Students' Mathematics Achievement Growth from Kindergarten through 8th Grade: The Role of School Readiness?

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Abstract

We employed a large nationally representative data set for elementary school students, the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K), to investigate how school readiness, measured in the fall of kindergarten, affects students' mathematics learning through the end of 8th grade. *Main findings*: All three constructs of school readiness – math and reading scores, and approaches to learning – showed a positive relationship with math scores at the end of each tested grade (1st, 3rd, 5th, and 8th). Students who entered kindergarten with higher math scores tended to show a lower rate of math growth; a positive association was found between approaches to learning and math learning growth. Findings suggest that for minority students and students from lower SES backgrounds, improved school readiness would increase the math achievement rate.

What is the pattern of mathematics achievement growth between kindergarten and 8^{th} grade? Do children who begin kindergarten with higher levels of knowledge relative to their peers continue to gain at a faster rate, or do they slow down? Do children's levels of skills and knowledge continue to influence their subsequent achievement? These are important questions for the life chances of U.S. children and ultimately for the future of inequality in U.S. society.

In this study we investigate how school readiness (measured at the beginning of kindergarten) affects students' mathematics learning through the end of 8^{th} grade. Specifically, the study has two main objectives: a) to estimate growth in students' mathematics achievement between spring of kindergarten and spring of 8^{th} grade as a function of school readiness; and b) to examine whether this relationships differs for various groups of students, defined by their gender, race/ethnicity, and family socioeconomic status. To address these objectives, we employ a large nationally representative data set for elementary school students, the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K), including the most recently available 8^{th}-grade wave of data.

Theoretical background

The literature offers no consensus on whether children who start school with low levels of knowledge improve, remain at the same relative position, or fall even further behind their peers over time. Similarly, there is no consensus on whether students who begin school with high achievement maintain their high rate of learning or assume a slower pace over time. Several studies have shown that higher beginning achievement is associated with lower subsequent learning rates, possibly due to a combination of regression to the mean and either instructional or testing ceiling effects (Bloom, 1976, 1984; Brown & Saks, 1986; Phillips, Norris, Osmond & Maynard, 2002). Other studies, however, have indicated that cognitive outcomes show strong continuity over time; earlier school achievement is strongly and positively related to later achievement; and variation among students tends to increase over time (Alexander, Entwisle & Horsey, 1997; Bast & Reitsma, 1997; Brophy, 1982; Duran & Weffer, 1992).

Several studies have specifically reported an increasing disparity in students' mathematics achievement throughout elementary and middle school. One study that followed children from preschool to 2nd grade found that those who started preschool with more knowledge showed faster rates of learning (Aunola, Leskinen, Lerkkanen & Nurmi, 2004). Bodovski and Farkas (2007) reported that students who began kindergarten with the lowest levels of math achievement also showed the least growth up to the spring of 3rd grade. Williamson, Appelbaum, and Epanchin (1991) found that individual differences in mathematics achievement increased between the 1st and 8th grades, with students' initial achievement positively correlated with their growth rate. This study, however, used a relatively small (667 cases), non-representative sample. Thus, using longitudinal data on a nationally representative sample of students is essential to examining the mathematics growth trajectories of different groups of children. Reardon and Galindo (2009) made a significant step in this direction while examining the Hispanic-White achievement gap between fall of kindergarten and spring of 5th grade using the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K). They found that although in the fall of kindergarten both Black and Hispanic students had math and reading scores significantly lower than those of White students, different learning trajectories were observed for these groups over the period of six years: the Black-White gap steadily increased, particularly in math, whereas the Hispanic-White gap narrowed by about one third (Reardon & Galindo, 2009, p. 869).

Studying mathematics learning trajectories does not only mean estimating the scope of skills and knowledge acquired by children. The learning of mathematics is sequential in nature and at higher levels (at the end of the middle school and up) it involves taking specific courses that are hierarchically organized, starting with general math and pre-algebra and up to trigonometry and calculus (Riegle-Crumb, 2006; Schneider et al., 1998; Stevenson et al., 1993). The majority of existing studies of mathematics course-taking focus on the courses students take in high school, either as an outcome in and of itself or as a predictor of college attendance and college major (Ayalon, 2002; Finn, Gerber, & Wang, 2002; Horn & Bobbitt, 2000; Kelly, 2009; Schiller & Muller, 2003; Trusty, 2002; Tyson, Lee, Borman, & Hanson, 2007). Within this research, and particularly in the studies that have used the National Educational Longitudinal Study (NELS: 88), 8th-grade math courses taken by students have served as a baseline for the investigation of later outcomes. Indeed, findings based on NELS and other data sources have shown that a high school level of math skills has a significant association with course selection in high school and explains, at least in part, social class and racial gap in high school achievement (Kelly, 2009; Ma, 2000; Ozturk & Singh, 2006; Wang & Goldschmidt, 2003).

