

Item number	Item
14	Shows eagerness to learn new things
15	Works independently
21	Easily adapts to changes in routine
23	Persists in completing tasks
24	Pays attention well

Table 9

Mother's Education Level of Spanish-Speaking Kindergartners

Previous Level Code	Previous Level Label	*n* (% of sample)	Revised Level Code	Revised Level Label	*n* (% of sample)
1	8th grade or below	363 (30.6%)	1	8th grade or below	363 (30.6%)
2	9th to 12th grade	211 (17.8%)	2	9th to 12th grade	211 (17.8%)
3	High School Completion	309 (26.1%)	3	High School Completion	309 (26.1%)
4	Voc/Tech Program	62 (5.2%)	4	Some College or Voc/Tech program	207 (17.5%)
5	Some College	145 (12.2%)	4	Some College or Voc/Tech program	207 (17.5%)
6	Bachelor's Degree	56 (4.7%)	5	College Degree (BA, MA, Doctorate)	83 (7.0%)
7	Some Grad/Professional School	9 (.8%)	5	College Degree (BA, MA, Doctorate)	83 (7.0%)
8	Master's Degree	11 (.9%)	5	College Degree (BA, MA, Doctorate)	83 (7.0%)
9	Doctorate Degree	7 (.6%)	5	College Degree (BA, MA, Doctorate)	83 (7.0%)

Table 10

SES of Spanish-Speaking Kindergartners

SES Quintile	*n*	% of SSK sample
Lowest	671	56.6
Second	223	18.8
Third	131	11.1
Fourth	101	8.5
Highest	59	5.0

Table 11

English Proficiency of Spanish-Speaking Kindergartners

English Proficiency	*n*	% of SSK sample
Proficient	472	39.8
Not Proficient	709	59.8
Data Missing	4	.4

Table 12

Correlations among Teacher Characteristic Variables: Spanish Used in Instruction, Importance Child Knows English entering Kindergarten, and Years Taught Kindergarten

	Spanish Used in Instruction	Importance Child Knows English entering Kindergarten	Years Taught Kindergarten
Spanish Used in Instruction	1		
Importance Child Knows English entering Kindergarten	.382*	1	
Years Taught Kindergarten	.143*	.075*	1

* Correlation is significant at the 0.01 level (2-tailed).

Table 13

Descriptive Statistics and Independent Samples Comparisons of Mean Values

Variable	Group	Mean	S.D.	Pooled S.D.	Mcg-M_{ssk}	*d*
Categorical SES measure (quintiles)	Comparison group	3.20	1.36			
	SSK	1.80	1.15	1.40	1.40*	1.00
Mother's level of education	Comparison group	4.42	1.69			
	SSK	2.70	1.66	1.76	1.72*	0.98
Father's level of education	Comparison group	4.57	1.92			
	SSK	2.65	1.79	1.99	1.92*	0.96
Importance child knows English entering kindergarten	Comparison group	3.50	0.96			
	SSK	2.58	1.1	1.01	0.92*	0.91
Years teacher has taught kindergarten	Comparison group	9.27	7.85			
	SSK	7.16	6.98	7.80	2.11*	0.27
Teacher rating of child's "approach to learning" – spring	Comparison group	3.01	0.67			
	SSK	2.89	0.65	0.67	0.12*	0.18
Mathematics IRT score – spring	Comparison group	19.98	7.26			
	SSK	14.26	5.19	7.28	5.72*	0.79

* $p < .001$

Table 14

Non-Parametric Comparison of Whether Spanish is Used for Instruction in the Classroom

	% Yes	% No	% Missing
Total	11.3	83.7	4.9
Comparison Group	7.2	88.0	4.8
SSK	55.3	38.2	6.5

Table 15

Parameter Coefficients and Effect Sizes of Direct and Indirect Effects

	Parameter	Standardized Coefficient	r^2*
Direct effects	**τ_1 Sp in class/math**	**.203**	**.041**
	τ_2 Imp English/math	.056	.003
	τ_3 Yrs taught/math	.026	.001
	α_1 Sp in class/appr	.052	.003
	α_2 Imp English/appr	-.006	.000
	α_3 Yrs taught/appr	-.050	.002
	β appr/math	**.342**	**.117**
Indirect (mediated) effects	**$\alpha_1\beta$ Sp in class**	**.018**	**.089**
	$\alpha_2\beta$ Imp English	-.002	n/a
	$\alpha_3\beta$ Yrs taught	-.017	n/a

*n/a (or not applicable) means the direct effect was negligible causing the indirect effect to be uninterruptible.

