ANALYZING THE GENDER GAP IN EDUCATIONAL ACHIEVEMENT IN CHILDREN AGES 5-12

by

JESSICA N. VAN PARYS

(Under the Direction of David B. Mustard)

ABSTRACT

This thesis uses the National Center for Education Statistics (NCES) Early Childhood Longitudinal Study – Kindergarten Cohort 1998-99 (ECLS-K) to examine how a range of educational achievement measures vary by gender, controlling for (other) individual, family, teacher and school characteristics. I find that young girls perform better on reading tests, while boys earn higher scores on math and science tests. These differences appear in kindergarten and persist through the fifth grade. The gender gaps in test scores are not mirrored in classroom grades, which are higher for girls in reading, but (statistically) similar for girls and boys in math and science. The thesis also shows that girls are more likely to pursue learning activities and exercise self-control in the classroom. These results suggest an important role for non-cognitive skills in explaining the gender gap in educational achievement.

INDEX WORDS: Gender Differences, Student Achievement, Primary School

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JESSICA N. VAN PARYS

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|---|---|
| Major Professor: | David B. Mustard |
| Committee: | Christopher M. Cornwell<br>Ronald S. Warren |

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
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# CHAPTER 1

# INTRODUCTION

Many researchers are concerned with racial and ethnic disparities in educational achievement and labor market outcomes. Understanding these gaps is important for the formulation of public policies to raise the achievement and earnings levels of lower-performing groups of people. Historically, there have been large earnings and achievement gaps between black and white Americans, and considerable work has been done over the last forty years to address these issues (O'Neil 1990; Neal and Johnson 1996; Heckman 1998; Heckman et al. 2000). There is also a considerable literature that examines earnings gaps by gender (O'Neil 1985; Weinberger and Kuhn 2006; Blau and Kahn 2006). White males have traditionally earned nearly one-third higher wages than white females, but this gender wage gap is on the decline. However, a new gender gap emerged beginning in the early 1980s, namely the rising educational achievement of females relative to males in the United States and Western Europe.

The gender achievement gap was first identified in higher education. Over the last twenty years the college-going rates of females have increased dramatically, while male college-going rates have stagnated, or in some circumstances, decreased. Today many colleges and universities have student bodies that are over 60% female. As the returns to a college degree have increased, females have been more likely than males to pursue additional education. This gender disparity in higher education will likely have consequences for marriage markets, intra-household decision-making, and for the gender composition of the U.S. labor market. For instance, as

females increase their years of educational attainment and pursue more demanding career paths, they may be more likely to postpone marriage and childbirth.

This thesis examines the gender gap from a fresh angle, focusing on differences in educational outcomes among primary school age children. With data on children that begin in the kindergarten year, I document how the achievement gap changes as children move from kindergarten to the fifth grade. Test scores and teacher evaluations measure skills in reading, math, and science. A social rating scale further describes each child's classroom behavior in an effort to evaluate the child's non-cognitive abilities.

The empirical results indicate that females score higher than males on reading tests and males score higher than females on math and science tests. These differences emerge in kindergarten and persist through the fifth grade. Females, however, earn substantially higher reading grades and there is no statistically significant difference between males and females in math and science grades. Teachers report that females are significantly more engaged in the learning process and exercise more self-control in the classroom. Analogous to the academic gaps, the behavioral gaps appear in kindergarten and grow larger by the fifth grade. These results indicate that a gender gap in educational achievement emerges in kindergarten and, where it emerges, increases in the proceeding years. While males excel on math and science tests, females achieve at higher levels in all other assessment batteries.

The remainder of this thesis takes the following form: Chapter 2 reviews the literature, Chapter 3 describes the data used in this study, Chapter 4 discusses the variables and methodology, Chapter 5 explains the empirical results, and Chapter 6 concludes with a discussion.

# CHAPTER 2

## LITERATURE REVIEW

Most research on the gender achievement gap is focused on higher education, and attempts to explain the variance in college attendance rates for males and females. Using data from the National Longitudinal Survey of Youth (NLSY), Averett and Burton (1996) find that men are more likely than women to attend college when the college wage premium is high. For women the wage premium has a statistically insignificant effect on the decision to attend college. These results alone suggest that male college attendance rates should have increased over the past twenty years in accord with the increase in the college wage premium. Explaining this contradiction is the work of other authors.

Several papers find that the rising levels of high school achievement among females explain most of the gender gap in higher education. Dynarski (2007) shows that males are more likely to start school at older ages and to be retained in a grade. Males are also less likely to be enrolled in school at age 16 and more likely to hold a General Equivalency Diploma (GED), as opposed to a regular high school diploma. She further finds that approximately one-fifth of the gender gap in college enrollment is explained by gender differences in the probability of graduating from high school with a diploma or a GED.

Other studies that document females' rising academic achievement are Reynolds and Burge (2007), Loury (2004), Jacob (2000), Goldin et al. (2006), and Cho (2006). Reynolds and Bruge (2007) find that gender differences in higher education are explained by rising parental expectations for female educational achievement from 1972 to 1992. These higher expectations

led females to be more likely to enroll in college preparatory coursework in 1992. Loury (2004) disaggregates the gender gap by race, and shows that over one-third of the African American gender gap is due to the greater influence of educated siblings on females rather than males.

Jacob (2000) finds that non-cognitive skills and the college wage premium for females account for nearly 90% of the gender gap in higher education. Goldin et al. (2006) corroborate those results. Using three longitudinal data sets from 1957, 1972, and 1992, they find that between 1972 and 1992 females narrowed the gap in math and science course taking as well as in test scores. They discover that female expectations for future work increased from 1968 to 1979 and that the age at first marriage for females increased by 2.5 years in the 1970s. The authors contend that these academic advancements and work expectations explain most of the higher rates of female college attendance. Cho's (2006) paper reports results similar to Goldin et al. (2006). Cho concludes that female advances in high school achievement account for more than one-half of the change in college enrollment by gender since the 1980s.

The gender gap in educational achievement is not isolated to the United States. Frenette and Zeman (2007) use Canadian data to explain why 38.8% of females attended universities in 2003, compared with only 25.7% of males. In order of importance, they find that grades at age 15, standardized reading scores at age 15, study habits, parental expectations, and the university earnings premium accounted for more than three-quarters of the gender gap in university enrollment. Machin and McNally (2005) use data on English schools and find that females outscore males on standardized reading tests and also pass more General Certificate of Secondary Examinations (GCSEs), which are subject-specific exams students must pass to advance in their education. Since these results control for male-female performance at age 11, they conclude that explanations for the gap are to be found in the teenage years, and not in early

childhood. Finally, Bedard and Cho (2007) show that OECD countries with less selective academic streams, as well as "pro-female" classrooms and program assignment policies have smaller gender gaps in math and science.

Few studies on the gender gap in educational achievement have analyzed K-8 data and none has examined the Early Childhood Longitudinal Study – Kindergarten Cohort data. Holmlund and Sund (2006) estimate the effect of having a same-sex teacher on classroom performance. They first find that the gender gap is higher when the share of female teachers is higher, but then determine that there is no effect on student outcomes when a child moves to a classroom with a teacher of the same sex. Lavy and Schlosser (2007) use data on Israeli schools to study peer effects in the classroom. They find that an increase in the proportion of girls in the classroom lowers the level of classroom disruption and violence, improves inter-student and student-teacher relationships, increases overall student satisfaction in school, and lessens teachers' fatigue. They conclude that a higher concentration of girls significantly improves students' cognitive outcomes. Finally, Anderson (2006) shows that investments in early childhood (e.g., pre-school) education provide short-term and long-term benefits for females, but have little effect on educational outcomes for males.