An important contribution to this literature was made by Riegle-Crumb (2006), who investigated math course-taking patterns by gender and race/ethnicity using data from Adolescent Health and Academic Achievement (AHAA). Not only was the initial math course taken at the beginning of high school consequential for the math courses taken at the end of high school, but the benefits of taking these courses varied by student gender and ethnicity: African-American and Latino males had lower returns from taking algebra in 9th grade compared to White males. In another study using the Educational Longitudinal Study data, Riegle-Crumb and Grodsky (2010) compared social class and race/ethnic gaps in students' achievement by math course stratum: students who took advanced courses vs. those in regular courses. Although being in advanced math classes improved achievement for all students, the authors found that race/ethnic gaps were actually larger among students in advanced math courses (pre-calculus and calculus). These findings highlight the importance of understanding the processes of accumulating knowledge prior to high school, not only in terms of specific courses taken but also the level of skills and knowledge students possess. If students do not have adequate preparation, they are at risk of falling behind their more advanced peers even if they take the same courses.

Level and nature of mathematics skills at the end of middle school are crucial to advanced course-taking in high school in both mathematics and science and to later success in post-secondary education (Hallinan & Kubitschek, 1999; Kelly, 2009; Lee & Frank, 1990; Lucas, 1999). Given findings that inequality in math achievement is being exacerbated by high school course selection, which is based on previous achievement, Wang and Goldschmidt (2003) called on the educational community "to identify elements that potentially limit mathematics success as early as possible" (p. 15) and highlighted the importance of improving early math skills for all students in order to prevent disparities in 8th grade and beyond. To that end, investigating the relationship between school readiness and subsequent achievement seems critically important.

Our study addresses two important policy issues. First, there is a wide consensus among educators and policy makers regarding the need for rigorous math preparation for all students to ensure that they continue their education in college and successfully participate in an increasingly competitive labor force. To that end, investigation of the factors that influence math achievement throughout children's school careers and specifically at the end of 8th grade is essential. Second, the issue of early childhood education and the importance of early acquired skills and behaviors that constitute school readiness are high on the agenda of both academic and political discourse in the U.S. Socioeconomic, racial and ethnic, and gender disparities in school readiness have been widely documented (Downey et al., 2004; Farkas & Hibbel, 2008; Ready et al., 2005; Reardon & Galindo, 2009). However, no study has linked children's school readiness to their math achievement growth throughout the end of middle school, using a large, nationally representative sample of U.S. students.

Data and Method

Data

The data for this study came from the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS–K). The ECLS-K, sponsored by the U.S. Department of Education, National Center for Education Statistics, selected a nationally representative sample of kindergartners in public and private schools in the United States in fall 1998 and followed these children through the spring of 2007. About 87% of these children were in 8th grade in 2007; 13% were enrolled below 8th grade because they had been retained at least once since kindergarten; and fewer than 1% were promoted a grade ahead and thus were above 8th grade in 2007 (DoE, 2008, p. 15).

Sampling for the ECLS-K involved a dual-frame, multistage sampling design. The first stage included the selection of 100 primary sampling units (PSU--counties and county groups). Public and private schools were then selected from PSUs, and children were sampled from the selected schools. Approximately 23 kindergarteners were selected in each school. The sample was freshened in spring 2000 to obtain a nationally representative sample of 1st graders by including in the study students not enrolled in kindergarten during the 1998–99 school year. The sample was not freshened in grades 3, 5, or 8. The initial sample in the fall of 1998 contained 21,260 kindergartners. A sample reduction is a built-in part of the ECLS-K data sample design. Starting with 3rd-grade data collection, only 50% of students from the original sample were followed and only the subsample of students who transferred from their school was followed in the 3 and 5th grades. No sub-sampling of movers was employed in 8th grade since most children had moved out of the elementary to the middle schools (DoE, 2008). By following students who entered kindergarten in 1998 through 8th grade, the ECLS-K data provide the first large-scale, nationally representative sample of children as they age through the elementary and middle school years. The final analytical sample consisted of 12,256 students and 1,183 schools.

