Gender Gaps in Math and Reading Gains During Elementary and High School by Race and Ethnicity

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Abstract

Gender differences in academic achievement have long fascinated researchers and policy-makers alike. In this paper we analyze differences in math and reading test score growth rates by gender for four different race and ethnic groups—white, black, Hispanic, and Asian students—for six different time periods. Our data cover both the earliest years of education and the crucial years of adolescence. In addition, we have data bracketing one non-schooling period. Together these data enable us to get a very complete picture of how gender gaps evolve over the course of early elementary and high school years and how these trajectories differ by race and ethnicity. While the gender gaps are not always statistically significant, they are for 15 of 48 comparisons made, all during school. In addition, all of the statistically significant results suggest that males learn more math and females more reading during early elementary school and again during high school.

Introduction

Who's smarter, girls or boys? Each year new studies appear examining if gender gaps in achievement exist, and if so, who is favored and by how much. These questions cannot be answered by achievement tests, or perhaps any other means, but policymakers and researchers continue to focus on gender gaps in achievement. While such gaps cannot be used to clearly identify differences in innate ability or the impacts of schools or society, they can help us determine where to direct resources and research. Of primary interest is not an achievement gap but a gap in learning, or the change in achievement over time, since any gap at a point in time can be quickly swamped by a small difference in learning rates. Previous research indicates that girls tend to outperform boys on reading and comprehension tests, and boys outperform girls on math and science tests, both in terms of achievement at a point in time, and to a lesser degree the rate of learning.

While a great deal of research stresses the importance of gender gaps in achievement (Dee 2006; Murray 2005), others argue that the achievement gap between girls and boys has been greatly exaggerated. Friedman (1989) found small differences by gender in average SAT scores and other tests based on results of meta-analyses. More recently, Mead (2006) notes that gaps by ethnicity and social class are far larger than the gender gaps. In addition, American boys are performing about as well as they ever have. Girls are improving faster in math and science, but this only means that they are closing the gaps in those areas. Mead worked with data from the National Assessment of Educational Progress (NAEP), which includes results of reading and math assessments administered periodically to nationally representative cohorts of students around the ages of 9, 13, and 17. These data are useful for looking at differences between states and over time, but tell us little about how gaps develop before the age of 9.

Gaps at a point in time can be quickly swamped by small differences in learning rates. Consequently we focus our research on rates of gain in achievement (i.e. learning rates). Some previous research, such as the work by Mead on NAEP, is based on comparisons of the performance of one cohort of students in one year (e.g., the average math scores of 9-year-olds in 2004) with the performance of another cohort in another year (e.g., the average math scores of 9-year-olds in 1973). While interesting, these comparisons cannot distinguish between differences in learning rates and differences in the composition of the cohorts being studied. In order to focus on learning rates we follow individual children over time.

Our data include two periods in children's lives. The first period starts in the fall of kindergarten and continues through the end of third grade (when children are typically 9 years old). The second period goes from eighth grade to twelfth grade, the critical adolescent and teenage years. In earlier work we looked at differences in test score growth rates by gender and by race separately (LoGerfo, Nichols, and Reardon 2006). In this report we look at the interactions between these two characteristics.

This report is divided into three sections. First, we discuss the data and analytic methods that produce the gender gap estimates. Second, we present and explain our findings. Finally, we conclude with a brief summary of our findings.

Data

We use two nationally representative and longitudinal datasets, the Early Childhood Longitudinal Study—Kindergarten cohort (ECLS-K) for elementary school and the National Education Longitudinal Study of 1988 (NELS:88) for high school. ECLS-K starts with children who were kindergartners in

1998 and NELS:88 starts with eighth-graders in 1988. These students are followed throughout their elementary school and high school experiences respectively.[1]

In this report we focus on differences by gender and ethnicity. We used four categories for ethnicity: white, black, Hispanic, and Asian.[2]

Participants in these studies took a battery of tests in reading and mathematics at the start of their relevant school transition. The elementary school children were tested five times starting in the first term of kindergarten and ending three years later. The high school students were tested three times starting in eighth-grade, typically the last grade before high school, and ending four years later. Results from this report indicate how much students learned during the intervals between test administrations.

Reading. Reading questions measured basic skills, from letter recognition and the link between letters and sounds to vocabulary and reading comprehension. Because more children than expected performed close to the ceiling on the spring K reading assessment, NCES increased the number and difficulty of questions covered by the assessment item pool used for the first grade exams (NCES 2002). Changes between the first and third grade rounds included adding more advanced questions about literal inference, extrapolation, and evaluation.

The NELS:88 reading tests posed questions about reading passages that varied in length from a single paragraph to a half-page. The tests measured skills in reading comprehension, literal inference, and critical evaluation, which represent an extension of the skills measured by the ECLS-K tests. In the follow-up test administrations students were given more difficult forms of the exams depending on their performance on the earlier tests. The high difficulty form was differentiated from the low difficulty form by including more complex texts taken from social studies and science.

Math. In ECLS-K math questions measured skills in conceptual knowledge, procedural knowledge, and problem solving. Items range from asking children to identify numbers to solving simple multiplication and division problems. The assessment pools included the same number and difficulty of questions in kindergarten and first grade. More difficult items were added in third grade. These additional items measure skills in geometry and spatial sense, data analysis, probability and statistics, and basic algebraic functions (NCES 2004).

At the secondary level, the NELS:88 tenth and twelfth grade math tests had three levels of difficulty, again administered based on previous performance. All levels of the test measured skills in arithmetic, similar to the skills found on the ECLS-K tests. The average and high difficulty level tests measured skills in algebra and geometry. The high difficulty level tests included pre-calculus questions and/or analytic geometry questions.

Achievement gain. Our outcome—achievement gain—can be measured using a number of metrics, all of which are based on points on the tests. The points are not the actual number right on the assessment as administered, but rather the number that item response theory (IRT) predicts the student would have answered correctly if s/he had been administered all the questions in the item pools. There was not sufficient time for the students to respond to all of the items. Thus, at a test administration, a student

[1] The NELS:88 dataset is refreshed at each follow-up so that their samples can be used to give representative estimates of all students in the later grades, including those who were either held back or skipped a grade and could therefore not be selected in earlier waves of data collection. These additional students are not included in our analyses.

[2] Pacific Islanders, Native Americans, and those reporting a mixed background are omitted due to small sample sizes.

was administered only a subset of items that corresponded to their grade level and skill level as estimated by an initial set of routing items.

The IRT model adjusts for the possibility that students are guessing (NCES, 2005), so the score is more accurate than a pure sum of correct responses. This IRT process allows each student's performance to be put on a common scale at each point in time, and over time and thus facilitates the quantification of learning rates.

Analytic Method

Differences in school exposure—testing time gaps. In large-scale studies, participants cannot all be administered cognitive assessments on the same day. Instead, assessments occur over a span of at least two and sometimes four months. This means that students have different levels of school exposure before they take their assessments. And because school exposure is positively correlated with test performance, models must adjust for these differences. We model test scores as a function of the time before a given assessment. In other words, each time parameter measures from the beginning of the school year to the date of the test[3], both of which are individually variable.[4] Thus by including these time measures, the models account for the variable amount of time spent in each grade, or school exposure. The coefficients for these parameters estimate the amount of learning during that time period.

The elementary school analyses model test scores as a function of the intervals between five points in time: beginning of kindergarten, end of kindergarten, beginning of first grade, end of first grade, and end of third grade. The total span of time covered is around 9.4 months per grade on average for kindergarten and first grade. The summer between kindergarten and first grade lasts around 2.6 months. The time spent between the end of first grade and the third grade assessment date averages 24 months.[5]

The secondary school analyses follow the same procedure but use the intervals between just three testing times—the springs of eighth grade, tenth grade, and twelfth grade. In NELS:88 most test dates occurred within a small time from of about 2 to 4 months (standard deviations equal to 1 and 2) and in regular intervals of about 24 months.[6]

Metrics for results. Findings are reported in a number of ways to facilitate interpretation. Learning or growth rates are reported in *points* per day, per month, and per time period. These metrics represent the most easily understood and familiar approach. We also present findings for differences in learning rates in units of standard deviations, or effect sizes. *Effect sizes* measure the magnitude of a

[3] In NELS:88, there are no dates for the start and end of school years. We assumed June 1, 1988 for the end of eighth grade and June 1, 1990 for the end of tenth grade.

[4] For example, for assessments in kindergarten, the amount of time in the first and third grades equals zero. This changes as the assessment time changes so that by third grade, the times in kindergarten and first grade are set (those grades are already completed and spanned a fixed amount of time, approximately 286 days, including weekends). However, the time in third grade before the assessment does not equal a full year, because at the third grade assessment, third grade is not yet completed.

[5] More precisely in our tables we take the original coefficients from our models (which were based on days) and multiply by 30.4 to get to months and then by the relevant number of months to calculate the growth during the period. Test score levels in later periods are estimated using the sum of growth by period plus the base score level.

[6] Exact test dates are not available for the base year of NELS:88 but are available for the first and second follow-ups. In order to calculate the elapsed time between tests, we impute the base year test date with the median test date for the base year of April 1, 1988. If the test dates were missing for the first or second follow-ups, we imputed them with the median test dates of March 20, 1990 and February 27, 1992, respectively.

relationship relative to the standard deviation of the outcome and can be compared across tests with different point ranges. We divide average growth rates in each period by the standard deviation of scores from the assessment at the beginning of the period, measured at the start of the period for the full sample (including all race and ethnic groups and both genders). This facilitates comparisons of expected gains across different test designs.