# CHAPTER 3

## DATA AND VARIABLES

The data for this study come from the Early Childhood Longitudinal Study – Kindergarten Cohort 1998-99 (ECLS-K), administered by the National Center for Education Statistics (NCES). In 1998, NCES randomly sampled schools (the primary sampling units) from across the United States. Within each school, all kindergarten classrooms were selected, from which children (units of observation) were randomly selected. Classrooms were required to have at least five kindergartners to qualify for the sample. NCES administered reading, math, and science tests to each child, collected information on each child's school, and submitted detailed questionnaires to each child's parents and teachers. Parents and teachers were asked to comment on their own personal characteristics and experiences, as well as on their relationship with the child.

Once children were selected for the fall 1998 sample, NCES dispensed follow-up assessments and questionnaires in the springs of 1999, 2000, 2002, and 2004. A "freshening" process occurred in the springs of kindergarten and the first grade, whereby a subset of "movers" were followed to their new schools. The remaining "movers" were replaced by a new sample of students from the original schools. The freshening process was discontinued after the first grade, and sample attrition set in as children moved to new schools. The data starts with 21,000 observations and concludes with approximately 9,000 observations in the fifth grade. Of the 21,000, only children who passed an English language screening test were administered the reading, math, and science assessments. This thesis' analysis begins with approximately 10,500

observations in kindergarten and concludes with 7,000 observations in the fifth grade.[1] These children were selected because they had all of the requisite data to estimate the model.

This thesis analyzes a range of direct and indirect assessments. NCES prepared the direct reading, math, and science assessments. Each test was divided into two parts. How well the child scored on the first portion of the assessment determined which second portion he or she would receive. Thus, scores used in this analysis are not raw scores, but rather item response theory (IRT) scores. Higher scores, however, still indicate higher levels of academic achievement.

Academic achievement was also measured with indirect assessments. Teachers were asked to rate each student's mastery of specific skills in reading, math, and science. NCES totaled these responses and constructed a continuous 0-4 point scale score for each child in each academic subject, where 0 indicates no understanding of the content or skill and 4 indicates complete mastery of the content or skill. This "Academic Rating Scale" (ARS) was designed to measure the same skills as those found on the direct reading, math, and science assessments. Moreover, teachers were unaware of their students' scores on the direct assessments when they provided answers for the ARS.

Another indirect assessment was the "Social Rating Scale" (SRS), which asked teachers to rate their children along several dimensions of classroom behavior. For example, teachers reported how engaged each child was in the classroom, how often the child externalized or internalized problems, how often the child lost control, and how well the child had developed interpersonal skills. NCES combined the answers to these types of questions to create a continuous scale score for each child, ranging from 0-3, which measured the child's

[1] There are approximately 7,300 child observations in the fifth grade for all outcome variables except math and science grades. Fifth grade students had different teachers by subject matter, so NCES did not ask the math and science teachers to administer grades for all of the children. Instead they randomly collected grades for half of the students taking math and half of the students taking science. This resulted in 3,611 observations on students with math grades and 3,445 observations on students with science grades.

TABLE 3.1 DESCRIPTIVE STATISTICS

ACADEMIC ACHIEVEMENT

| | Female | | Male | |
|---|---|---|---|---|
| **Reading Scores** | **Mean** | **Std. Dev.** | **Mean** | **Std. Dev.** |
| Kindergarten | 42.72 | 13.68 | 40.30 | 13.69 |
| First | 76.28 | 21.43 | 72.45 | 21.71 |
| Third | 124.09 | 22.88 | 119.86 | 24.77 |
| Fifth | 143.16 | 21.39 | 140.00 | 23.57 |
| **Reading Grades** | | | | |
| Kindergarten | 3.55 | 0.76 | 3.33 | 0.78 |
| First | 3.62 | 0.89 | 3.40 | 0.89 |
| Third | 3.51 | 0.84 | 3.27 | 0.85 |
| Fifth | 3.61 | 0.81 | 3.37 | 0.82 |
| **Math Scores** | | | | |
| Kindergarten | 34.09 | 10.65 | 34.50 | 12.36 |
| First | 59.03 | 15.27 | 60.89 | 17.56 |
| Third | 93.17 | 19.84 | 97.41 | 21.07 |
| Fifth | 113.70 | 20.43 | 118.04 | 20.46 |
| **Math Grades** | | | | |
| Kindergarten | 3.67 | 0.79 | 3.56 | 0.84 |
| First | 3.54 | 0.85 | 3.53 | 0.89 |
| Third | 3.14 | 0.71 | 3.15 | 0.74 |
| Fifth | 3.45 | 0.66 | 3.46 | 0.73 |
| **Science Scores** | | | | |
| Kindergarten | 27.66 | 7.51 | 27.93 | 7.98 |
| First | 35.12 | 7.16 | 35.87 | 7.25 |
| Third | 45.43 | 13.30 | 48.53 | 13.88 |
| Fifth | 57.65 | 14.04 | 61.00 | 13.53 |
| **Science Grades** | | | | |
| Kindergarten | 3.75 | 0.92 | 3.62 | 0.97 |
| First | 3.41 | 0.94 | 3.35 | 0.96 |
| Third | 3.26 | 0.89 | 3.25 | 0.92 |
| Fifth | 3.40 | 0.86 | 3.35 | 0.88 |

TABLE 3.2 DESCRIPTIVE STATISTICS

CLASSROOM BEHAVIOR

| | Female | | Male | |
|---|---|---|---|---|
| **Approaches to Learning** | **Mean** | **Std. Dev.** | **Mean** | **Std. Dev.** |
| Kindergarten | 2.30 | 0.62 | 2.00 | 0.68 |
| First | 2.23 | 0.66 | 1.94 | 0.69 |
| Third | 2.26 | 0.62 | 1.95 | 0.67 |
| Fifth | 2.30 | 0.60 | 1.94 | 0.67 |
| **Self Control** | | | | |
| Kindergarten | 2.31 | 0.58 | 2.11 | 0.63 |
| First | 2.31 | 0.57 | 2.11 | 0.62 |
| Third | 2.35 | 0.56 | 2.14 | 0.61 |
| Fifth | 2.38 | 0.53 | 2.16 | 0.60 |

"Approaches to Learning," "Self-Control," "Internalizing Problems," "Externalizing Problems," and "Interpersonal Skills." Similar to the ARS scale, higher scores represent higher levels of non-cognitive achievement. This thesis utilizes the "Approaches to Learning" and "Self-Control" scores as outcome variables. These variables measure two types of non-cognitive skills that might differ by gender in the classroom environment. These are also theoretically important skills, as classroom behavior may be correlated with students' academic or labor market outcomes (Heckman 2008).

Tables 3.1 and 3.2 report mean statistics for the test scores, grades, and behavioral assessments. The left portion of each table contains means and standard deviations for the outcome variables of the females in the sample, while the right portion of each table does the same for the males in the sample. Table 3.1 shows that females earn on average, 43 points on the kindergarten reading test, while males score 40 points. Females also earn higher classroom grades in kindergarten reading – 3.55 points for females compared with 3.33 points for males. The table further shows that there are no differences in means between males and females for

scores on math and general knowledge tests in kindergarten, but that males earn higher scores on these tests in later years. However, females earn higher classroom grades in reading, math, science, approaches to learning, and self-control in nearly every evaluation cycle. The standard deviations in test scores, grades, and behavioral assessments are lower for females, thus indicating there is a wider achievement spread among the male students.

Tables 3.3 and 3.4 give summary statistics for the control variables used to estimate the gender gap in educational achievement. ECLS-K provides extensive background information on each child's home and school environments. The next section of the thesis, which describes the methodology, includes a discussion of the control variables used in the model.