Method

The data analysis had two parts. First, we examined how school readiness affects children's math score at the end of each tested grades (1st, 3rd, 5th and 8th). In these data students are clustered within schools; therefore, the usual ordinary least squares (OLS) regression assumption of completely independent observations may be violated because students in the same school tend to be similar on unmeasured variables. If OLS methods are used on these data, this correlation will be captured in the error term, violating the OLS assumption of the independence of error terms and leading to biased estimates of standard errors. To correct for this we employed multivariate regressions adjusted for sample clustering in school.

Second, we used growth curve models utilizing Hierarchical Linear Model (HLM) to analyze the effect of school readiness on the growth of math achievement from 1st thru 8th grades, as showed in the models:

Model:

Equation (1):

Level 1: Measurement model

$Y_{ij} = \pi_{0j} + \pi_{1j}*(\text{Grade}) + \pi_{2j}*(\text{Grade square}) + \varepsilon_{ij}$

Level 2: Student model

$\pi_{0j} = \beta_{00} + \beta_{01} *(\text{School readiness}) + \beta_{02}*(\text{Student background characteristics}) + \mu_{0j}$

$\pi_{1j} = \beta_{10} + \beta_{11}*(\text{School readiness}) + \beta_{12}*(\text{Student background characteristics}) + \mu_{1j}$

$\pi_{2j=} \beta_{20} + \mu_{1j}$

Level 1 is a repeated measures model in which the dependent variable is the math achievement at grade i for student j. The Grade variable is centered so that it takes on the value of zero in the 1st grade. π_{0j} is the initial status of the child, which is the expected outcome for that child in the spring of 1st grade. π_{1j} is the learning rate (slope) for student j during the academic year, and π_{2j} is the math learning acceleration (quadratic) for the student. At the student level (level 2), each level 1 outcome functions as a dependent variable predicted by school readiness, holding constant other predictors in the model.

Variables

Dependent variables

Our main dependent variable is student's math achievement. We employed the mathematics achievement variables that are scaled tests administered to children in the spring of 1st grade (2000), the spring of 3rd grade (2002), the spring of 5th grade (2004), and the spring of 8th grade (2007). Scoring is based upon Item-Response Theory (IRT), so scores can be compared longitudinally (DoE, 2004). The literature suggests that academic performance over this time span is important and will be reflected in both high school grades and ultimate educational attainment (Entwisle, Alexander & Olson, 2005).

School readiness

School readiness is measured by three dimensions:

Math score: Standardized IRT Test of Mathematics Achievement in spring of Kindergarten. The test was directly administered to the children by NCES staff.

Reading score: Standardized IRT Test of Mathematics Achievement in spring of Kindergarten. The test was directly administered to the children by NCES staff.

Approaches to learning: Composite scale based on six items measuring teacher's judgment of child's persistence at tasks, eagerness to learn, attentiveness, learning independence, flexibility, and organization. By definition, approaches to learning is based on teacher's judgment, so it may be biased. However, it has been shown that in both kindergarten and 1st grade, and net of prior test scores and reading ability group placement, this variable significantly affects future student test scores and reading ability group placement (Tach & Farkas, 2006). Also, in another study based on ECLS-K data (Bodovski & Youn, forthcoming), we found that when the three teacher-judged student behavior measures (approaches to learning, externalizing and internalizing behavior problems) are used together to predict later test scores, net of prior test scores, approaches to learning is by far the most powerful predictor. Further, neither Downey and Pribesh (2004), nor Tach and Farkas (2006) found significant student/teacher race interactions in regressions involving the behavioral variables. Nevertheless, we do acknowledge the possibility that middle-class teachers and/or White teachers may be prejudiced in their judgment of the approaches to learning exhibited by lower SES and minority students, as they could ‘‘misread” behavior of these students.

Family background characteristics

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

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

Male: Dummy variable; female is the reference group.

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

Two married biological parents, Non-biological parent, Single parent, and Other parent: Biological parents refers to present biological mother and father, Single parent indicates biological father or mother only, Non-biological parent refers to present biological mother and other father or the vice versa, and Other family structure indicates adoptive parents, related guardians, and unrelated guardians. Dummy variables; two married biological parent is the reference group.