Proficiency index. We also present several graphs to show gender differences in learning rates. These graphs chart average male and female learning rates across time and benchmark gains against skill proficiencies that correspond to point gains on the assessments. The point where a student's score corresponds to a 50 percent probability of mastery of a topic or skill set is the ability level at which children are learning the topic at the fastest rate. We refer to this type of proficiency as the current level of achievement for a student with this score. For example, a child in the ECLS-K study with a math score of 43.84 has a 50 percent chance of being proficient on the topic labeled "ADD/SUBTRACT." From this, we can plausibly say that students with scores in the vicinity of 44 are learning to add and subtract. The next such level "MULTIPLY/DIVIDE" occurs at an IRT score of 67.32, so students in the vicinity of 67 are learning to multiply and divide. Gradations of ability between these two milestones (in the range from 44 to 67 points) cannot be tied to specific named skills, but the milestones offer a means to measure increases in an essentially arbitrary test score metric using familiar concepts. The following exhibits provide the key to converting test scores to proficiency scores.

EXHIBIT 1. SKILLS BEING LEARNED AT SPECIFIED IRT SCORE LEVELS – ECLS-K
(Assumes 50% Proficiency Level Corresponds to Point of Maximal Learning Speed)

Math Skills	
IRT Score	Proficiency Type
10.05	1-COUNT, NUMBER, SHAPE
18.71	2-RELATIVE SIZE
28.46	3-ORDINALITY, SEQUENCE
43.84	4-ADD/SUBTRACT
67.32	5-MULTIPLY/DIVIDE
91.29	6-PLACE VALUE
104.41	7-RATE & MEASUREMENT

Reading Skills	
IRT Score	Proficiency Type
21.41	1-LETTER RECOGNITION
30.73	2-BEGINNING SOUNDS
36.08	3-ENDING SOUNDS
51.03	4-SIGHT WORDS
68.87	5-WORD IN CONTEXT
91.63	6-LITERAL INFERENCE
112.98	7-EXTRAPOLATION
124.59	8-EVALUATION

EXHIBIT 2. SKILLS BEING LEARNED AT SPECIFIED IRT SCORE LEVELS – NELS:88
(Assumes 50% Proficiency Level Corresponds to Point of Maximal Learning Speed)

Reading Skills	
IRT Score	Proficiency Type
15.59	1-COMPREHENSION, INCLUDING LEVEL OF DETAIL
30.65	2-SIMPLE INFERENCES AND UNDERSTAND ABSTRACT CONCEPTS
43.30	3-COMPLEX INFERENCE AND EVALUATE JUDGMENTS

Math Skills	
IRT Score	Proficiency Type
22.82	1-SINGLE OPERATIONS WITH WHOLE NUMBERS
37.24	2-FRACTIONS, DECIMALS, POWERS, AND ROOTS
46.21	3-SIMPLE PROBLEM SOLVING
57.73	4-INTERMEDIATE LEVEL MATH CONCEPTS
73.55	5-MULTI-STEP PROBLEM SOLVING AND ADVANCED MATH

Linear models. To account for different rates of learning across students, we construct growth curve models, with growth varying by time period in a piecewise fashion (e.g., in ECLS-K, Fall-K to Spring-K; Fall-1 to Spring-1, etc.). Models are two-level hierarchical models, with testing times nested within students. Level 1 represents testing times, with analyses weighted by precision weights to account for measurement error in the test scores. Level 2 represents individual students, weighted to ensure generalizability of the sample (the inverse of the probability of being selected for the sample). We report findings from these models with robust standard errors. The model's equations can be written as:

Level 1

$$Y_{ti} = \pi_{0i} + \Sigma\pi_{ki}\, a_{ti} + e_{ti}$$

Y_{ti} = observed test score in points at day t for individual i
π_{0i} = initial skill level at time 0 for subject i,
π_{ki} = growth rate in skills for subject i per day over time period k;
a_{ki} = days passed in period k for person i by time t,
e_{ti} = error term

Level 2

$$\pi_{0i} = \beta_{00} + \Sigma\beta_{0q}X_{qi} + r_{0i}$$

$$\pi_{ki} = \beta_{k0} + \Sigma\,\beta_{kq}X_{qi} + r_{ki}$$

β_{0q} = the effect of X_q on the initial skill level parameter
β_{kq} = the effect of X_q on the growth parameter during period k
X_{qi} = an individual background measure (e.g., gender, race/ethnicity)
r_{0i} and r_{ki} = random effects with mean of 0, assumed to be normally distributed

These hierarchical models allow the initial levels and learning rates of student to have common components and individual random components and to have varying slopes across the time periods

considered in the models. If one ignores the random slopes and intercepts, the models are equivalent to a linear regression of test scores on the lengths of time spent in various parts of the educational system at the point the score is measured. The estimated constant in such a model is the initial score when entering kindergarten or at the end of eighth grade, and the coefficients on time variables are growth rates of scores in points per day during the relevant spans of time (see LoGerfo, Nichols, and Reardon 2006 for more details). These are converted to points per month in our tables.

Our samples consist primarily of students with test scores in most waves of the data. However, some test score data are missing and the missing data rates vary by race and across waves meaning that for some subjects and subgroups, changes over time may be driven by changes in the composition of the test takers. In particular, large fractions of Asian and Hispanic students did not take the reading tests in the early elementary school, starting with 30 percent of Hispanic students and 23 percent of Asian students in the fall of kindergarten and going down to less than 2 percent of each of these groups by the end of 3rd grade. This occurred in large part because students who could not speak English well were not asked to take the test. Thus, changes in their performance in reading could be driven by changes in the composition of who took the tests. In contrast, less than four percent of white or black children missed the reading test in any year. The situation in math is somewhat better in that only Asian students missed taking the test at a high rate with about 23 percent not taking the math test in the fall of kindergarten. No other group had more than 2 percent missing the test in any wave.

In NELS the data are only missing for about 3 percent of the eighth and tenth grade samples. In twelfth grade, however, test scores are missing for about 18 percent of the sample. Test scores are more likely to be missing for those with low initial test scores, low-income students, and black students. To help alleviate possible problems caused by missing data dropouts and students who dropped out or were retained in grade were excluded from the analysis sample. Nonetheless, the growth grades in grades 10-12 may be biased, especially for black and Hispanic students.

Results

We first explore gender differences in reading then turn to gender differences in mathematics. For each subject, results are broken out by gender alone and then by gender with race. Elementary school results are presented first, followed by secondary school results.

Gender Differences in Reading

Gender Alone

Elementary school. Female students begin kindergarten with higher reading scores than male students, as shown in the 4th column of table 1. At the start of kindergarten, girls are predicted to score nearly a point higher on the reading assessment. During both kindergarten and during first grade girls gain more than boys (0.015 SD per month in kindergarten; and 0.009 SD per month in first grade) as shown in the 2nd column of table 1.[7] Interestingly girls do not make more gains relative to boys while out of school during the summer between kindergarten and first grade or after the first grade. Nevertheless, due to

[7] The statistical significance levels are all based on results from the model with test scores in points as the outcome. The coefficient estimates from this model are transformed into effect sizes by dividing by the standard deviation in test scores. The statistical significance of these results would have differed somewhat if we had used standardized test scores (original score in points divided by standard deviation) as the outcome.

the initial differences and their higher growth rates during the school year in kindergarten and again in first grade, girls finish third grade with an average reading score nearly 4 points higher than boys.[8]

This advantage is seen in figure 1. In kindergarten, the lines representing gains are quite close, and they separate by first grade with the line representing females' learning very slightly steeper. During the second and third grades, the lines that identify male and female learning rates are parallel, with the gain for females slightly higher than the gain for boys. But, in terms of substance, by the end of third grade, both boys and girls are learning literal inference and not yet learning extrapolation.