TABLE 3.3 DESCRIPTIVE STATISTICS

PERSONAL AND FAMILY CHARACTERISTICS

| **Personal Characteristics** | **K** | **First** | **Third** | **Fifth** |
|---|---|---|---|---|
| Male | 0.51 | 0.50 | 0.50 | 0.50 |
| | (0.50) | (0.50) | (0.50) | (0.50) |
| Black | 0.13 | 0.12 | 0.09 | 0.09 |
| | (0.34) | (0.32) | (0.29) | (0.29 |
| Hispanic | 0.14 | 0.14 | 0.14 | 0.18 |
| | (0.34) | (0.35) | (0.35) | (0.38) |
| Asian | 0.04 | 0.04 | 0.04 | 0.05 |
| | (0.21) | (0.21) | (0.20) | (0.23) |
| Pacific Islander | 0.01 | 0.01 | 0.01 | 0.01 |
| | (0.11) | (0.12) | (0.12) | (0.11) |
| Native American | 0.02 | 0.01 | 0.01 | 0.02 |
| | (0.13) | (0.12) | (0.10) | (0.13) |
| Mixed race | 0.03 | 0.03 | 0.02 | 0.03 |
| | (0.17) | (0.16) | (0.15) | (0.16) |
| **Family Characteristics** | **K** | **First** | **Third** | **Fifth** |
| WIC Benefits | 0.37 | 0.34 | 0.31 | 0.33 |
| | (0.48) | (0.47) | (0.46) | (0.47) |
| Teenage Mother | 0.24 | 0.22 | 0.20 | 0.20 |
| | (0.42) | (0.41) | (0.40) | (0.40) |
| Mother > 30 years old | 0.13 | 0.14 | 0.14 | 0.14 |
| | (0.33) | (0.34) | (0.35) | (0.35) |
| Age at K entry (in months) | 65.70 | 65.78 | 65.73 | 65.64 |
| | (4.13) | (4.17) | (4.19) | (4.19) |
| # Books in the home | 79.51 | 109.86 | 132.16 | 111.94 |
| | (60.18) | (151.61) | (184.26) | (171.72) |
| Socioeconomic Status | 0.08 | 0.09 | 0.08 | 0.05 |
| | (0.77) | (0.79) | (0.77) | (0.80) |
| Observations | 10530 | 9494 | 6658 | 7428 |

Notes: Standard errors are in parentheses.

TABLE 3.4 DESCRIPTIVE STATISTICS

TEACHER AND SCHOOL CHARACTERISTICS

| **Teacher Characteristics** | **K** | **First** | **Third** | **Fifth** |
|---|---|---|---|---|
| Teacher experience (years) | 9.06 | 14.79 | 15.19 | 14.48 |
| | (7.62) | (10.09) | (10.11) | (10.19) |
| Teacher education | 2.11 | 2.13 | 2.22 | 2.24 |
| | (0.90) | (0.93) | (0.92) | (0.93) |
| **School Characteristics** | **K** | **First** | **Third** | **Fifth** |
| Public school | 0.80 | 0.79 | 0.79 | 0.80 |
| | (0.40) | (0.41) | (0.41) | (0.40) |
| Urban school | 0.38 | 0.37 | 0.35 | 0.37 |
| | (0.48) | (0.48) | (0.48) | (0.48) |
| Rural school | 0.24 | 0.23 | 0.26 | 0.24 |
| | (0.43) | (0.42) | (0.44) | (0.43) |
| Southern school | 0.34 | 0.36 | 0.29 | 0.29 |
| | (0.47) | (0.48) | (0.46) | (0.45) |
| % Minority < 10 | 0.36 | 0.36 | 0.40 | 0.34 |
| | (0.48) | (0.48) | (0.50) | (0.47) |
| % Minority 10-25 | 0.19 | 0.20 | 0.19 | 0.18 |
| | (0.40) | (0.40) | (0.39) | (0.39) |
| % Minority 25-50 | 0.16 | 0.16 | 0.16 | 0.18 |
| | (0.37) | (0.37) | (0.37) | (0.38) |
| % Minority 50-75 | 0.10 | 0.10 | 0.09 | 0.08 |
| | (0.29) | (0.29) | (0.28) | (0.27) |
| % Minority >75 | 0.18 | 0.18 | 0.16 | 0.22 |
| | (0.38) | (0.39) | (0.37) | (0.41) |
| Observations | 10530 | 9494 | 6658 | 7428 |

Notes: Standard errors are in parentheses.

# CHAPTER 4

# METHODOLOGY

To understand the role of gender on various measures of educational achievement, I estimate empirical models of the form,

$$Y_{it} = \alpha_0 + \beta_1 * gender_{it} + \underline{\phi} * personal_{it} + \underline{\gamma} * family_{it} + \underline{\lambda} * teacher_{it} + \underline{\delta} * school_{it} + u_{it}$$

where *i* indexes children and *t* indexes grade. Each cross-sectional wave includes students who were assessed in the spring of that school year (i.e., spring kindergarten, spring first grade, spring third grade, spring fifth grade). The model incorporates sampling weights to account for the over-sampling of Pacific Islanders and the attrition rate as children left the sample over time. The model also uses the replicate sample weights provided by NCES to conduct linearized jackknife variance estimation.

*Y* includes test scores, grades, and behavioral assessments. *Personal* is a vector of personal characteristics, including the child's race and ethnicity. Children are classified into one of six categories: white, black, Hispanic, Asian, Pacific Islander, Native American, or mixed racial identity.

*Family* is a set of family characteristics, including the age of the child at kindergarten entry, the age of the mother at first birth, the number of books in the home, the socioeconomic status of the family, and if the mother received WIC benefits during pregnancy. The socioeconomic (SES) index is comprised of five variables – family income, the mother's and

father's highest levels of educational attainment, and the mother and father's occupational prestige rankings. These family characteristics are the control variables employed by Levitt and Fryer (2004) to evaluate the black-white gap in educational achievement.

*Teacher* is a vector of teacher characteristics including the teacher's highest level of educational attainment and the number of years of teaching experience. Teachers were sorted into one of four categories for their highest level of educational attainment; they either had a bachelor's degree, some additional training beyond a bachelor's degree, a Master's degree, or another advanced degree such as a PhD.

*School* is a vector of school characteristics that includes whether the school is located in an urban, suburban, or rural district, if it is a public institution, if it is located in the south, and the percentage of the student body qualifying as racial or ethnic minorities. Finally, $u$ is the variation in educational achievement that is unexplained by gender or the other control variables.

Tables 3.3 and 3.4 give descriptive statistics for these personal, family, teacher, and school characteristics. The columns of these tables represent the grade level. Unlike tables 3.1 and 3.2, where the outcome variables show differences by gender, these tables report means and standard deviations for the entire sample of students. This is done because there is very little variation between males and females in these control variables. For example, 37% of mothers with boys and 37% of mothers with girls received WIC benefits at pregnancy.

Table 3.3 shows that the sample is approximately 50% male across grades. In kindergarten, the sample is 13% black, 14% Hispanic, 4% Asian, 1% Pacific Islander, 2% Native American, and 3% of mixed racial identity. Of the racial and ethnic groups that comprise the sample, blacks leave the sample at the highest rate. By fifth grade only 9% of the sample is black. In the kindergarten year, 37% of the children's mothers received WIC benefits, 24% of the

mothers were teenagers at first birth, while 13% of the mothers were greater than 30 years old at first birth. Children's average age at kindergarten entry was 65.7 months. The average number of books in the home was approximately 80 in the kindergarten year, which increased to 112 by the fifth grade. The average socioeconomic status of the children's families remained relatively constant from kindergarten to fifth grade. In kindergarten, the average family had an SES index of 0.08, while in kindergarten the average family had an SES index of 0.05. Finally, sample attrition occurred as the number of child observations drops from 10,530 in kindergarten to 7,428 in fifth grade.