Results

Table 1 presents the descriptive statistics for all variables included in the analyses. The sample is composed of 14% Black students, 12% Hispanic students, 4% Asian students, and 6% other races (Pacific Islanders and Native Americans). About half of the sample was male. With regard to family structure, 20% of the children were raised in a single-parent family, about 10% were raised by non-biological parents, and 4% were raised in other family structure. Our three constructs of school readiness are based on the children's math and reading scores, as well as their level of approaches to learning at the start of kindergarten. The average math score was 27.02 (SD=9.17), the average reading score was 35.75 (SD=10.24), and the average level of approaches to learning was 3.03 (SD=.66). Our dependent variable -- math scores -- 61.26 (SD=18.08) at the end of 1st grade, 98.72 (SD=24.71) at the end of 3rd grade, 123.69 (SD=24.79) at the end of 5th grade, and 142.22 (SD=22.01) at the end of 8th grade.

Table 2 shows all three components of school readiness by race/ethnicity and gender. White and Asian students started kindergarten with higher math and reading scores, and higher approaches to learning than did Black, Hispanic, and students of other races. Boys outperformed girls in math; the situation was reversed for reading.

The effect of school readiness on math achievement

Table 3 presents the regression analyses predicting students' math achievement at the end of the 1st, 3rd, 5th, and 8th grades from school readiness. As the table shows and consistent with previous studies, higher-SES children had higher math scores at the end of each year, and this effect was larger as students proceeded through the grades. Males also scored consistently higher than females from 1st through 8th grade. In addition, a consistent disadvantage was indicated for Black and other race students compared to White students throughout the school years, whereas Hispanic students showed lower math achievement only at the end of 1st grade. In the case of Asian children, although they showed lower math scores at the end of 1st grade and no difference for 3rd grade, they scored higher than White children at the end of the 5th and 8th grades. Moreover, children growing up in single-parent families were more likely to have lower math scores at the end of 5th and 8th grades than children raised by two married biological parents, and students with non-biological parents demonstrated lower math achievement in 8th grade compared to those with two married biological parents. Also, children from other-parent families were constantly at a disadvantage, and their test score gap increased over their schooling. Lastly, number of siblings indicated a positive relationship with students' 1st-grade math scores, yet the direction of this relationship changed to negative when students were in the 3rd and 5th grades.

The three constructs of school readiness – math and reading scores, and approaches to learning at the entrance of kindergarten – all showed a positive relationship with math scores at the end of each tested grade. More specifically, students' math scores and approaches to learning at the beginning of kindergarten appeared to be associated with their later math achievement for every tested year, suggesting that those students who entered kindergarten with higher math scores and stronger approaches to learning would be at a substantial advantage in math achievement from 1st through 8th grades. Similarly, reading score at the beginning of kindergarten showed a positive influence on later math achievement, although its impact was limited to the 1st and 3rd grades. Thus, our overall findings suggest that those students who entered kindergarten with higher math and reading scores and stronger approaches to learning had a consistent advantage in later math achievement at the end of their school years.

The impact of school readiness on math learning growth rate

Table 4 presents analyses of how school readiness impacts students' math learning growth rate from 1st through 8th grade and whether there is any varying effect of school readiness on a particular group of students.

Students from higher SES families demonstrated a faster math learning growth rate. Yet, interestingly, males did not have a faster math growth rate than female students, although they ended up with higher math scores at the end of every tested grade (Table 3). In addition, Black students were the only group to demonstrate slower learning growth than White students; Hispanic and other students did not differ from Whites. A relative advantage of Asian students over Whites was indicated in growth of math learning. Furthermore, students growing up in a single-parent or non-biological parent families had lower math score gains than students with two married biological parents, although no disadvantage was shown for students from other-parent families. Similarly, the number of siblings was negatively associated with math learning growth.

Now we turn to the impact of school readiness on students' average math learning growth rate. According to our findings, the relationship between school readiness and math learning growth rate showed a somewhat different pattern of influence compared to the analyses of school readiness and math scores at the end of each grade. In particular, students who entered kindergarten with higher math scores tended to show a lower rate of math growth, although they maintained higher math achievement at the end of each year. Furthermore, students' early reading scores in kindergarten did not have a significant impact on their math score gain. Yet, our results indicated a positive association between approaches to learning and math learning growth, suggesting that those students who possessed better approaches to learning when they entered kindergarten improved math learning at a faster rate.