Table 1: Reading by Gender—Elementary School

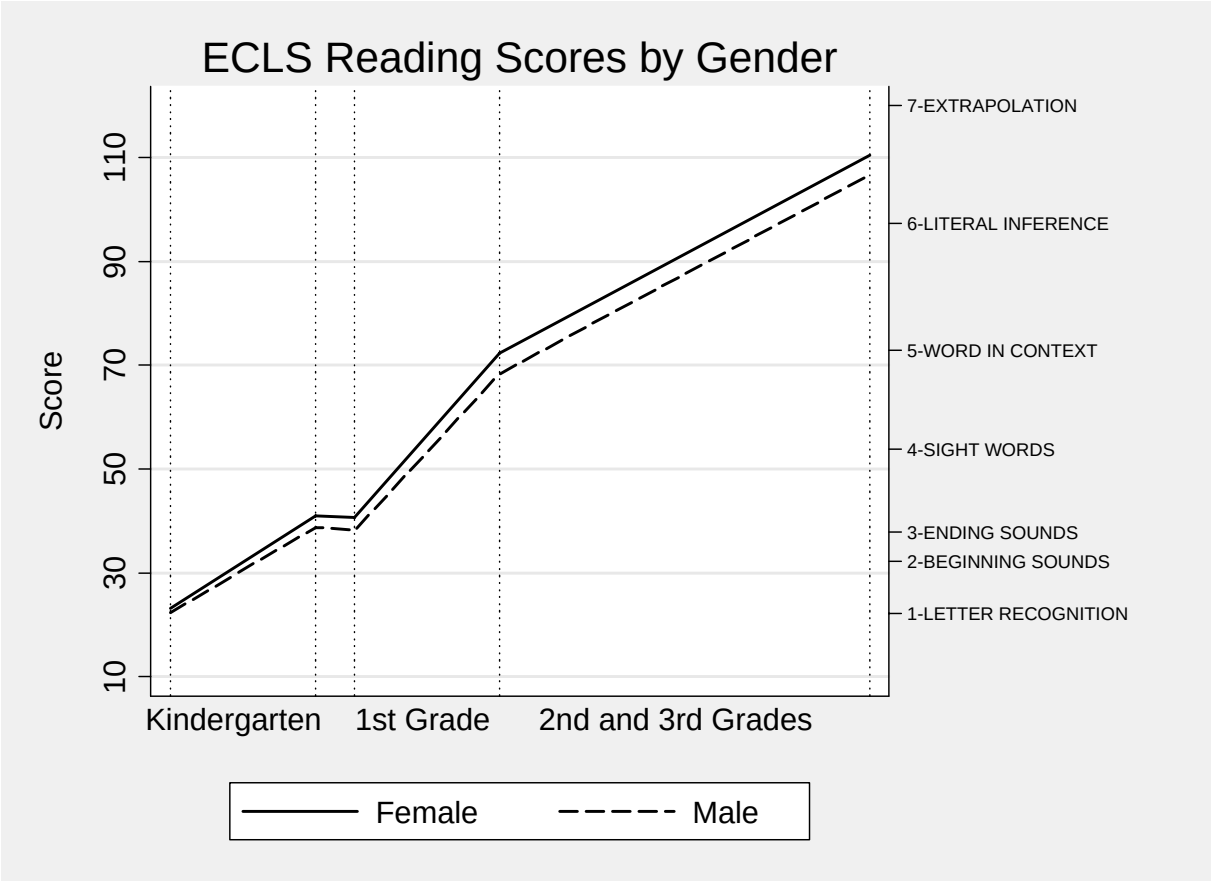
Time Period	Gain Per Month	Effect Size Per Month	Gain Per Period	Level At End of Period
Male Students				
Before Kindergarten				22.29
During Kindergarten	1.750	0.189	16.44	38.73
	(0.015)			
Summer K-1st	(0.230)	-0.017	-0.59	38.14
	(0.065)			
During 1st Grade	3.210	0.206	30.24	68.38
	(0.027)			
After 1st Grade, into 3rd Grade	1.590	0.102	38.25	106.63
	(0.009)			
Female Students (difference from Male Students)				
Before Kindergarten				0.94
During Kindergarten	**0.136**	**0.015**	**1.28**	2.22
	(0.021)			
Summer K-1st	0.120	0.009	0.31	2.53
	(0.092)			
During 1st Grade	**0.144**	**0.009**	**1.36**	3.88
	(0.037)			
After 1st Grade, into 3rd Grade	-0.007	0.000	-0.17	3.72
	(0.013)			

Estimates in bold are statistically significant at the 5% level.

Statistical significance is only calculated for the gender differences in test score growth rates.

[8] The statistical significance of differences in the initial test score levels is calculated for all groups compared to white males. We have not yet calculated the statistical significance of differences between genders for other groups or for test score levels after the base period.

FIGURE 1: DIFFERENCES IN READING LEARNING RATES BY GENDER—ELEMENTARY SCHOOL



Secondary school. In early high school, females hold a significant initial advantage in reading achievement compared to males at the beginning of high school. Findings presented in table 2 show that female students score nearly 2 points higher in eighth grade than their male peers. In addition, while females make reading gains similar to those of males early in high school, their growth rates are slightly higher than those of the males between tenth and twelfth grades (0.002 SD per month), leaving them with a slightly larger point advantage at the end of high school compared to the beginning.

Table 2: Reading by Gender—Secondary School

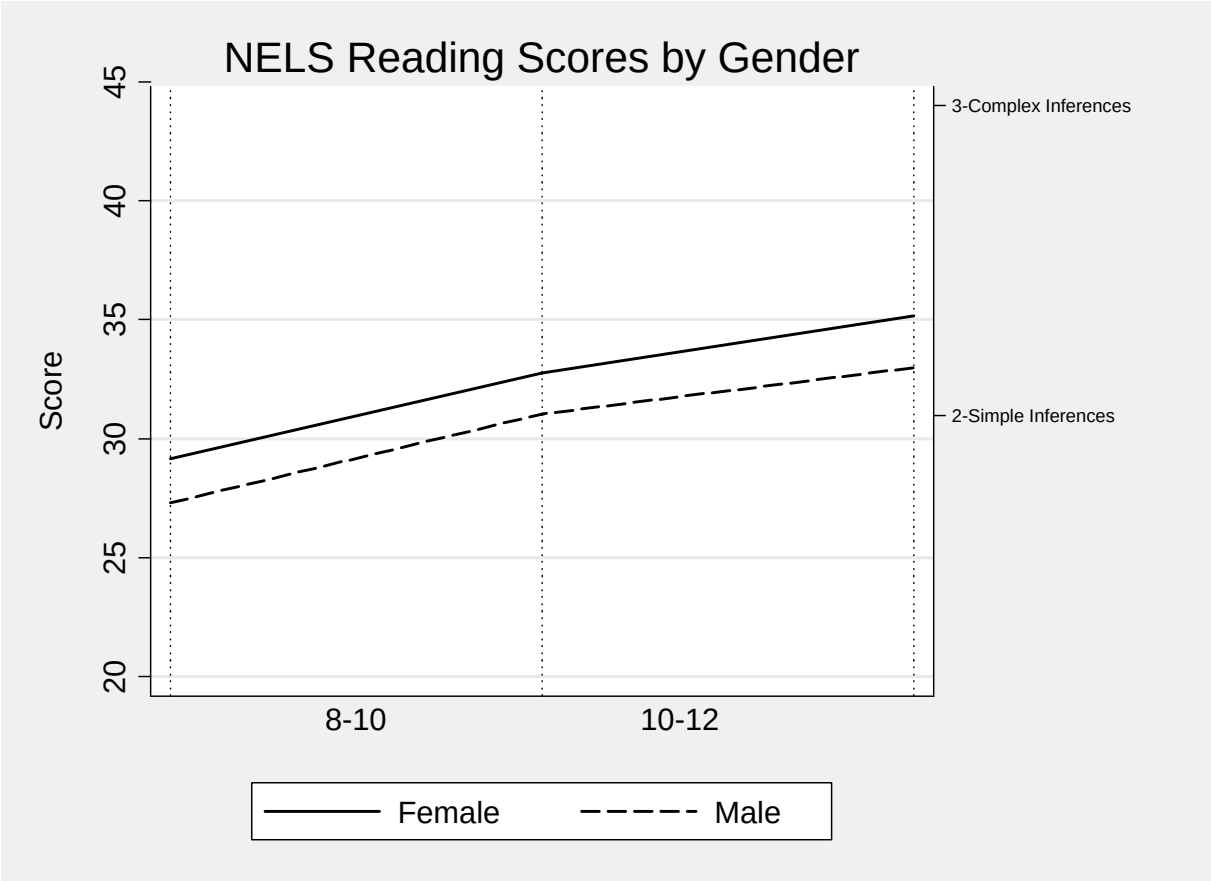
Time Period	Gain Per Month	Effect Size Per Month	Gain Per Period	Level At End of Period
Male Students				
Before High School				27.30
8th Grade to 10th Grade	0.156	0.020	3.74	31.04
	(0.005)			
10th Grade to 12th Grade	0.081	0.009	1.94	32.98
	(0.007)			
Female Students (difference from Male Students)				
Before High School				1.87
8th Grade to 10th Grade	-0.007	-0.001	-0.16	1.71
	(0.007)			
10th Grade to 12th Grade	**0.019**	**0.002**	**0.46**	2.17
	(0.008)			

Estimates in bold are statistically significant at the 5% level.

Statistical significance is only calculated for the gender differences in test score growth rates.

Females start ahead of males in reading and learn faster both during elementary school and during high school. In both periods, however, the extra gains of females are quite small compared to the overall gains experienced by both males and females. For example, while females gain about 3 more points than males during the K-3 period, males gain over 80 points during this period. Similarly, during high school females gain only about 0.3 points more than boys (-0.16 + 0.46), while boys only gain about 6 points (32.98-27.30). Thus, as a percent of the overall gain of boys, the female advantage is fairly small during both periods. From the graph in figure 2, both groups are, on average, moving from learning simple to more complex inferences.

FIGURE 2: DIFFERENCES IN READING LEARNING RATES BY GENDER—SECONDARY SCHOOL



Gender and Race

In this section we analyze gender gaps in rates of learning to ready by race and ethnicity. In general females gain reading skills at a faster rate than males for all race and ethnic groups considered. The differences in learning rates favored females in 15 out of 24 comparisons made and were statistically significant for almost half (7) of those. They were never statistically significant when they favored males. By the end points of the periods analyzed (end of 3rd grade and end of high school), the gender gaps in scores all favor females but generally remain much smaller than the black-white or Hispanic-white gaps.

The results for reading by race and gender are shown in tables 3 and 4 which are similar to tables 1 and 2 except that for black, Hispanic, and Asian males the estimates show the differences with white males while for black, Hispanic, and Asian females the estimates show the differences with males of the same race/ethnic group. The estimates for white males are of their learning rates (columns 1 to 3) or test scores at the end of the period (column 4). Appendix tables A1 and A2 present estimates in reading for all race/ethnic groups compared to white males.