The top section of Table 3.4 shows that the average number of years of teaching experience rises from kindergarten to fifth grade. Kindergarten teachers had, on average, taught for 9 years, while fifth grade teachers had 14.5 years of teaching experience. The average level of teacher education is consistent across grades. The average teacher has some certification beyond a bachelor's degree, but just less than a master's degree.

The lower section of Table 3.4 gives the means and standard deviations for characteristics describing schools in the sample. Approximately 80% of schools are public institutions, 37% are located in urban districts, while 24% are located in rural districts. Nearly one-third of the schools are located in the southern United States, and approximately 18% of schools have minority students comprising more than 75% of the student body.

I begin by estimating the gender and racial gaps in reading test scores among kindergartners, first without any control variables, and then successively adding family, teacher, and school characteristics. This approach shows how the male-female achievement gap compares with the black-white and Hispanic-white achievement gaps, and Table 4.1 gives the results for these four different model specifications. Each column of the table represents a different model

specification. Beginning in Column I and moving left to right across the table, control variables are added to illustrate how the gender, race, and ethnicity gaps change across model specifications. The most dramatic shift occurs between Columns I and II. Column I does not control for any family characteristics, and the black-white gap in kindergarten reading scores is 5.8 points. Similarly, the Hispanic-white gap is 5 points. Comparing these estimates with the coefficient estimate on males, the race and ethnicity gaps in reading test scores are three points higher than the gap by gender. Estimates that control for family characteristics are reported in Column II, and show that the race and ethnicity gaps nearly drop to zero and are not statistically significant. Males, however, continue to earn two points less than females on the kindergarten reading assessments and this coefficient estimate is significant at the 99% level. Adding control variables for teacher and school characteristics does not diminish the gaps in achievement by race, ethnicity, or gender. These results hold for all test scores and grades in the kindergarten year. The control variables that typically reduce the gaps by race and ethnicity do not reduce the gaps by gender.

The model's fit increases substantially after controlling for family characteristics. Race and gender alone explain 4% of the variance in kindergarten reading test scores. However, the combination of personal and family characteristics explains 17% of this variation. Adding teacher and school characteristics does very little to explain the variation in reading test scores, as the $R^2$ increases only to 0.18.

To summarize, this table demonstrates that, at least in kindergarten, achievement gaps by race and ethnicity are largely a function of observable variables in the child's home environment (e.g., socioeconomic status). The achievement gaps by gender are less easily explained. Indeed

this is a principal result for the thesis. The gender achievement gap in schooling is persistent and its determinants remain unknown.

In the next chapter, all tables report results from the full model specification, which includes personal, family, teacher, and school control variables, and the male-female achievement gaps are compared with the race and ethnicity achievement gaps.

TABLE 4.1 READING TEST SCORES (KINDERGARTEN)
DIFFERENT MODEL SPECIFICATIONS

| | I | II | III | IV |
|---|---|---|---|---|
| **Personal Characteristics** | | | | |
| Male | -2.34* | -2.21* | -2.22* | -2.23* |
| | (0.28) | (0.27) | (0.26) | (0.26) |
| Black | -5.79* | -0.03 | -0.16 | -1.34* |
| | (0.39) | (0.42) | (0.42) | (0.51) |
| Hispanic | -5.03* | -0.47 | -0.46 | -1.27* |
| | (0.37) | (0.38) | (0.37) | (0.42) |
| **Family Characteristics** | | | | |
| WIC Benefits | | -1.76* | -1.79* | -1.72* |
| | | (0.31) | (0.31) | (0.31) |
| Teenage Mother | | -1.64* | -1.59* | -1.60* |
| | | (0.31) | (0.31) | (0.31) |
| Mother > 30 yrs | | 2.71* | 2.68* | 2.45* |
| | | (0.49) | (0.49) | (0.49) |
| Age at K entry (in months) | | 0.45* | 0.45* | 0.45* |
| | | (0.03) | (0.03) | (0.03) |
| # Books in home (in 100s) | | 7.82* | 8.00* | 8.00* |
| | | (1.20) | (1.01) | (0.92) |
| Socioeconomic status | | 3.63* | 3.67* | 3.46* |
| | | (0.24) | (0.24) | (0.24) |
| **Teacher Characteristics** | | | | |
| Experience (in years) | | | -0.01 | -0.02 |
| | | | (0.06) | (0.06) |
| Master's Degree | | | -1.09* | -0.56 |
| | | | (0.36) | (0.37) |
| Other prof. degree/ PhD | | | 2.04 | 2.97 |
| | | | (2.37) | (2.47) |
| **School Characteristics** | | | | |
| Public school | | | | -1.79* |
| | | | | (0.42) |
| Urban school | | | | 0.00 |
| | | | | (0.34) |
| Rural school | | | | -1.31* |
| | | | | (0.35) |
| Southern school | | | | 1.26* |
| | | | | (0.31) |
| % Minority > 75 | | | | 0.99 |
| | | | | (0.52) |
| Observations | 10530 | 10530 | 10530 | 10530 |
| $R^2$ | 0.04 | 0.17 | 0.17 | 0.18 |

# CHAPTER 5

# RESULTS

Academic achievement measures and behavioral assessments divide the results chapter. Section 5.1 describes the results in reading test scores and grades. Section 5.2 gives the results in math. Section 5.3 lists the results for general knowledge and science. Section 5.4 discusses the behavioral assessment scores. Each regression model controls for personal, family, teacher, and school characteristics; however, many of the coefficient estimates are not reported in the tables due to space limitations. Since this thesis focuses on the gender gap and how it compares with the race and ethnicity gaps, the tables are designed to show how the coefficient estimates on male, black, and Hispanic change from kindergarten to fifth grade. In other words, this chapter examines how the race and gender gaps differ by achievement measure and how they change over time. The results are reported in their original units, with standard errors reported in parentheses below the coefficient estimates. Stars (*) on coefficient estimates indicate statistical significance above the 95% confidence level. Because the coefficient estimates are not always interpreted easily, especially for the test scores, Table 3.1 shows summary statistics for academic achievement measures and Table 3.2 gives descriptive statistics for behavioral assessment scores. The reader may use these tables to determine the economic significance of the results.

## 5.1 READING

The results for reading assessments and reading grades can be found in Tables 5.1.1 and 5.1.2, respectively. Beginning in kindergarten, females earn 2.2 points more than males on

reading tests. This gap increases to 3.3 points in the first grade, peaks at 4 points in the third grade, and falls to 3.6 points in the fifth grade. The coefficient estimates are precisely estimated at the 99% confidence level. These score gaps translate to 0.13 - 0.15 standard deviations. The results remain consistent over the years; females begin with a slight reading advantage in kindergarten and maintain that advantage. Males, however, do not fall further behind females in reading test scores from kindergarten to the fifth grade.

Comparing these results with the coefficient estimates on black and Hispanic children provides interesting insights. Controlling for personal, family, teacher, and school characteristics, the male-female reading test score gap is larger than the black-white gap in kindergarten and first grade. With the exception of third grade, the male-female gap is always greater than the Hispanic-white gap in reading test scores.

Contrasting the results for reading test scores with those for reading grades gives a more pronounced perspective of the gender gap. These results are located in Table 5.1.2. On a 4.0 grading scale, females earn 0.21 points higher than males in kindergarten. This gap increases moderately to 0.22 points higher in first grade, 0.24 points higher in third grade, and 0.25 points higher in fifth grade. Because the variance in grades remains relatively constant over the years, these coefficient estimates show that females earn approximately 0.25-standard deviation higher reading grades. These results are also all significant at the 99% confidence level. Similar to the results for reading test scores, females begin with an advantage in reading grades and maintain that advantage over the years, but in this case males fall a bit further behind. The male-female gap is always larger than the black-white or Hispanic-white gaps in reading grades. At the peak of the racial and ethnic gaps in third grade, whites earn grades 0.20 points higher than blacks and

0.12 points higher than Hispanics. These are still well below the 0.24-point grade gap between males and females.