Table 16

Descriptive Statistics of SSK's Mathematics and Approach to Learning Scores by SES

Mathematics					
SES Quintile	*n*	Minimum	Maximum	Mean	Std. Deviation
1	671	6.97	42.16	13.18	4.56
2	223	7.53	31.78	14.17	4.60
3	131	7.19	35.84	15.79	5.06
4	101	7.98	38.20	18.05	6.83
5	59	8.37	43.32	19.01	6.18
Approach to Learning					
SES Quintile	*n*	Minimum	Maximum	Mean	Std. Deviation
1	671	1.17	4.00	2.85	0.66
2	223	1.33	4.00	2.91	0.62
3	131	1.00	4.00	2.91	0.67
4	101	1.50	4.00	2.95	0.67
5	59	1.50	4.00	3.09	0.49

Table 17

Frequency of Spanish-use in Classroom Instruction by SES

	Spanish used in the Classroom		
SES Quintile	% Yes	% No	% Missing Data
1	65.67	27.32	7.01
2	48.27	44.34	7.38
3	42.90	52.58	4.52
4	29.46	65.82	4.72
5	20.88	77.15	1.97

Table 18

Descriptive Statistics of SSK's Mathematics and Approach to Learning Scores by Mother Education Level

Mathematics	*n*	Minimum	Maximum	Mean	Std. Deviation
Mother Education Level					
8th grade or below	363	6.97	35.82	13.05	4.41
9th to 12th grade	211	7.51	31.60	13.07	4.44
High School Completion	309	7.19	42.16	14.37	5.09
Some College or Voc/Tech program	207	8.05	43.32	16.23	5.55
College Degree (BA, MA, Doctorate)	83	7.85	38.20	17.99	6.70
Approach to Learning					
Mother Education Level					
8th grade or below	363	1.33	4.00	2.88	0.66
9th to 12th grade	211	1.17	4.00	2.80	0.66
High School Completion	309	1.17	4.00	2.89	0.65
Some College or Voc/Tech program	207	1.00	4.00	2.95	0.59
College Degree (BA, MA, Doctorate)	83	1.20	4.00	2.97	0.69

Table 19

Frequency of Spanish-use in Classroom Instruction by Mother Level of Education

	Spanish used in the Classroom		
Mother Education Level	% Yes	% No	% Missing Data
8th grade or below	69.03	23.43	7.53
9th to 12th grade	55.09	39.42	5.49
High School Completion	56.30	36.65	7.05
Some College or Voc/Tech program	38.01	57.12	4.88
College Degree (BA, MA, Doctorate)	33.04	64.62	2.34

Table 20

Descriptive Statistics of SSK's Mathematics and Approach to Learning Scores by English Proficiency

Mathematics					
English Proficiency	*n*	Minimum	Maximum	Mean	Std. Deviation
Not Proficient	709	6.97	35.84	13.00	4.27
English Proficient	472	7.52	43.32	16.25	5.82
Approach to Learning					
English Proficiency	*n*	Minimum	Maximum	Mean	Std. Deviation
Not Proficient	709	1.20	4.00	2.86	.65
Proficient	472	1.00	4.00	2.93	.63

Table 21

Percentage of Students for Whom Spanish is Used for Instruction, by English Proficiency

	Spanish used in the Classroom		
English Proficiency	% Yes	% No	% Missing Data
Not Proficient	69.8	22.6	7.5
Proficient	33.2	62.0	4.8