Elementary school. White females start kindergarten with reading scores fewer than 2 points higher than males. The female advantage in reading widens during early elementary school but remains fairly stable in second and third grades. The earlier advantage leaves white female students with a 5 point advantage over males by the end of third grade.

A far more striking difference emerges between white males and black males during this time period. The differences in their reading scores start small, but as black male students progress through elementary school the differences grow quickly. Black male students start kindergarten with a 2-point deficit compared to white males. During kindergarten, black males' learning rates slip behind white males by 0.03 SD per month. The big story hits in first grade during which black male students have learning rates that are slower than those of white male students by 0.07 SD per month, more than double the difference in kindergarten. This disadvantage means that over the first grade year, black male students gain 8 fewer points than white male students on the reading assessment. This is a dramatic setback. Their learning rate disadvantage is not as great in second and third grades, but the impact of the first grade year remains. By the time black male students finish third grade, they are more than 14 points behind white male students, almost triple the gender gap observed within the group of white children.

Black female students also perform poorly in reading relative to white males, but not by as much as black males. Indeed, black females start, continue, and finish better than black males in reading. The reading gains for black female students in kindergarten and in first grade are significantly higher than the gains for black male students, leaving black females slightly ahead of their male peers by around 4 points. While this 4-point advantage is noticeable, it is much smaller than the 11 to 14 point black/white differences for females and males respectively.

Like black males and females, Hispanic males also lose ground relative to white males during elementary school. Hispanic males start kindergarten with more than a 4-point shortfall on the reading assessment compared to white males. Their learning rates are slower during kindergarten and slower still during first grade. However, it should be kept in mind that these are the periods when Hispanic students experienced the largest increases in the fractions taking the exam—10 percentage points in each case. If the new test takers were those with relatively low skills this may explain the apparent decrease in learning rates. There was also a fairly large increase in the fraction taking the test between 1st and 3rd grade (around 9 percentage points) but the decline in scores relative to white students is not as sharp in this period during which Hispanic male students' gains trail those of white male students by less than two points.

Compared to Hispanic males, Hispanic females do much better in reading in kindergarten gaining about 0.02 standard deviations more per month. This is the only grade in which the learning rate of Hispanic females differs significantly from that for Hispanic males. But the earlier advantage persists. By the end of 3rd grade the Hispanic females outscore their male counterparts by about 4.7 points, a large difference, but one that is much smaller than the 13 to 14 point Hispanic-white test score gaps.

While black and Hispanic males appear to lose ground in reading relative to white males during elementary school, Asian males make gains during kindergarten and in the summer between kindergarten and 1st grade. However, later in elementary school (between grades 1 and 3) Asian males lose ground. It is tempting to attribute this to the fraction of Asian students taking the test but the major changes in that fraction occur before 1st grade, making this explanation less likely.[9]

In contrast to the other racial groups there are no clear gender gaps in learning rates between Asian males and females as none of their estimated gender gaps in learning rates are statistically significant, though the point estimates favor females for 3 out of 4 of the periods covered.

[9] By the spring of 1st grade almost 97 percent of the Asian sample is taking the reading test.

Table 3: Reading by Gender and Race—Elementary School

Time Period	Gain Per Month	Effect Size Per Month	Gain Per Period	Level At End of Period
White Male Students				
Before Kindergarten				23.26
During Kindergarten	1.83	0.198	17.22	40.48
Summer K-1st	-0.33	-0.036	-0.85	39.63
During 1st Grade	3.41	0.369	32.09	71.72
After 1st Grade, into 3rd Grade	1.63	0.176	39.25	110.97
White Female Students (difference from White Male Students)				
Before Kindergarten				1.57
During Kindergarten	**0.13**	**0.014**	**1.19**	2.76
Summer K-1st	0.18	0.020	0.47	3.23
During 1st Grade	**0.19**	**0.020**	**1.78**	5.00
After 1st Grade, into 3rd Grade	0.00	0.00	-0.02	4.98
Black Male Students (Difference from White Male Students)				
Before Kindergarten				-2.38
During Kindergarten	**-0.28**	**-0.031**	**-2.66**	-5.04
Summer K-1st	0.16	0.018	0.42	-4.62
During 1st Grade	**-0.63**	**-0.068**	**-5.93**	-10.55
After 1st Grade, into 3rd Grade	**-0.16**	**-0.018**	**-3.95**	-14.50
Black Female Students (Difference from Black Male Students)				
Before Kindergarten				0.36
During Kindergarten	**0.13**	**0.014**	**1.23**	1.59
Summer K-1st	-0.19	-0.021	-0.50	1.10
During 1st Grade	**0.35**	**0.038**	**3.31**	4.41
After 1st Grade, into 3rd Grade	-0.03	-0.003	-0.65	3.76
Hispanic Male Students (Difference from White Male Students)				
Before Kindergarten				-4.42
During Kindergarten	**-0.23**	**-0.025**	**-2.17**	-6.59
Summer K-1st	0.29	0.032	0.76	-5.84
During 1st Grade	**-0.62**	**-0.066**	**-5.79**	-11.63
After 1st Grade, into 3rd Grade	**-0.06**	**-0.006**	**-1.37**	-13.00
Hispanic Female Students (Difference from Hispanic Male Students)				
Before Kindergarten				0.95
During Kindergarten	**0.23**	**0.024**	**2.12**	3.07
Summer K-1st	0.14	0.015	0.36	3.43
During 1st Grade	0.10	0.011	0.95	4.38
After 1st Grade, into 3rd Grade	0.01	0.001	0.28	4.66
Asian Male Students (Difference from White Male Students)				
Before Kindergarten				1.93
During Kindergarten	**0.27**	**0.0289**	**2.51**	4.44
Summer K-1st	**0.84**	**0.0902**	**2.15**	6.59
During 1st Grade	-0.23	-0.0246	-2.15	4.44
After 1st Grade, into 3rd Grade	**-0.25**	**-0.0266**	**-5.95**	-1.50
Asian Female Students (Difference from Asian Male Students)				
Before Kindergarten				1.06
During Kindergarten	0.08	0.008	0.72	1.78
Summer K-1st	-0.24	-0.026	-0.62	1.15
During 1st Grade	0.12	0.013	1.09	2.24
After 1st Grade, into 3rd Grade	0.01	0.001	0.14	2.39

Estimates in bold are statistically significant at the 5% level.

Statistical significance is only calculated for the gender differences in test score growth rates.

Another interesting pattern that emerges in the data is that the gender gaps in reading learning rates are never statistically significant during the summer between kindergarten and first grade (though the estimate for white students is significant at the 11 percent level). The overall gender gap in learning rates for all race/ethnic groups combined is also not statistically significant (as shown in table 1). This may have occurred in part because the standard errors for the growth estimates during the summer are much larger than for the other time periods considered because the summer is so much shorter[10].

Secondary school. The gender gaps in learning rates for reading also favor females during high school. As shown in table 4, when analyzed by race/ethnicity and time period they are positive in 3 cases out of 8 and positive and statistically significant in 2 cases, both in grades 10 to 12 which is consistent with the significant overall gender gap favoring females in this grade level reported in table 2. As noted earlier, the results favoring males are never statistically significant. Finally, as was the case in elementary school, the resulting test score gaps by gender remain much smaller than the Black-white gaps, though similar in magnitude to the Hispanic-white gap for males.

White females start high school with higher reading skills than white males (by around 2 points) and learn more between grades 10 and 12. However, the change in the reading gap (around 0.4 points) is fairly small compared to the original gap and compared to the Black-white gap for males of 5.5 points.

In addition to starting behind, black males lose ground relative to white males in reading between grades 8 and 10 and end high school about 7 points behind as shown in table 4. In comparison, the gender gap for black students at this time is fewer than 3 points. In contrast to black males, Hispanic males actually gain ground relative to white males during high school, though this more rapid growth occurs later, between grades 10 and 12, and could be related to changes in the composition of Hispanic male test takers in the later years of high school (see table A2).[11] By the end of high school the Hispanic males are more than 3 points behind white males whereas the gender gap between male and female Hispanic students is less than 1 point.

The gender gap in reading scores evolves during high school in the same way for Asian students as it does for white students—with females learning more in grades 10 to 12 but not during grades 8 to 10. Between grades 10 and 12 Asian females gain about 1.8 points in reading compared to their male counterparts, leaving them about 3.6 points ahead. This is the one case where the gender gap is larger than the racial gap, as the Asian-white gap in reading is close to 0 for both males and females by the end of high school.

It is interesting to note that during high school both white and Asian females experience faster reading growth than their male counterparts between grades 10 and 12, whereas for black and Hispanic students such differences were not found. This could be related to differences in how gender interacts with race during high school or it could reflect differential rates of missing test scores between males and females for black and Hispanic students in 12th grade.

[10] In general slopes are estimated more precisely when the x variable (days per period) varies more. Thus our standard errors are largest in the summer when the time variable has the smallest range and, consequently the least variance. Conversely, the estimated growth rates between grades 1 and 3 are estimated most precisely because that is the longest time period (see tables 1, 2, 5, and 6 for standard errors by time period).

[11] More precisely, if low-scoring Hispanic males in our sample are more likely to be tested in 8th and 10th grade than in 12th grade this could bias the estimated growth rates for Hispanic males up. See LoGerfo et al (2006) for further discussion of this issue.