The striking difference between reading test scores and reading grades is that females earn substantially higher grades than males, but have only marginally higher test scores. This foreshadows a trend in the results, and testable explanations will be provided in the discussion section of the paper.

TABLE 5.1 READING TEST SCORES

| | Kindergarten | First | Third | Fifth |
|---|---|---|---|---|
| **Personal Characteristics** | | | | |
| Male | -2.23* | -3.26* | -3.96* | -3.64* |
| | (0.26) | (0.59) | (0.80) | (0.99) |
| Black | -1.34* | -1.85* | -5.10* | -5.28* |
| | (0.51) | (1.15) | (1.61) | (1.96) |
| Hispanic | -1.27* | -1.80* | -4.48* | -2.71 |
| | (0.42) | (1.04) | (1.46) | (1.78) |
| **Family Characteristics** | | | | |
| WIC Benefits | -1.72* | -2.71* | -4.93* | -4.04* |
| | (0.31) | (0.81) | (1.12) | (1.37) |
| Teenage Mother | -1.60* | -1.79* | -3.59* | -4.52* |
| | (0.31) | (0.83) | (1.19) | (1.46) |
| Mom > 30 yrs | 2.45* | 3.15* | 3.48* | 2.73* |
| | (0.49) | (0.89) | (1.07) | (1.28) |
| Age at K entry (in months) | 0.45* | 0.37* | 0.52* | 0.60* |
| | (0.03) | (0.07) | (0.10) | (0.11) |
| # Books in home (in 100s) | 7.82* | 1.02* | 1.25* | 1.12* |
| | (0.92) | (0.31) | (0.32) | (0.41) |
| Socioeconomic status | 3.46* | 7.24* | 9.43* | 10.07* |
| | (0.24) | (0.47) | (0.62) | (0.79) |
| **Teacher Characteristics** | | | | |
| Experience (in years) | -0.02 | 0.17 | -0.10 | 0.09 |
| | (0.06) | (0.11) | (0.17) | (0.20) |
| Master's Degree | -0.56 | -3.87 | 0.24 | -0.28 |
| | (0.37) | (2.88) | (1.16) | (1.47) |
| Other prof. degree/ PhD | 1.36 | -3.98 | -1.47 | -1.52 |
| | (0.67) | (2.90) | (1.94) | (1.79) |
| **School Characteristics** | | | | |
| Public School | -1.79* | -3.25* | -0.90 | 0.89 |
| | (0.42) | (0.85) | (1.09) | (1.48) |
| Urban school | 0.00 | -0.21 | 2.23* | 1.21 |
| | (0.34) | (0.70) | (0.97) | (1.16) |
| Rural school | -1.31* | -1.66 | -0.97 | -0.98 |
| | (0.35) | (0.90) | (1.21) | (1.55) |
| Southern school | 1.26* | 1.33 | 0.77 | 0.16 |
| | (0.31) | (0.70) | (0.93) | (1.16) |
| % Minority > 75 | 0.99 | -3.48* | -6.54* | -4.70* |
| | (0.52) | (1.11) | (1.66) | (1.97) |
| **Observations** | 10530 | 9494 | 6801 | 7428 |
| **$R^2$** | 0.18 | 0.19 | 0.29 | 0.31 |

TABLE 5.2 READING GRADES

| | Kindergarten | First | Third | Fifth |
|---|---|---|---|---|
| **Personal Characteristics** | | | | |
| Male | -0.21* | -0.22* | -0.24* | -0.25* |
| | (0.02) | (0.02) | (0.02) | (0.03) |
| Black | -0.06* | -0.12* | -0.20* | -0.15* |
| | (0.03) | (0.05) | (0.05) | (0.06) |
| Hispanic | -0.11* | -0.08* | -0.12* | -0.10* |
| | (0.03) | (0.04) | (0.04) | (0.05) |
| **Family Characteristics** | | | | |
| WIC Benefits | -0.11* | -0.12* | -0.12* | 0.14* |
| | (0.02) | (0.03) | (0.03) | (0.04) |
| Teenage Mother | -0.08* | -0.12* | -0.10* | 0.15* |
| | (0.02) | (0.03) | (0.04) | (0.04) |
| Mom > 30 yrs | 0.06* | 0.07* | 0.07* | 0.13* |
| | (0.02) | (0.03) | (0.03) | (0.04) |
| Age at K entry (in months) | 0.03* | 0.03* | 0.02* | 0.01* |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| # Books in home (in 100s) | 0.52* | 0.05* | 0.04* | 0.04* |
| | (0.06) | (0.01) | (0.01) | (0.01) |
| Socioeconomic status | 0.20* | 0.24* | 0.29* | 0.25* |
| | (0.01) | (0.02) | (0.02) | (0.02) |
| **Teacher Characteristics** | | | | |
| Experience (in years) | 0.01* | -0.01* | -0.02* | -0.01 |
| | (0.00) | (0.00) | (0.01) | (0.01) |
| Master's Degree | -0.05* | -0.35* | 0.05 | 0.08* |
| | (0.02) | (0.13) | (0.03) | (0.04) |
| Other prof. degree/ PhD | -0.01 | -0.34* | 0.02 | 0.10 |
| | (0.04) | (0.13) | (0.05) | (0.07) |
| **School Characteristics** | | | | |
| Public School | 0.06* | 0.02 | 0.14* | 0.18* |
| | (0.02) | (0.03) | (0.03) | (0.05) |
| Urban school | 0.08* | 0.07* | 0.05 | 0.10* |
| | (0.02) | (0.03) | (0.03) | (0.04) |
| Rural school | -0.04* | -0.06* | -0.05 | -0.03 |
| | (0.02) | (0.03) | (0.04) | (0.04) |
| Southern school | 0.04* | 0.05* | 0.05 | 0.05 |
| | (0.02) | (0.02) | (0.03) | (0.04) |
| % Minority > 75 | 0.15* | 0.09* | 0.16* | 0.13* |
| | (0.03) | (0.04) | (0.05) | (0.06) |
| **Observations** | 10530 | 9494 | 6801 | 7428 |
| **$R^2$** | 0.16 | 0.13 | 0.16 | 0.17 |

5.2 Math

The results for math test scores and math grades are reported in Tables 5.2.1 and 5.2.2, respectively. Beginning in kindergarten, males earn 0.36 points more than females on the math tests, but this estimate is not statistically significant. In other words, there is no gender difference in assessments that test the children's ability to do math in kindergarten. However, the math test score gap increases to 1.7 points in first grade, 4.8 points in third grade, and 3.3 points in fifth grade. These last three results are significant at the 99% confidence level. They correspond to males earning 0.04 to 0.14 standard deviation higher scores than females on math tests.

Comparing these results to those for the reading tests, females do not begin kindergarten with significantly lower cognitive abilities in math. However, gender parity disappears in the first grade and the gender gap widens over the next four years. Males in the fifth grade earn higher math scores while females earn higher reading scores.

The black-white gap in math test scores begins in kindergarten and increases considerably into the fifth grade. Blacks earn, on average, 2.8 fewer points than whites in kindergarten and 7.8 fewer points in the fifth grade. Hispanics earn 1.44 points fewer than whites in kindergarten and the gap peaks at 4.9 points in the third grade. By fifth grade, there is not a statistically significant difference between Hispanics and whites in math test scores.

Table 5.2.2 shows that there is no statistically significant difference between males and females in math grades. Indeed, the coefficient estimates on male are negative in all but the third grade, though they are not significantly different from zero. These results move in opposition to those found for math test scores. Although males score higher on the math tests, teachers do not rate males as more likely than females to excel in mathematics in the classroom.