Table 22

Parameter Coefficients and Effect Sizes of Direct and Indirect Effects by SES

	SES Quintile	Parameter	Standardized Coefficient	r^2*
Direct effects	Lowest	τ Sp in class/math	.078	.006
		α Sp in class/appr	.046	.002
		β appr/math	.357	.127
	Second	τ Sp in class/math	.131	.017
		α Sp in class/appr	.026	.001
		β appr/math	.403	.162
	Third	τ Sp in class/math	.212	.045
		α Sp in class/appr	.076	.006
		β appr/math	.125	.016
	Fourth	τ Sp in class/math	.212	.045
		α Sp in class/appr	.190	.036
		β appr/math	.461	.212
	Highest	τ Sp in class/math	.022	.001
		α Sp in class/appr	.132	.018
		β appr/math	.172	.030
Indirect (mediated) effects	Lowest	$\alpha\beta$	.016	n/a
	Second	$\alpha\beta$	.010	.080
	Third	$\alpha\beta$	.010	.050
	Fourth	$\alpha\beta$	.088	.413
	Highest	$\alpha\beta$	.023	n/a

*n/a (or not applicable) means the size of the indirect effect was not interpretable because the size of the direct effect (τ) was negligible.

Table 23

Parameter Coefficients and Effect Sizes of Direct and Indirect Effects by Mother's Level of Education

	Mother Level of Education	Parameter	Standardized Coefficient	r^2*
Direct effects	8th grade or below	τ Sp in class/math	.112	.013
		α Sp in class/appr	.088	.008
		β appr/math	.338	.115
	9th to 12th grade	τ Sp in class/math	.028	.001
		α Sp in class/appr	.069	.005
		β appr/math	.377	.142
	High School Completion	τ Sp in class/math	.189	.036
		α Sp in class/appr	.103	.011
		β appr/math	.396	.157
	Some College or Voc/Tech program	τ Sp in class/math	.226	.051
		α Sp in class/appr	.061	.004
		β appr/math	.149	.022
	College Degree (BA, MA, Doctorate)	τ Sp in class/math	.183	.034
		α Sp in class/appr	.217	.047
		β appr/math	.500	.250
Indirect (mediated) effects	8th grade or below	$\alpha\beta$	.030	.266
	9th to 12th grade	$\alpha\beta$	.026	n/a
	High School Completion	$\alpha\beta$	.041	.216
	Some College or Voc/Tech program	$\alpha\beta$	.009	.040
	College Degree (BA, MA, Doctorate)	$\alpha\beta$	.109	.593

*n/a (or not applicable) means the size of the indirect effect was not interpretable because the size of the direct effect (τ) was negligible.

Table 24

Parameter Coefficients and Effect Sizes of Direct and Indirect Effects by English Proficiency

	English Proficiency	Parameter	Standardized Coefficient	r^2*
Direct effects	Not Proficient	α Sp in class/appr	.029	.001
		β appr/math	.047	.002
		τ Sp in class/math	.321	.103
	Proficient	α Sp in class/appr	.155	.024
		β appr/math	.003	.000
		$\alpha\beta$	.366	.134
Indirect (mediated) effects	Proficient	$\alpha\beta$	.001	.006
	Not Proficient	$\alpha\beta$	.015	n/a

*n/a (or not applicable) means the size of the indirect effect was not interpretable because the size of the direct effect (τ) was negligible.

Table 25

Bivariate Correlations between SES, Mother Level of Education, and English Proficiency

Variables	SES	Mother Level of Education	English Proficiency
SES	1		
Mother Level of Education	.74*	1	
English Proficiency	.37*	.33*	1

* $p < .01$

Table 26

Differences in Direct and Indirect Effects by Levels of SES, Mother's Education Level, and English Proficiency

	n	Direct Effect of Spanish-use in Classroom on Mathematics Achievement (r^2)	Indirect Effect of Teacher's Rating of Child's Approach to Learning (r^2)*
SES Quintile			
1	671	.006	n/a
2	223	.017	.08
3	131	.045	.05
4	101	.045	.413
5	59	.001	n/a
Mother's Education Level			
8th grade or below	363	.013	.266
9th to 12th grade	211	.001	n/a
High School Completion	309	.036	.216
Some College or Voc/Tech program	207	.051	.04
College Degree (BA, MA, Doctorate)	83	.034	.593
English Proficiency			
Not Proficient	709	.001	.006
Proficient	472	.024	n/a

*n/a (or not applicable) means the size of the indirect effect was not interpretable because the size of the direct effect was negligible.

Figure 1.

Theoretical Model: The Impact of Teacher Characteristics of Mathematics Achievement of SSK