Table 4: Reading by Gender and Race—Secondary School

Time Period	Gain Per Month	Effect Size Per Month	Gain Per Period	Level At End of Period
White Male Students				
Before High School				27.86
8th Grade to 10th Grade	0.16	0.017	3.72	31.58
10th Grade to 12th Grade	0.08	0.008	1.86	33.44
White Female Students (difference from White Male Students)				
Before High School				2.34
8th Grade to 10th Grade	-0.01	-0.001	-0.16	2.18
10th Grade to 12th Grade	**0.02**	**0.003**	**0.59**	2.77
Black Male Students (difference from White Male Students)				
Before High School				-5.49
8th Grade to 10th Grade	**-0.0731**	**-0.00791**	**-1.75**	-7.25
10th Grade to 12th Grade	0.0116	0.00126	0.28	-6.97
Black Female Students (difference from Black Male Students)				
Before High School				1.94
8th Grade to 10th Grade	0.0387	0.00419	0.93	2.88
10th Grade to 12th Grade	-0.0091	-0.00099	-0.22	2.66
Hispanic Male Students (difference from White Male Students)				
Before High School				-4.1
8th Grade to 10th Grade	-0.0142	-0.00154	-0.34	-4.44
10th Grade to 12th Grade	**0.0414**	**0.00449**	**0.99**	-3.44
Hispanic Female Students (difference from Hispanic Male Students)				
Before High School				1.01
8th Grade to 10th Grade	-0.0015	-0.00016	-0.04	0.98
10th Grade to 12th Grade	-0.0208	-0.00226	-0.5	0.47
Asian Male Students (difference from White Male Students)				
Before High School				-0.06
8th Grade to 10th Grade	0.0358	0.00388	0.86	0.8
10th Grade to 12th Grade	0.0218	0.00236	0.52	1.32
Asian Female Students (difference from Asian Male Students)				
Before High School				2.37
8th Grade to 10th Grade	-0.0229	-0.00249	-0.55	1.82
10th Grade to 12th Grade	**0.0733**	**0.00794**	**1.76**	3.58

Estimates in bold are statistically significant at the 5% level.

Statistical significance is only calculated for the gender differences in test score growth rates.

Gender Alone

Elementary school. Male and female students start kindergarten with very similar math scores, but in sharp contrast to the reading results, male students begin to edge out girls in first grade (see table 5). Also in contrast to the reading results, the gap continues to widen over time. In kindergarten, boys and girls start with similar math scores and make similar gains on the math assessment. In first grade, girls begin to make less gain in math (-0.008 SD). By the third grade assessment, girls have earned 2.79 points less on the math assessment than boys. But this does not translate to a great difference in skill attainment. Both male and female students are learning place value by the end of third grade, as shown in figure 3.

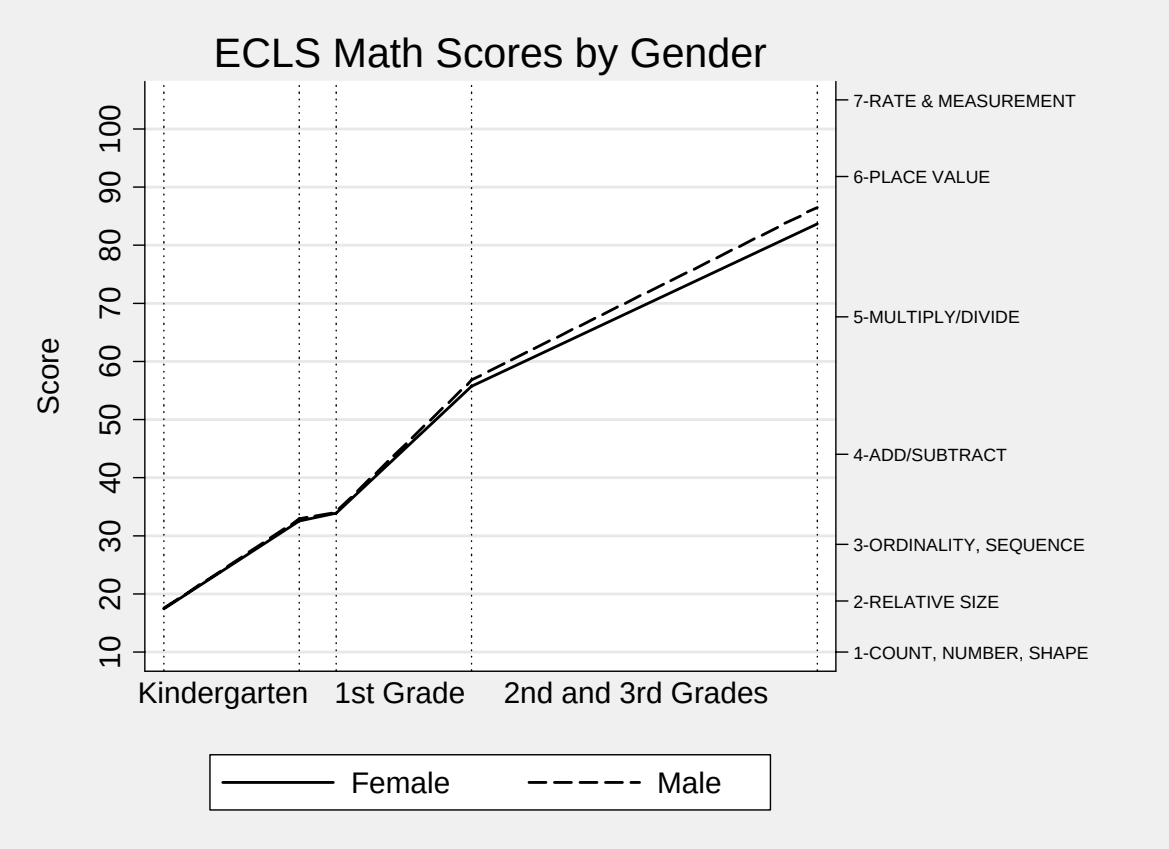
Table 5: Math by Gender—Elementary School

Time Period	Gain Per Month	Effect Size Per Month	Gain Per Period	Level At End of Period
Male Students				
Before Kindergarten				17.53
During Kindergarten	1.63	0.198	15.37	32.91
	(0.01)			
Summer K-1st	0.47	0.040	1.21	34.11
	(0.06)			
During 1st Grade	2.41	0.195	22.72	56.83
	(0.02)			
After 1st Grade, into 3rd Grade	1.23	0.100	29.68	86.51
	(0.01)			
Female Students (difference from Male Students)				
Before Kindergarten				-0.03
During Kindergarten	(0.04)	-0.004	-0.33	-0.36
	(0.02)			
Summer K-1st	0.05	0.004	0.12	-0.24
	(0.09)			
During 1st Grade	**(0.10)**	**-0.008**	**-0.90**	-1.15
	(0.03)			
After 1st Grade, into 3rd Grade	**(0.07)**	**-0.006**	**-1.64**	-2.79
	(0.01)			

Estimates in bold are statistically significant at the 5% level.

Statistical significance is only calculated for the gender differences in test score growth rates.

FIGURE 3: DIFFERENCES IN MATH LEARNING RATES BY GENDER—ELEMENTARY SCHOOL



Secondary school. Perhaps not surprisingly, given the elementary school student results presented earlier in table 8, females start high school with slightly lower math achievement than their male peers (a difference of about a half point). These differences, presented in table 6, do not increase between eighth and tenth grades but do increase between tenth and twelfth grades when female students gain about 0.84 points less per period on the math test than boys. This gap in gain represents about 0.01 SD on the tenth-grade test. By the end of high school, the initial male advantage on the math assessment increases to an advantage of almost 2 points. In terms of a gap in substantive knowledge, the difference between male and female students seems quite small. Both genders on average have already gained simple problem-solving skills and are beginning to learn more complex mathematics skills.