In contrast to the male-female gap in math grades, the black-white gap in math grades is consistent with the black-white gap in test scores. For math grades, the coefficient estimates on black are always negative and statistically significant. In kindergarten, blacks earn 0.10 points fewer than whites on math grades, and this increases into the third grade. In the fifth grade, the gap falls to 0.08, but again this may be due to sample attrition. Blacks exited the sample at faster rates than whites or Hispanics, so there may be sample attrition bias for blacks in fifth grade math.

TABLE 5.3 MATH TEST SCORES

| | Kindergarten | First | Third | Fifth |
|---|---|---|---|---|
| **Personal Characteristics** | | | | |
| Male | 0.36 | 1.68* | 4.78* | 3.27* |
| | (0.21) | (0.43) | (0.66) | (1.024) |
| Black | -2.80* | -6.33* | -9.40* | -7.48* |
| | (0.38) | (0.80) | (1.35) | (1.95) |
| Hispanic | -1.44* | -2.79* | -4.85* | -1.96 |
| | (0.36) | (0.81) | (1.18) | (1.66) |
| **Family Characteristics** | | | | |
| WIC Benefits | -1.74* | -1.67* | -4.15* | -4.32* |
| | (0.27) | (0.57) | (0.90) | (1.24) |
| Teenage Mother | -1.17* | -1.43* | -2.30* | -2.41 |
| | (0.27) | (0.57) | (0.92) | (1.42) |
| Mom > 30 yrs | 1.29* | 1.69* | 2.01* | 2.03 |
| | (0.37) | (0.69) | (0.91) | (1.47) |
| Age at K entry (in months) | 0.59* | 0.48* | 0.60* | 0.37* |
| | (0.03) | (0.05) | (0.09) | (0.11) |
| # Books in home (in 100s) | 5.30* | 0.95* | 0.77* | 1.58* |
| | (0.76) | (0.22) | (0.29) | (0.35) |
| Socioeconomic status | 3.18* | 5.69* | 8.46* | 7.75* |
| | (0.20) | (0.34) | (0.54) | (0.76) |
| **Teacher Characteristics** | | | | |
| Experience (in years) | -0.01 | -0.02 | -0.25 | -0.06 |
| | (0.05) | (0.08) | (0.13) | (0.21) |
| Master's Degree | 0.00 | 2.05 | -0.38 | 1.57 |
| | (0.30) | (1.94) | (0.95) | (1.43) |
| Other prof. degree/ PhD | 1.40* | 1.76 | -1.02 | -1.05 |
| | (0.58) | (1.94) | (1.48) | (1.94) |
| **School Characteristics** | | | | |
| Public School | -1.84* | -1.11* | 3.17* | 1.46 |
| | (0.33) | (0.56) | (1.02) | (1.51) |
| Urban school | 0.27 | -0.40 | 0.58 | -1.05 |
| | (0.26) | (0.51) | (0.80) | (1.26) |
| Rural school | -1.09* | -1.82* | -2.85* | -2.44 |
| | (0.30) | (0.67) | (0.98) | (1.32) |
| Southern school | 0.57 | 1.40* | 2.52* | 1.41 |
| | (0.25) | (0.50) | (0.77) | (1.15) |
| % Minority > 75 | -0.57 | -1.34 | -3.11* | -3.41 |
| | (0.41) | (0.81) | (1.38) | (2.06) |
| **Observations** | 10530 | 9494 | 6801 | 7364 |
| **$R^2$** | 0.25 | 0.23 | 0.29 | 0.29 |

TABLE 5.4 MATH GRADES

| | Kindergarten | First | Third | Fifth |
|---|---|---|---|---|
| **Personal Characteristics** | | | | |
| Male | -0.12 | -0.01 | 0.01 | -0.04 |
| | (0.02) | (0.02) | (0.02) | (0.03) |
| Black | -0.10* | -0.20* | -0.17* | -0.08* |
| | (0.03) | (0.04) | (0.05) | (0.07) |
| Hispanic | -0.11* | -0.08* | -0.07 | 0.07 |
| | (0.03) | (0.04) | (0.04) | (0.06) |
| **Family Characteristics** | | | | |
| WIC Benefits | -0.14* | -0.16* | -0.09* | -0.06 |
| | (0.02) | (0.03) | (0.03) | (0.04) |
| Teenage Mother | -0.07* | -0.07* | -0.07* | -0.10* |
| | (0.02) | (0.03) | (0.03) | (0.04) |
| Mother > 30 yrs | 0.04 | 0.06* | 0.08* | 0.14* |
| | (0.03) | (0.03) | (0.03) | (0.06) |
| Age at K entry (in months) | 0.03* | 0.03* | 0.02* | 0.02* |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| # Books in home (in 100s) | 0.38* | 0.04* | 0.02* | 0.05* |
| | (0.06) | (0.01) | (0.01) | (0.01) |
| Socioeconomic status | 0.17* | 0.23* | 0.23* | 0.22* |
| | (0.01) | (0.02) | (0.02) | (0.03) |
| **Teacher Characteristics** | | | | |
| Experience (in years) | 0.01* | -0.01* | -0.02* | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.01) |
| Master's Degree | -0.09* | -0.13 | 0.07* | -0.01 |
| | (0.02) | (0.12) | (0.03) | (0.05) |
| Other prof. degree/ PhD | -0.05 | -0.13 | 0.00 | -0.01 |
| | (0.04) | (0.12) | (0.05) | (0.06) |
| **School Characteristics** | | | | |
| Public School | 0.08* | 0.02 | 0.14* | 0.08 |
| | (0.02) | (0.03) | (0.03) | (0.06) |
| Urban school | 0.09* | 0.02 | 0.03 | -0.01 |
| | (0.02) | (0.03) | (0.03) | (0.04) |
| Rural school | -0.09* | -0.11* | -0.05 | -0.10* |
| | (0.02) | (0.03) | (0.03) | (0.05) |
| Southern school | 0.02 | 0.05* | 0.09* | 0.05 |
| | (0.02) | (0.02) | (0.03) | (0.04) |
| % Minority > 75 | -0.01 | 0.06 | 0.16* | 0.01 |
| | (0.03) | (0.04) | (0.05) | (0.07) |
| **Observations** | 10530 | 9494 | 6801 | 3611 |
| **$R^2$** | 0.15 | 0.13 | 0.13 | 0.14 |

## 5.3 SCIENCE

Tables 5.3.1 and 5.3.2 give the results for science test scores and grades.[2] Similar to the pattern for math grades and test scores, males score higher than females on science tests, but there is no statistically significant difference between males and females in their science grades. Males score 0.34 points higher on tests of general knowledge in kindergarten. The science test score gap peaks at 3.5 points in the third grade, and then drops to 2.7 points in the fifth grade. There is, however, no gender gap in science grades. In fact, females score 0.13 points higher than males in tests of general knowledge in kindergarten. The coefficient estimate on male remains negative, but it is not statistically significant into the third grade, and then is approximately zero in the fifth grade.

For blacks and Hispanics, the science achievement gap relative to whites is large in both test scores and grades. Blacks and Hispanics earn 6.4 and 2.7 points fewer, respectively, than whites on science tests in the fifth grade. These correspond to approximately one-half of a standard deviation difference in test scores between blacks and whites, and one-quarter of a standard deviation difference in test scores between Hispanics and whites. Their science grades are also 0.23 and 0.21 points lower than whites in the fifth grade. These grades are approximately one-quarter of a standard deviation lower than the grades for white students. Thus, the gaps in science grades relative to science test scores are a bit smaller in magnitude for blacks, but these gaps are consistent for Hispanic students.