After the main effect of school readiness was examined, we looked at whether these effects were different for any particular group of students. The second to fourth columns of Table 4 present the interactions of school readiness with SES, gender, and race/ethnic group. To assess such interaction effects, we used factor scores for the three components of school readiness, math and reading score, and approaches to learning, in order to facilitate the interpretation of our findings. The interaction between school readiness and SES showed a negative effect on learning growth rate, which indicates that students from a lower SES background are more likely to reveal a higher growth rate by improving their school readiness upon entering kindergarten. Further, a negative interaction effect between males and school readiness suggests that not only is boys' growth rate in math slower than girls', but boys with the highest entering scores grow even more slowly. This may indicate two things: first, boys' consistent math advantage over girls is a function of their beginning school knowledge, and higher achieving boys experience "ceiling effect" in math. The interaction effects between school readiness and race/ethnicity indicate that Black, Hispanic, and other races students' math learning growth can be improved by enhancing the level of their school readiness. In addition, the negative interaction effect for Asians and school readiness suggests that they may experience a "ceiling effect" in math.

Thus far, the combined results in Tables 3 and 4 have shown that although, on average, students with higher levels of school readiness may demonstrate a lower *rate* of math score gain, they consistently show higher math performance at the end of the 1st, 3rd, 5th, and 8th grades. In addition, the unprivileged groups (e.g., low SES and minority students) can benefit more than White and higher SES students from improved school readiness.

Discussion

We employed a large nationally representative data set for elementary school students, the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K), including the most recently available 8th-grade wave of data, to investigate how school readiness (measured at the beginning of kindergarten) affects students' mathematics learning through the end of 8th grade. Specifically, the study had two main objectives: a) to estimate growth in students' mathematics achievement between spring of kindergarten and spring of 8th grade as a function of school readiness; and b) to examine whether these relationships differ for various groups of students, defined by their gender, race/ethnicity, and family socioeconomic status.

We found that all three constructs of school readiness – math and reading scores, and approaches to learning at the entrance of kindergarten – exhibited a positive relationship with math scores *at the end of each tested grade*. More specifically, students' math scores and approaches to learning at the beginning of kindergarten appeared to be associated with their later math achievement for every tested year, suggesting that those students who entered kindergarten with higher math scores and stronger approaches to learning would be at a substantial advantage in math achievement from 1st through 8th grades. Similarly, reading score at the beginning of kindergarten had a positive influence on later math achievement, although its impact was limited to the 1st and 3rd grades. Thus, our overall findings suggest that those students who entered kindergarten with higher math and reading scores and stronger approaches to learning had a consistent advantage on their later math achievement at the end of school years.

A different pattern has been detected with respect to mathematics achievement *growth*. Students who entered kindergarten with higher math scores tended to exhibit lower rates of math growth; students' reading scores in kindergarten did not have a significant impact on their math score gain. Yet, our results indicated a positive association between approaches to learning and math learning growth, suggesting that those students who possessed better approaches to learning upon entering kindergarten experienced math growth at a faster rate.

To answer our second research question regarding the differential effects of school readiness for different groups of students we examined the interaction terms between school readiness and SES, gender, and race/ethnicity. We found that for students from lower-SES backgrounds and for minority students, improved school readiness paid off in faster growth in math achievement.

Taken together, our findings inform policy makers about the effects of school readiness on mathematics achievement at the end of middle school for different groups of students defined by their gender, race/ethnicity and family socioeconomic standing. This information may be used in creating interventions targeting students at risk of underachievement. It is important to note that our study does not enable determination of a causal relationship between school readiness and subsequent mathematics achievement and course selection. This study is not a randomized experiment and thus it is impossible to draw a causal inference from it (Schneider et al., 2007). School readiness is impossible to study experimentally (we cannot randomly assign children to having stronger/weaker sets of skills and knowledge), but our findings provide insights into the relationships between school readiness and later outcomes for different groups of children, thus suggesting where interventions that can be studied experimentally might be most effective (Schneider et al., 2007, p. 95). Furthermore, a longitudinal analysis of a large-scale, nationally representative data set allows statistical control for a variety of children- and school-related factors, which should help reduce bias in the estimates. In particular, the time lag of almost 9 years between the measures of school readiness and the end of middle school achievement provides a basis for suggestive causal relationships and helps to reduce selection bias. Thus, our study maps the math growth trajectory from kindergarten to 8th grade based on students' school readiness, which is a necessary first step that lays the foundation for more rigorous future research that will address causality, such as propensity score modeling, to account for differences in mathematics achievement trajectories by individual-, family-, and school-related factors.