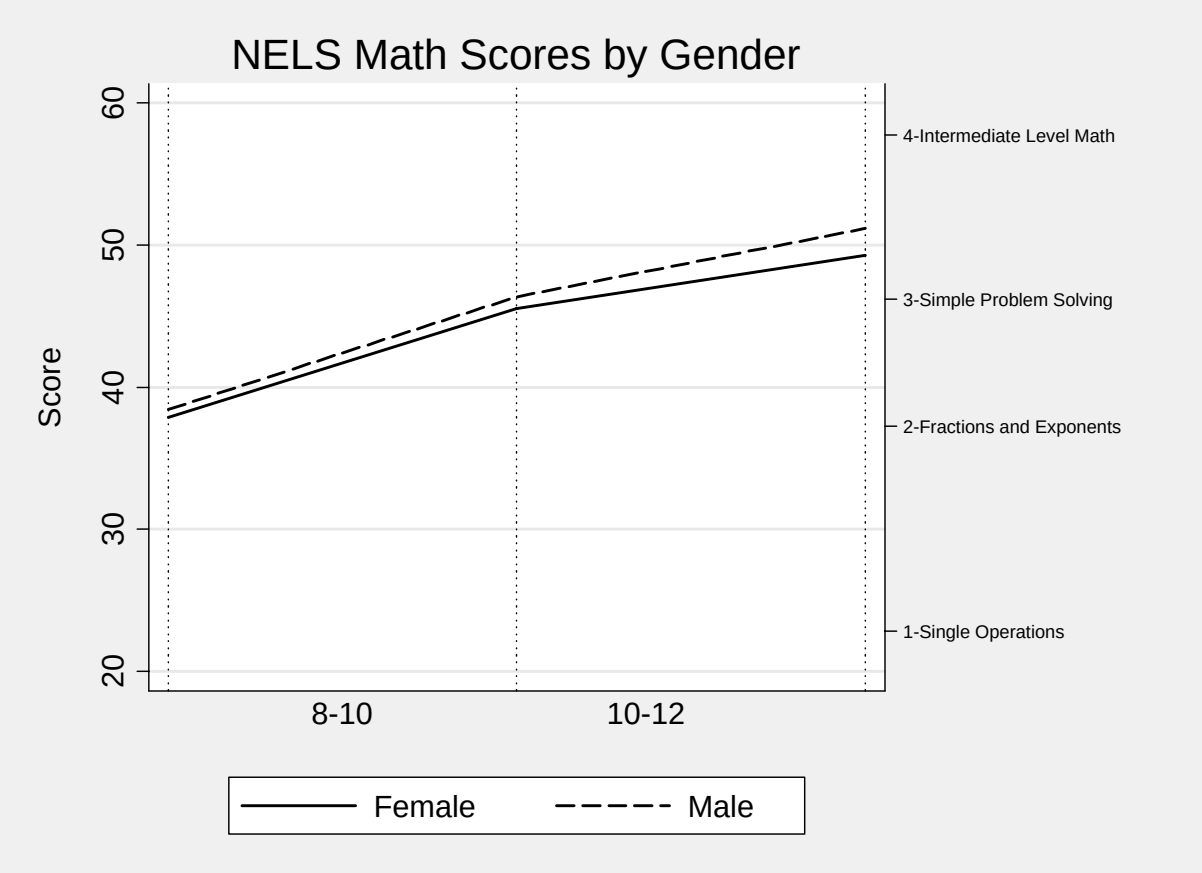
Table 6: Math by Gender—Secondary School

Time Period	Gain Per Month	Effect Size Per Month	Gain Per Period	Level At End of Period
Male Students				
Before High School				38.44
8th Grade to 10th Grade	0.33	0.030	7.92	46.36
	-0.01			
10th Grade to 12th Grade	0.20	0.015	4.81	51.17
	-0.01			
Female Students (difference from Male Students)				
Before High School				-0.56
8th Grade to 10th Grade	-0.01	-0.001	-0.28	-0.84
	-0.01			
10th Grade to 12th Grade	**-0.04**	**-0.003**	**-1.06**	-1.90
	-0.01			

Estimates in bold are statistically significant at the 5% level.

Statistical significance is only calculated for the gender differences in test score growth rates.

FIGURE 4: DIFFERENCES IN MATH LEARNING RATES BY GENDER—SECONDARY SCHOOL



Gender and Race

As noted earlier the evidence we have suggests that females gain reading skills at a faster rate than males both overall and when analyzed by race and ethnicity. The exact opposite is true for math. In this case the differences in learning rates favored males in 16 of 24 comparisons and half of those were statistically significant. The differences were never statistically significant when they favored females. By the end points of the periods analyzed (end of third grade and end of high school), the gender gaps in math scores generally favor males (except for among black students) and, as with reading scores, these gaps by gender are much smaller than the black-white or Hispanic-white gaps.

Elementary school. Although white females start kindergarten demonstrating similar math skills to white males, their learning rates are not as fast, as shown in table 7.[12] The largest gap in the learning rates occurs during first grade (-0.005 SD per month) and the white female learning rate in math is still significantly slower than that of white males during second and third grades. By the end of third grade white females are about 2 points behind their white male counterparts in math.

Black males start kindergarten about 4 points behind white males and have slower learning rates during kindergarten, first grade, and between first and the end of third. This leaves them about 15 points behind white males on the math assessment by the end of third grade. Such a large deficit presents a difficult challenge to overcome and is much larger than the overall 3-point gender difference in math scores at the end of elementary school. Black males and females appear to learn math at fairly similar rates during kindergarten and first grade and while the males learn more between first and third grade none of the gender differences in level test scores is statistically significant during elementary school.

Hispanic males start elementary school more than 5 points below white males in math and lose quite a bit of ground to them during kindergarten and 1st grade, ending up almost 10 points behind. As was the case in reading this loss relative to white students may well be related to the sharp increases in the fractions of Hispanic students taking the tests during these periods.

Hispanic females start elementary school ahead of their male counterparts in math but then lose ground during 1st grade and between 1st and 3rd grades. The net gap is less than 1.5 points, much smaller than the 10-point gap between Hispanic and males.

Asian males start kindergarten with higher math scores than white males, keep pace with white male gains in kindergarten, and then gain far more during the summer between kindergarten and first grade than white males. This 0.06 SD per month summertime advantage pushes them to end up 4 points ahead of white male students by the end of summer. However, in first grade, their monthly math gains slip dramatically (-0.03 SD), almost completely losing their large advantage. This may be due to a real change in learning or it could be due to the influx of English language learners to the sample in first grade, though there was only about a 4 percentage point change in the fraction taking the test during this period. After 1st grade Asian male students again outpace everyone but end up only about 2 points ahead of white males.

[12] In our regression results the initial female advantage is statistically significant but a comparison of raw test score differences is not statistically significant and favors the males.

Table 7: Math by Gender and Race—Elementary School

Time Period	Gain Per Month	Effect Size Per Month	Gain Per Period	Level At End of Period
White Male Students				
Before Kindergarten				19.03
During Kindergarten	1.74	0.11	16.37	35.40
Summer K-1st	0.42	0.03	1.08	36.48
During 1st Grade	2.51	0.16	23.62	60.10
After 1st Grade, into 3rd Grade	1.25	0.08	30.10	90.20
White Female Students (difference from White Male Students)				
Before Kindergarten				0.41
During Kindergarten	-0.04	-0.002	-0.35	0.06
Summer K-1st	0.10	0.006	0.25	0.30
During 1st Grade	**-0.08**	**-0.005**	**-0.79**	-0.49
After 1st Grade, into 3rd Grade	**-0.06**	**-0.004**	**-1.40**	-1.88
Black Male Students (difference from White Male Students)				
Before Kindergarten				-4.18
During Kindergarten	**-0.39**	**-0.025**	**-3.67**	-7.85
Summer K-1st	-0.01	-0.001	-0.04	-7.89
During 1st Grade	**-0.41**	**-0.026**	**-3.90**	-11.78
After 1st Grade, into 3rd Grade	**-0.13**	**-0.008**	**-3.13**	-14.91
Black Female Students (Difference from Black Male Students)				
Before Kindergarten				0.09
During Kindergarten	0.04	0.003	0.39	0.48
Summer K-1st	-0.06	-0.004	-0.15	0.33
During 1st Grade	0.04	0.002	0.34	0.67
After 1st Grade, into 3rd Grade	**-0.08**	**-0.005**	**-1.93**	-1.26
Hispanic Male Students (difference from White Male Students)				
Before Kindergarten				-5.43
During Kindergarten	**-0.27**	**-0.017**	**-2.50**	-7.93
Summer K-1st	0.12	0.008	0.31	-7.62
During 1st Grade	**-0.17**	**-0.011**	**-1.60**	-9.22
After 1st Grade, into 3rd Grade	-0.03	-0.002	-0.64	-9.86
Hispanic Female Students (Difference from Hispanic Male Students)				
Before Kindergarten				0.62
During Kindergarten	0.01	0.001	0.09	0.71
Summer K-1st	0.12	0.008	0.31	1.03
During 1st Grade	**-0.14**	**-0.009**	**-1.36**	-0.33
After 1st Grade, into 3rd Grade	**-0.05**	**-0.003**	**-1.16**	-1.49
Asian Male Students (difference from White Male Students)				
Before Kindergarten				1.45
During Kindergarten	0.07	0.004	0.64	2.09
Summer K-1st	**0.91**	**0.058**	**2.33**	4.41
During 1st Grade	**-0.45**	**-0.029**	**-4.22**	0.20
After 1st Grade, into 3rd Grade	**0.09**	**0.006**	**2.16**	2.36
Asian Female Students (Difference from Asian Male Students)				
Before Kindergarten				-0.80
During Kindergarten	**-0.22**	**-0.014**	**-2.03**	-2.83
Summer K-1st	-0.81	-0.051	-2.07	-4.90
During 1st Grade	0.14	0.009	1.28	-3.62
After 1st Grade, into 3rd Grade	-0.04	-0.002	-0.87	-4.49

Estimates in bold are statistically significant at the 5% level.

Statistical significance is only calculated for the gender differences in test score growth rates.

Asian females learn math at a somewhat lower rate than their male counterparts during kindergarten. The differences in learning rates are less clear after that but by the end of third grade they are about 4.5 points behind their male counterparts. This gap is larger than the Asian-white gap for males of 1.45 points, but still much smaller than the Black-white gap for males of 10 points.

Secondary school. Males continue to learn math at a faster rate than females in high school, though the estimated gender gaps are only statistically significant in grades 10 to 12 and for white and Hispanic students, as shown in table 8. White females gain about 0.003 fewer standard deviations per month in math than white males between grades 10 and 12. For Hispanic students the difference in learning rates by gender is slightly larger at -0.005 standard deviations per month.