[2] In the kindergarten and first grades, these are "general knowledge" test scores and grades. General knowledge questions cover a combination of social science and natural science subject matter. In the third and fifth grades, these test scores and grades reflect science curriculum only.

TABLE 5.5 SCIENCE TEST SCORES

| | Kindergarten | First | Third | Fifth |
|---|---|---|---|---|
| **Personal Characteristics** | | | | |
| Male | 0.34* | 0.72* | 3.48* | 2.74* |
| | (0.13) | (0.19) | (0.39) | (0.68) |
| Black | -2.35* | -2.76* | -7.04* | -6.41* |
| | (0.27) | (0.40) | (0.74) | (1.30) |
| Hispanic | -2.05* | -3.02* | -5.06* | -2.56* |
| | (0.25) | (0.35) | (0.70) | (1.06) |
| **Family Characteristics** | | | | |
| WIC Benefits | -1.16* | -0.95* | -2.37* | -2.93* |
| | (0.17) | (0.27) | (0.54) | (0.79) |
| Teenage Mother | -0.91* | -0.87* | -1.74* | -2.68* |
| | (0.17) | (0.28) | (0.55) | (0.95) |
| Mother > 30 yrs | 1.43* | 0.93* | 2.33* | 2.06* |
| | (0.22) | (0.23) | (0.55) | (1.08) |
| Age at K entry (in months) | 0.40* | 0.27* | 0.38* | 0.40* |
| | (0.02) | (0.02) | (0.05) | (0.07) |
| # Books in home (in 100s) | 5.80* | 0.62* | 0.95* | 0.96* |
| | (0.47) | (0.10) | (0.18) | (0.22) |
| Socioeconomic status | 2.20* | 2.34* | 5.03* | 4.44* |
| | (0.12) | (0.14) | (0.32) | (0.50) |
| **Teacher Characteristics** | | | | |
| Experience (in years) | 0.05 | 0.05 | 0.03 | -0.13 |
| | (0.03) | (0.03) | (0.08) | (0.14) |
| Master's Degree | 0.24 | -1.68 | 0.05 | 0.01 |
| | (0.18) | (1.38) | (0.58) | (0.90) |
| Other prof. degree/ PhD | 0.66* | -1.68 | -0.16 | -0.26 |
| | (0.32) | (1.39) | (0.92) | (1.34) |
| **School Characteristics** | | | | |
| Public School | -0.74* | -0.48 | 1.29 | 0.43 |
| | (0.18) | (0.26) | (0.67) | (0.93) |
| Urban school | 0.25 | 0.22 | 0.45 | 0.08 |
| | (0.16) | (0.23) | (0.48) | (0.81) |
| Rural school | -0.68* | -0.35 | 0.11 | 0.57 |
| | (0.19) | (0.26) | (0.57) | (0.87) |
| Southern school | -0.49* | -0.25 | 0.03 | 1.07 |
| | (0.15) | (0.22) | (0.47) | (0.76) |
| % Minority > 75 | -2.83* | -2.87* | -4.42* | -5.46* |
| | (0.27) | (0.37) | (0.76) | (1.30) |
| **Observations** | 10530 | 9494 | 6801 | 7364 |
| **$R^2$** | 0.41 | 0.36 | 0.38 | 0.37 |

TABLE 5.6 SCIENCE GRADES

| | Kindergarten | First | Third | Fifth |
|---|---|---|---|---|
| **Personal Characteristics** | | | | |
| Male | -0.13* | -0.04* | -0.02 | 0.00 |
| | (0.02) | (0.02) | (0.03) | (0.05) |
| Black | -0.08* | -0.17* | -0.20* | -0.23* |
| | (0.04) | (0.05) | (0.05) | (0.10) |
| Hispanic | -0.13* | -0.12* | -0.13* | -0.21* |
| | (0.03) | (0.04) | (0.05) | (0.08) |
| **Family Characteristics** | | | | |
| WIC Benefits | -0.12* | -0.18* | -0.09* | -0.10 |
| | (0.03) | (0.03) | (0.04) | (0.06) |
| Teenage Mother | -0.07* | -0.06* | -0.09* | -0.15* |
| | (0.03) | (0.03) | (0.04) | (0.06) |
| Mother > 30 yrs | 0.06* | 0.11* | 0.11* | 0.13 |
| | (0.03) | (0.03) | (0.04) | (0.07) |
| Age at K entry (in months) | 0.03* | 0.03* | 0.02* | 0.01 |
| | (0.00) | (0.00) | (0.00) | (0.01) |
| # Books in home (in 100s) | 0.42* | 0.06* | 0.03* | 0.01 |
| | (0.07) | (0.01) | (0.01) | (0.03) |
| Socioeconomic status | 0.21* | 0.22* | 0.27* | 0.24* |
| | (0.02) | (0.02) | (0.02) | (0.04) |
| **Teacher Characteristics** | | | | |
| Experience (in years) | 0.00 | -0.01* | -0.02* | -0.01 |
| | (0.00) | (0.00) | (0.01) | (0.01) |
| Master's Degree | -0.07* | -0.25 | 0.08* | 0.18* |
| | (0.03) | (0.13) | (0.04) | (0.06) |
| Other prof. degree/ PhD | -0.10* | -0.23 | 0.02 | 0.23* |
| | (0.05) | (0.13) | (0.06) | (0.10) |
| **School Characteristics** | | | | |
| Public School | -0.04 | 0.05 | 0.15* | 0.16* |
| | (0.03) | (0.03) | (0.04) | (0.08) |
| Urban school | 0.10* | 0.12* | 0.04 | 0.16* |
| | (0.02) | (0.03) | (0.03) | (0.06) |
| Rural school | -0.04 | -0.06 | -0.03 | 0.04 |
| | (0.03) | (0.04) | (0.04) | (0.06) |
| Southern school | -0.01 | 0.02 | 0.08* | 0.13* |
| | (0.02) | (0.03) | (0.03) | (0.06) |
| % Minority > 75 | 0.06 | 0.11* | 0.02 | -0.03 |
| | (0.04) | (0.05) | (0.05) | (0.09) |
| **Observations** | 10530 | 9494 | 6801 | 3445 |
| **$R^2$** | 0.14 | 0.12 | 0.13 | 0.15 |

## 5.4 CLASSROOM BEHAVIOR – APPROACHES TO LEARING AND SELF-CONTROL

Tables 5.4.1 and 5.4.2 show results for the behavioral rating scale in the ECLS-K sample. Though teachers (and parents) grade the children in the data set on a variety of behavioral assessments (e.g., frequency the child internalizes and externalizes problems, the child's interpersonal skills), this thesis only describes the results for how well the child "approaches learning" and how well the child exercises "self-control" in the classroom. These two measurements are consistently available for all four time periods, and they proxy for non-cognitive skills the children possess. This analysis includes non-cognitive skills because they are important inputs for educational achievement as well as labor market outcomes (Heckman 2008). Combining gender differences in non-cognitive and cognitive skills offers a more detailed depiction of the gender achievement gap.

Teachers rate males as significantly less likely to be engaged in classroom learning or to exercise self-control. On a continuous 0-3 point scale, kindergarten males earn 0.30 points lower than females for their interest in learning activities and 0.20 points lower in their degree of self-control. These are substantial gaps, amounting to one-half and one-third of a standard deviation, respectively, in behavioral scores. Moreover, the gaps in classroom behavioral assessments between males and females increase in magnitude over time. In the fifth grade, males score nearly two-thirds of a standard deviation lower for their interest in classroom learning. Similarly, the score gap for self-control in the classroom increases moderately to more than one-third of a standard deviation.