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Table 1. Descriptive statistics

Student-level variables		*N*=12,256	
		Mean	SD
SES		.07	.79
Male		.51	.5
Black		.14	.35
Hispanic		.12	.33
Asian		.04	.21
Other		.06	.24
Single		.20	.4
Non biological parent		.09	.29
Other parent		.04	.19
Number of siblings		1.49	1.11
School readiness			
	Math score at kindergarten	27.02	9.17
	Reading score at kindergarten	35.75	10.24
	Approaches to learning at kindergarten	3.03	.66
Math score at 1st grade		61.26	18.09
Math score at 3rd grade		98.72	24.71
Math score at 5th grade		123.69	24.79
Math score at 8th grade		142.22	22.01

Table 2. School readiness by race-ethnicity and gender

	Math	Reading	Approaches to learning
White	28.08	36.46	3.03
Black	22.47	32.43	2.78
Hispanic	21.82	32.43	2.87
Asian	29.41	39.39	3.08
Other	23.93	33.02	2.88
Male	26.01	34.60	2.83
Female	25.79	35.84	3.10
Total sample	25.91	35.21	2.96

Table 3. Prediction of the end of 1st, 3rd, 5th and 8th grade math achievement by school readiness and student background characteristics

	1st grade	3rd grade	5th grade	8th grade
SES	1.728** (.168)	3.838** (.247)	4.72** (.279)	4.744** (.273)
Male	2.537** (.227)	5.729** (.335)	6.087** (.391)	2.861** (.394)
Black	-.465** (.318)	-8.927** (.549)	-10.481** (.724)	-9.856** (.785)
Hispanic	-.898** (.345)	-.543 (.537)	.462 (.627)	.167 (.655)
Asian	-1.33* (.556)	.697 (.825)	3.758** (.862)	4.074** (.919)
Other	-2.727** (.447)	-4.136** (.717)	-3.966** (.893)	-3.870** (.950)
Single parent	.072 (.297)	-.424 (.475)	-1.685** (.580)	-2.905** (.610)
Biological and Non biological parent	.397 (.386)	-.609 (.594)	-.987 (.780)	-1.656* (.801)
Other parent	-1.371* (.554)	-4.355** (.929)	-5.042** (1.166)	-6.255** (1.287)
Number of siblings	.265** (.096)	-.342* (.146)	-.748** (.182)	-.302 (.186)
Math K	1.145** (.024)	1.349** (.033)	1.160** (.035)	.851** (.032)
Reading K	.08** (.083)	.083** (.023)	.047 (.026)	.050 (.026)
Approaches to learning K	3.104** (.189)	4.872** (.287)	5.383** (.347)	4.22** (.355)

Note: Standard errors in parentheses
*p< .05; **p<.01

Table 4. Prediction of student's math learning growth from 1st thru 8th grade by school readiness at entrance to kindergarten and background characteristics

	Model 1	Model 2	Model 3	Model 4
SES	.418** (.036)	.479** (.038)	.381** (.036)	.372** (.036)
Male	-.047 (.051)	-.126** (.049)	-.126* (.052)	-.141** (.049)
Black	-.641** (.094)	-.502** (.093)	-.612** (.094)	-.447** (.094)
Hispanic	.131 (.082)	.230** (.082)	.172 (.082)	.184* (.081)
Asian	.769** (.121)	.866** (.121)**	.792** (.121)	.972** (.143)
Other	-.167 (.115)	-.055 (.114)	-.144 (.114)	-.127 (.111)
Single parent	-.381** (.075)	-.308** (.076)	-.397** (.075)	-.357** (.075)
Biological and Non biological parent	-.228* (.101)	-.240* (.101)	-.254* (.101)	-.261* (.101)
Other parent	-.657 (.156)	-.605** (.158)	-.072** (.023)	-.653** (.156)
Number of siblings	-.075** (.024)	-.053* (.024)	-.675** (.158)	-.060* (.024)
Math, K	-.048** (.003)	N/A	N/A	N/A
Reading, K	-.004 (.003)	N/A	N/A	N/A
Approaches to learning, K	.150** (.044)	N/A	N/A	N/A
Readiness*SES		-.421** (.029)		
Readiness*Male			-.173** (.051)	
Readiness*Black				.819** (.100)
Readiness*Hispanic				.467** (.094)
Readiness*Asian				-.233** (.087)
Readiness*Other				.667** (.113)

Note: Standard errors in parentheses. *p< .05; **p<.01