We find no statistically significant gender differences in the rates of learning math for black students in high school. Table 8 suggests that black females are ahead of black males in math throughout high school and the raw test scores show a similar pattern. This is in spite of the fact that black males appeared to be doing about as well as black females at the end of primary school and were actually learning math faster between grades 1 and 3. This suggests that there may be something that happens between 3rd and 8th grade that causes black males to slip behind black females. There will be a new wave of ECLS data released this year that may help to determine whether or not this is the case.[13]

Hispanic males and females also start high school with lower scores on the math test than white male students. The Hispanic students are about 6 to 8 points behind white male students, with Hispanic female students performing worse than their Hispanic male peers. Hispanic male students keep pace with the learning rate of white male students throughout high school. Interestingly, Hispanic female students make slightly slower math gains than white males (see table A4).

Asian male students outscore and outpace white male students on the math assessment at least at the start of high school and during the first two years. In the final two years of high school, Asian male students gain at the same rate as white male students. Asian female students begin high school with an average score about 3 points higher than that of white males, but make similar gains to this group throughout high school (see table A4).

In reading we found that during high school both white and Asian females experience faster reading growth than their male counterparts between grades 10 and 12 whereas for black and Hispanic students such differences were not found. In math the pattern is that the gender gaps also appear between grades 10 and 12 rather than between grades 8 and 10, though this time the results are significant for white and Hispanic students and not for black or Asian students. Again, this could be related to differences in how gender interacts with race during high school or it could reflect differential rates of missing test scores between males and females for black students. The lack of statistical significance for Asian students might also be related to the small sample size as the estimated gender gap in learning for Asian students between grades 10 and 12 (at –0.04 points) was almost as large as the statistically significant gap found for white students (at –0.05). In any case it is interesting to note that gender gaps in both math and reading appear to expand more between grades 10 and 12 rather than between grades 8 and 10.

[13] There are a number of other possible explanations for this pattern. First, it may be the case that the elementary and high school assessments analyzed here capture different types of math skills. Similarly, it may be the case that rates of learning math for black boys compared to black girls in early elementary school differed for the ECLS-K and NELS cohorts.

Table 8: Math by Gender and Race—Secondary School

Time Period	Gain Per Month	Effect Size Per Month	Gain Per Period	Level At End of Period
White Male Students				
Before High School				39.15
8th Grade to 10th Grade	0.33	0.025	7.79	46.94
10th Grade to 12th Grade	0.20	0.015	4.75	51.68
White Female Students (difference from White Male Students)				
Before High School				0.02
8th Grade to 10th Grade	0.00	0.000	0.03	0.06
10th Grade to 12th Grade	**-0.05**	**-0.003**	**-1.10**	-1.04
Black Male Students (difference from White Male Students)				
Before High School				-10.47
8th Grade to 10th Grade	**-0.05**	**-0.004**	**-1.12**	-11.59
10th Grade to 12th Grade	**-0.03**	**-0.002**	**-0.76**	-12.35
Black Female Students (difference from Black Male Students)				
Before High School				2.53
8th Grade to 10th Grade	-0.03	-0.002	-0.71	1.82
10th Grade to 12th Grade	0.00	0.000	0.07	1.89
Hispanic Male Students (difference from White Male Students)				
Before High School				-5.83
8th Grade to 10th Grade	-0.02	-0.001	-0.37	-6.20
10th Grade to 12th Grade	0.02	0.001	0.44	-5.76
Hispanic Female Students (difference from Hispanic Male Students)				
Before High School				-1.98
8th Grade to 10th Grade	-0.03	-0.003	-0.78	-2.76
10th Grade to 12th Grade	**-0.06**	**-0.005**	**-1.52**	-4.28
Asian Male Students (difference from White Male Students)				
Before High School				3.35
8th Grade to 10th Grade	**0.06**	**0.005**	**1.50**	4.85
10th Grade to 12th Grade	0.02	0.002	0.59	5.43
Asian Female Students (difference from Asian Male Students)				
Before High School				-0.42
8th Grade to 10th Grade	-0.04	-0.003	-1.04	-1.45
10th Grade to 12th Grade	-0.04	-0.003	-0.96	-2.40

Estimates in bold are statistically significant at the 5% level.

Statistical significance is only calculated for the gender differences in test score growth rates.

Conclusion

The general pattern that males do better in math and females do better in reading appears in at least some grade levels for all ethnic groups. Although coefficient estimates are sometimes in the opposite direction from this pattern, the reversals are never statistically significant. The results are in the expected direction for 31 of 48 comparisons and are statistically significant[14] for 15 of these comparisons at the 5 percent level.

The results for white children are strongest with statistically significant results for 6 of 12 comparisons. The results for the other ethnic groups are not statistically significant as often as for white children. This is likely in part because they are based on smaller sample sizes. The gender gap results are also stronger in the earlier grades than in the later grades with two interesting exceptions.

First, none of the eight comparisons is statistically significant for the summer between kindergarten and first grade. This suggests that gender may matter more during school than it does when students are not in school, perhaps supporting other evidence that certain school-related factors may be affecting gender gaps (Dee, 2006). Of course, this suggestion is given based on information about only the summer between kindergarten and first grade, which may not be relevant for subsequent summers, and may be too short of a period to provide sufficient statistical power to identify gender differences in learning rates.

Second, the gender gaps in learning rates are statistically significant in 4 out of 8 comparisons between grades 10 and 12 of high school, perhaps because of important changes in social norms and expectations that become more prominent during this period.

In sum, while gender gaps in achievement are fairly small compared to ethnic differences, the gender gaps in learning rates are fairly consistent—when statistically significant differences are found they suggest that males tend to learn more math and females tend to learn more reading during both early elementary school (before 3rd grade) and high school regardless of ethnicity. These patterns are of interest in that they show that whatever the forces are that drive these gender differences, they appear to operate across racial and ethnic lines, at least during these grade levels within the U.S. school system.

[14] See appendix table A5 for details. Even in the absence of a real difference, we would expect to see a statistically significant difference in roughly 2 of the 48 comparisons. Following Miller (1986), corrections for multiple hypothesis testing within race/ethnicity would require a p-value of approximately .01 to reject at the nominal 5 percent level—in this case the measured gender gaps are statistically significant for 10 of the 48 comparisons.

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Appendix

Supporting Tables

TABLE A1: READING BY GENDER AND RACE VS. WHITE MALES—ELEMENTARY SCHOOL

Time Period	Gain Per Month	Effect Size Per Month	Gain Per Period	Level At End of Period
White Male Students				
Before Kindergarten				23.26
During Kindergarten	1.83	0.198	17.22	40.48
Summer K-1st	-0.330	-0.0357	-0.85	39.63
During 1st Grade	3.41	0.369	32.09	71.72
After 1st Grade, into 3rd Grade	1.63	0.176	15.34	87.06
White Female Students (difference from White Male Students)				
Before Kindergarten				1.57
During Kindergarten	**0.126**	**0.0136**	**1.19**	2.76
Summer K-1st	0.183	0.0197	0.47	3.23
During 1st Grade	**0.189**	**0.0204**	**1.78**	5.00
After 1st Grade, into 3rd Grade	-0.000913	-0.0000986	-0.01	5.00
Black Male Students (Difference from White Male Students)				
Before Kindergarten				-2.38
During Kindergarten	**-0.283**	**-0.0305**	**-2.66**	-5.04
Summer K-1st	0.164	0.0178	0.42	-4.62
During 1st Grade	**-0.630**	**-0.0680**	**-5.93**	-10.55
After 1st Grade, into 3rd Grade	**-0.164**	**-0.0178**	**-1.54**	-12.09
Black Female Students (Difference from White Male Students)				
Before Kindergarten				-2.02
During Kindergarten	**-0.152**	**-0.0165**	**-1.43**	-3.45
Summer K-1st	-0.0287	-0.00310	-0.07	-3.52
During 1st Grade	**-0.278**	**-0.0300**	**-2.62**	-6.14
After 1st Grade, into 3rd Grade	**-0.191**	**-0.0207**	**-1.80**	-7.94
Hispanic Male Students (Difference from White Male Students)				
Before Kindergarten				-4.42
During Kindergarten	**-0.231**	**-0.0250**	**-2.17**	-6.59
Summer K-1st	0.294	0.0318	0.76	-5.84
During 1st Grade	**-0.615**	**-0.0664**	**-5.79**	-11.63
After 1st Grade, into 3rd Grade	**-0.0569**	**-0.00615**	**-0.54**	-12.16
Hispanic Female Students (Difference from White Male Students)				
Before Kindergarten				-3.47
During Kindergarten	-0.00597	-0.000644	-0.06	-3.53
Summer K-1st	**0.435**	**0.0470**	**1.12**	-2.41
During 1st Grade	**-0.514**	**-0.0555**	**-4.84**	-7.24
After 1st Grade, into 3rd Grade	-0.0454	-0.00491	-0.43	-7.67
Asian Male Students (Difference from White Male Students)				
Before Kindergarten				1.93
During Kindergarten	**0.267**	**0.0289**	**2.51**	4.44
Summer K-1st	**0.835**	**0.0902**	**2.15**	6.59
During 1st Grade	-0.228	-0.0246	-2.15	4.44
After 1st Grade, into 3rd Grade	**-0.247**	**-0.0266**	**-2.32**	2.12
Asian Female Students (Difference from White Male Students)				
Before Kindergarten				2.99
During Kindergarten	**0.343**	**0.0371**	**3.23**	6.22
Summer K-1st	0.593	0.0641	1.52	7.74
During 1st Grade	-0.112	-0.0121	-1.05	6.69
After 1st Grade, into 3rd Grade	**-0.241**	**-0.0260**	**-2.27**	4.42

Estimates in bold are significantly significant at the 5 percent level. Statistical significance is only calculated for differences in test score growth rates compared to white males.