There is a race gap in behavioral scores, but it is less than one-third of the behavioral score gap by gender. Blacks earn 0.10 points fewer than whites for their interest in kindergarten learning, and this gap increases slightly to 0.12 points in the fifth grade. Blacks also earn lower

scores than whites for self-control in the classroom, but these coefficient estimates remain smaller than those that measure the male-female gap in self-control. There is no statistically significant gap between whites and Hispanics in their approaches to learning. For self-control in the classroom, Hispanics have higher scores than whites in the third and fifth grades.

TABLE 5.7 CLASSROOM BEHAVIOR - APPROACHES TO LEARNING

| | Kindergarten | First | Third | Fifth |
|---|---|---|---|---|
| **Personal Characteristics** | | | | |
| Male | -0.30* | -0.30* | -0.32* | -0.39* |
| | (0.01) | (0.02) | (0.02) | (0.02) |
| Black | -0.10* | -0.18* | -0.19* | -0.12* |
| | (0.03) | (0.03) | (0.04) | (0.06) |
| Hispanic | 0.01 | 0.04 | 0.01 | 0.04 |
| | (0.02) | (0.03) | (0.03) | (0.04) |
| **Family Characteristics** | | | | |
| WIC Benefits | -0.14* | -0.14* | -0.14* | -0.14* |
| | (0.02) | (0.02) | (0.03) | (0.03) |
| Teenage Mother | -0.07* | -0.06* | -0.10* | -0.06 |
| | (0.02) | (0.02) | (0.03) | (0.04) |
| Mother > 30 yrs | -0.03 | 0.02 | -0.04 | 0.04 |
| | (0.02) | 0.02) | (0.03) | (0.03) |
| Age at K entry (in months) | 0.02* | 0.02* | 0.01* | 0.01* |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| # Books in home (in 100s) | 0.20* | 0.02* | 0.01 | 0.03* |
| | (0.05) | (0.01) | (0.01) | (0.01) |
| Socioeconomic status | 0.09* | 0.13* | 0.16* | 0.14* |
| | (0.01) | (0.01) | (0.01) | (0.02) |
| **Teacher Characteristics** | | | | |
| Experience (in years) | 0.02* | 0.00 | 0.00 | 0.01 |
| | (0.00) | (0.00) | (0.00) | (0.01) |
| Master's Degree | -0.02 | -0.27* | 0.04 | 0.11* |
| | (0.02) | (0.10) | (0.03) | (0.04) |
| Other prof. degree/ PhD | -0.05 | -0.27* | 0.01 | 0.08 |
| | (0.03) | (0.10) | (0.04) | (0.06) |
| **School Characteristics** | | | | |
| Public School | 0.07* | 0.06* | 0.02 | -0.01 |
| | (0.02) | (0.02) | (0.02) | (0.04) |
| Urban school | 0.02 | 0.03 | 0.00 | -0.01 |
| | (0.02) | (0.02) | (0.02) | (0.03) |
| Rural school | -0.03 | 0.00 | -0.03 | 0.04 |
| | (0.02) | (0.02) | (0.03) | (0.03) |
| Southern school | -0.03 | 0.00 | 0.05* | 0.07* |
| | (0.02) | (0.02) | (0.02) | (0.03) |
| % Minority > 75 | 0.03 | 0.07* | 0.06 | 0.08 |
| | (0.03) | (0.03) | (0.04) | (0.05) |
| **Observations** | 10530 | 9494 | 6801 | 7428 |
| **$R^2$** | 0.14 | 0.13 | 0.16 | 0.18 |

TABLE 5.8 CLASSROOM BEHAVIOR - SELF-CONTROL

| | Kindergarten | First | Third | Fifth |
|---|---|---|---|---|
| **Personal Characteristics** | | | | |
| Male | -0.20* | -0.19* | -0.22* | -0.23* |
| | (0.01) | (0.01) | (0.02) | (0.02) |
| Black | -0.15* | -0.16* | -0.21* | -0.16* |
| | (0.03) | (0.03) | (0.04) | (0.06) |
| Hispanic | 0.02 | 0.03 | 0.06* | 0.09* |
| | (0.02) | (0.03) | (0.03) | (0.04) |
| **Family Characteristics** | | | | |
| WIC Benefits | -0.11* | -0.10* | -0.13* | -0.09* |
| | (0.02) | (0.02) | (0.02) | (0.03) |
| Teenage Mother | -0.05* | -0.06* | -0.06* | -0.10* |
| | (0.02) | (0.02) | (0.03) | (0.03) |
| Mother > 30 yrs | -0.04* | -0.03 | -0.08* | -0.02 |
| | (0.02) | (0.02) | (0.03) | (0.03) |
| Age at K entry (in months) | 0.01* | 0.01* | 0.00 | 0.01 |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| # Books in home (in 100s) | 0.10* | 0.01 | 0.01 | 0.01 |
| | (0.05) | (0.01) | (0.01) | (0.01) |
| Socioeconomic status | 0.04* | 0.07* | 0.08* | 0.09* |
| | (0.01) | (0.01) | (0.01) | (0.02) |
| **Teacher Characteristics** | | | | |
| Experience (in years) | 0.01* | 0.00 | 0.01 | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.01) |
| Master's Degree | 0.01 | -0.25* | 0.06* | 0.07 |
| | (0.02) | (0.08) | (0.03) | (0.04) |
| Other prof. degree/ PhD | -0.05 | -0.26* | 0.01 | 0.06 |
| | (0.03) | (0.08) | (0.04) | (0.05) |
| **School Characteristics** | | | | |
| Public School | 0.09* | 0.10* | 0.01 | 0.03 |
| | (0.02) | (0.02) | (0.02) | (0.04) |
| Urban school | 0.02 | 0.04* | 0.01 | -0.03 |
| | (0.02) | (0.02) | (0.02) | (0.03) |
| Rural school | -0.01 | -0.02 | -0.02 | -0.02 |
| | (0.02) | (0.02) | (0.02) | (0.03) |
| Southern school | 0.00 | -0.01 | 0.04* | 0.06* |
| | (0.02) | (0.02) | (0.02) | (0.03) |
| % Minority > 75 | -0.06* | 0.00 | -0.03 | -0.01 |
| | (0.03) | (0.03) | (0.04) | (0.05) |
| **Observations** | 10530 | 9494 | 6801 | 7428 |
| **$R^2$** | 0.09 | 0.08 | 0.11 | 0.11 |

# CHAPTER 6

# CONCULSION

The results of this paper confirm that a gender gap in educational achievement exists among children ages 5-12. The nature of the gap is also consistent over time. Males score higher than females on math and science tests, whereas females score higher than males on reading tests. Females score higher than males on indirect measures of skill (i.e. grades and classroom behavior). The gaps by gender are larger than the gaps by race and ethnicity in the case of reading test scores, reading grades, and both indices of classroom behavior. The gender gap is notably pronounced for outcomes of relatively subjective measurement, where teachers evaluate the students. Cumulatively, these results suggest that more non-cognitive skills at early ages for females may help to explain the gender gaps in measured educational achievement.

This paper's analysis does not account for the gender of the teacher because NCES suppressed that information in the data set. The feminization-of-schools literature, which documents the increasing proportion of teachers who are female, might explain the gender gap in subjective outcomes. Female teachers may favor female students in the classroom, or their teaching techniques may better suit female students' learning styles. In either case, the gender of the teacher may affect the academic achievement and behavior of males and females in the classroom.

Another potential explanation for the gender gap is the classroom sex composition, the ratio of males to females in the classroom. Teaching males and females separately has received attention in the mainstream media (Weil 2008). It is possible that separating males from females

in school may increase the achievement levels of both groups of students. Though this notion more often applies to adolescent children, it may prove effective for younger children as well, particularly if the separation mitigates behavioral problems. The ECLS-K data set contains variables pertaining to the number of males and females in the classroom, so this will be one of the next steps in understanding the gender gap.

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