TABLE A2: READING BY GENDER AND RACE VS. WHITE MALES—SECONDARY SCHOOL

Time Period	Gain Per Month	Effect Size Per Month	Gain Per Period	Level At End of Period
White Male Students				
Before High School				27.86
8th Grade to 10th Grade	0.155	0.0168	3.72	31.58
10th Grade to 12th Grade	0.0776	0.00840	1.86	33.44
White Female Students (difference from White Male Students)				
Before High School				2.34
8th Grade to 10th Grade	-0.00657	-0.000712	-0.16	2.18
10th Grade to 12th Grade	**0.0247**	**0.00268**	**0.59**	2.77
Black Male Students (difference from White Male Students)				
Before High School				-5.49
8th Grade to 10th Grade	**-0.0731**	**-0.00791**	**-1.75**	-7.25
10th Grade to 12th Grade	0.0116	0.00126	0.28	-6.97
Black Female Students (difference from White Male Students)				
Before High School				-3.55
8th Grade to 10th Grade	**-0.0344**	**-0.00372**	**-0.82**	-4.37
10th Grade to 12th Grade	0.00250	0.000270	0.06	-4.31
Hispanic Male Students (difference from White Male Students)				
Before High School				-4.10
8th Grade to 10th Grade	-0.0142	-0.00154	-0.34	-4.44
10th Grade to 12th Grade	**0.0414**	**0.00449**	**0.99**	-3.44
Hispanic Female Students (difference from White Male Students)				
Before High School				-3.09
8th Grade to 10th Grade	-0.0157	-0.00170	-0.38	-3.46
10th Grade to 12th Grade	0.0206	0.00223	0.49	-2.97
Asian Male Students (difference from White Male Students)				
Before High School				-0.06
8th Grade to 10th Grade	0.0358	0.00388	0.86	0.80
10th Grade to 12th Grade	0.0218	0.00236	0.52	1.32
Asian Female Students (difference from White Male Students)				
Before High School				2.31
8th Grade to 10th Grade	0.0129	0.00139	0.31	2.62
10th Grade to 12th Grade	**0.0951**	**0.0103**	**2.28**	4.90

Estimates in bold are statistically significant at the 5 percent level. Statistical significance is only calculated for differences in test score growth rates compared to white males.

TABLE A3: MATH BY GENDER AND RACE VS. WHITE MALES—ELEMENTARY SCHOOL

Time Period	Gain Per Month	Effect Size Per Month	Gain Per Period	Level At End of Period
White Male Students				
Before Kindergarten				19.03
During Kindergarten	1.74	0.111	16.37	35.40
Summer K-1st	0.420	0.0268	1.079	36.48
During 1st Grade	2.51	0.160	23.62	60.10
After 1st Grade, into 3rd Grade	1.25	0.0799	11.76	71.86
White Female Students (difference from White Male Students)				
Before Kindergarten				0.41
During Kindergarten	-0.0377	-0.00241	-0.35	0.06
Summer K-1st	0.0962	0.00615	0.247	0.30
During 1st Grade	**-0.0837**	**-0.00535**	**-0.79**	-0.49
After 1st Grade, into 3rd Grade	**-0.0581**	**-0.00371**	**-0.55**	-1.03
Black Male Students (difference from White Male Students)				
Before Kindergarten				-4.18
During Kindergarten	**-0.390**	**-0.0249**	**-3.67**	-7.85
Summer K-1st	-0.0144	-0.000918	-0.037	-7.89
During 1st Grade	**-0.414**	**-0.0264**	**-3.90**	-11.78
After 1st Grade, into 3rd Grade	**-0.130**	**-0.00830**	**-1.22**	-13.01
Black Female Students (difference from White Male Students)				
Before Kindergarten				-4.09
During Kindergarten	**-0.349**	**-0.0223**	**-3.28**	-7.37
Summer K-1st	-0.0717	-0.00458	-0.184	-7.56
During 1st Grade	**-0.378**	**-0.0242**	**-3.56**	-11.12
After 1st Grade, into 3rd Grade	**-0.210**	**-0.0134**	**-1.98**	-13.09
Hispanic Male Students (difference from White Male Students)				
Before Kindergarten				-5.43
During Kindergarten	**-0.266**	**-0.0170**	**-2.50**	-7.93
Summer K-1st	0.120	0.00770	0.308	-7.62
During 1st Grade	**-0.170**	**-0.0109**	**-1.60**	-9.22
After 1st Grade, into 3rd Grade	-0.0264	-0.00168	-0.25	-9.47
Hispanic Female Students (difference from White Male Students)				
Before Kindergarten				-4.81
During Kindergarten	**-0.256**	**-0.0164**	**-2.41**	-7.22
Summer K-1st	0.242	0.0155	0.622	-6.60
During 1st Grade	**-0.314**	**-0.0201**	**-2.95**	-9.55
After 1st Grade, into 3rd Grade	**-0.0745**	**-0.00476**	**-0.70**	-10.25
Asian Male Students (difference from White Male Students)				
Before Kindergarten				1.45
During Kindergarten	0.0677	0.00433	0.64	2.09
Summer K-1st	**0.905**	**0.0578**	**2.326**	4.41
During 1st Grade	**-0.448**	**-0.0286**	**-4.22**	0.20
After 1st Grade, into 3rd Grade	**0.0899**	**0.00575**	**0.85**	1.04
Asian Female Students (difference from White Male Students)				
Before Kindergarten				0.65
During Kindergarten	**-0.148**	**-0.00944**	**-1.39**	-0.74
Summer K-1st	0.100	0.00641	0.257	-0.49
During 1st Grade	**-0.312**	**-0.0199**	**-2.94**	-3.42
After 1st Grade, into 3rd Grade	**0.0538**	**0.00343**	**0.51**	-2.92

Estimates in bold are statistically significant at the 5 percent level. Statistical significance is only calculated for differences in test score growth rates compared to white males.

TABLE A4: MATH BY GENDER AND RACE VS. WHITE MALES—SECONDARY SCHOOL

Time Period	Gain Per Month	Effect Size Per Month	Gain Per Period	Level At End of Period
White Male Students				
Before High School				39.15
8th Grade to 10th Grade	0.325	0.0247	7.79	46.94
10th Grade to 12th Grade	0.198	0.0151	4.75	51.68
White Female Students (difference from White Male Students)				
Before High School				0.02
8th Grade to 10th Grade	0.00143	0.000109	0.03	0.06
10th Grade to 12th Grade	**-0.0459**	**-0.00349**	**-1.10**	-1.04
Black Male Students (difference from White Male Students)				
Before High School				-10.47
8th Grade to 10th Grade	**-0.0469**	**-0.00357**	**-1.12**	-11.59
10th Grade to 12th Grade	**-0.0318**	**-0.00242**	**-0.76**	-12.35
Black Female Students (difference from White Male Students)				
Before High School				-7.94
8th Grade to 10th Grade	**-0.0761**	**-0.00579**	**-1.83**	-9.77
10th Grade to 12th Grade	**-0.0289**	**-0.00220**	**-0.69**	-10.46
Hispanic Male Students (difference from White Male Students)				
Before High School				-5.83
8th Grade to 10th Grade	-0.0153	-0.00116	-0.37	-6.20
10th Grade to 12th Grade	0.0184	0.00140	0.44	-5.76
Hispanic Female Students (difference from White Male Students)				
Before High School				-7.81
8th Grade to 10th Grade	**-0.0481**	**-0.00366**	**-1.15**	-8.96
10th Grade to 12th Grade	**-0.0452**	**-0.00343**	**-1.08**	-10.04
Asian Male Students (difference from White Male Students)				
Before High School				3.35
8th Grade to 10th Grade	**0.0626**	**0.00476**	**1.50**	4.85
10th Grade to 12th Grade	0.0244	0.00186	0.59	5.43
Asian Female Students (difference from White Male Students)				
Before High School				2.93
8th Grade to 10th Grade	0.0193	0.00147	0.46	3.40
10th Grade to 12th Grade	-0.0153	-0.00116	-0.37	3.03

Estimates in bold are statistically significant at the 5 percent level. Statistical significance is only calculated for differences in test score growth rates compared to white males.

Table A5
Are Gender Gaps Statistically Significant by Race?
P-values of Test Statistics of Gender Gap Growth Coefficient Estimates

	Reading				Mathematics			
Time Period	Black	White	Hispanic	Asian	Black	White	Hispanic	Asian
Elementary								
Growth During Kindergarten	**0.01**	**0.00**	**0.00**	0.50	0.31	0.11	0.50	**0.02**
Growth Summer K-1st	0.50	0.11	0.50	0.50	0.50	0.41	0.50	0.11
Growth During 1st Grade	**0.00**	**0.00**	0.24	0.50	0.50	**0.05**	**0.03**	0.50
Growth 1st Grade to 3rd Grade	0.50	0.95	0.50	0.50	**0.00**	**0.00**	**0.03**	0.50
Secondary								
Growth 8th to 10th	0.16	0.39	0.50	0.50	0.31	0.86	0.13	0.19
Growth 10th to 12th	0.50	**0.01**	0.50	**0.04**	0.50	**0.00**	**0.01**	0.27

Note: 0.50 implies >=0.50, 0.00 implies<=0.005, bold implies statistically significant at the 0.05 level.