COLUMBIA UNIVERSITY

Closing the Gender Gap

QMSS Master's Thesis

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Abstract

In this paper I argue that the gender gap in reading achievement is due to male students in low socioeconomic status (SES) environments having an oppositional attitude toward school where they can gain status by flouting school whereas female students in all SES environments are equally engaged in academics. However, in high-SES schools male oppositional attitudes are moderated and the gender gap closes. I model these effects with a hierarchical linear model and find that male students are more sensitive to changes in a school's average SES but not the diversity in SES backgrounds even after controlling for other cultural indicators. As a result, in high-SES schools, male students on average perform as well if not better than female students. The gender gap then is a result of school composition rather than innate gender differences.

I. Introduction

Over the past several decades female students have caught up and surpassed male students in college attendance, test scores, dropout at lower rates, and other educational outcomes. While there are several competing explanations for the gender gap ranging from innate biological differences to the school environment being more feminine and less accepting of masculine learning behavior, in this paper I argue that peer effects are primarily responsible for the gender gap. Male students respond more positively in school environments that emphasize academic success than female students whose attitudes toward school are more stable across all backgrounds. I use a school's average socioeconomic status (SES) and how diverse a school's population is on a socioeconomic scale as two different measures of a school's culture and examine their effects on both male and female students.

Average socioeconomic status and a school's socioeconomic diversity is an extension of previous research that found strong connection between an individual's SES and their academic achievement. Students from higher SES backgrounds, as measured by their parents SES, generally perform better than students from lower SES backgrounds. These results are explained by the observation that students at higher levels of SES are often more motivated and more competent in the skills necessary for success in school. However, the gender gap is not concentrated by low- or high-SES background students as male students at all SES levels have in the last several decades been performing worse than female students. There must instead be another factor influencing educational outcomes that affects male and female students differently.

I hypothesize in this paper that the driving force behind the gender gap is the different ways that male and female students respond to the academic culture of their school and adopt positive and negative attitudes toward academics that accounts for their different outcomes. My first hypothesis is that male students in schools with high average SES will perform as well as female students but male students will perform worse in low average SES schools. As a result, the gender gap will be concentrated in low-SES schools and absent in high-SES schools. Similarly to individual SES, a school's average SES measures the motivation of the student body and academic-oriented culture of the school. High-SES schools are expected to have cultures where students are expected to attend college and succeed in school more than schools with low average SES. These expectations are driven not only by students individually being more motivated but the culture of the schools focusing students on academic success.

It is this difference in cultures as measured by school SES, the aggregate of individual student SES, that explains the gender gap. The attitude that male students have toward school is more pliant than that of female students. For male students in some cultural situations success in school can be considered effeminate or looked down upon whereas for female students success in schools is rarely considered unfeminine. As a result, male students can gain status with their peers by not succeeding in school or purposefully acting out against teachers and school authorities. Since students with high-SES backgrounds are more academically inclined, schools with high average SES have cultures where success in academics is desirable and, for male students, not considered effeminate but desirable.

My second related hypothesis is that greater diversity in the SES backgrounds of a school's students is also driving the gender gap. A school's SES diversity is measured by the standard deviation of the school's average SES. Male students in schools with high diversity will perform worse academically as anti-authority and school attitudes may serve a cohesive function for students from dissimilar backgrounds while female students at all levels of SES maintain similar attitudes toward school.

In order to model these cultural and peer effects, I use data from the National Education Longitudinal Study (NELS) dataset, which includes survey data of middle and high school students and was conducted from 1988 to 2000. While the data lacks the internal validity of random assignment, the NELS dataset is a nationally representative survey and includes nested data with information on students as well as their schools. In addition to measures of academic achievement and socioeconomic status, the NELS dataset includes variables for a student's race, the type of school they attend, the school's geographic location, and individual behaviors and attitudes.

The paper is organized as follows. Section II reviews past literature on the gender gap, several theories for the cause of educational disparities, and several methodological issues related to measuring peer effects. Section III outlines the National Education Longitudinal Study dataset used to explore peer effects for a national sample of high school students in the 1990s along with several descriptive statistics of note. Section IV discusses the methodology and models of the paper. Section V presents the results of the model and peer effects on academic achievement. Section VI summarizes the results, limitations, and presents several avenues for future research.

II. Literature Review

While there has been much focus in the past on the disparity of educational opportunities for racial minorities and lower social classes, the growing gender gap between male and female students is of increasing concern as female educational attainment continues to exceed that of their male counterparts. Between 1979 and 2000, the proportion of college students who are women increased from 42% to 58% (Freeman, 2004; Aud, 2012). Although the decline in men's educational attainment has been attributed to the larger benefits of education for women compared to men, the difference in benefits cannot explain the gap in educational attainment, as it predates college with a prevalent gap in academic achievement as early as fifth grade (DiPrete, 2006; Legewie, 2012).

The gains women have made in educational attainment extend to areas such as science, technology, engineering, and mathematics (STEM fields) that have also traditionally been dominated by men. Earlier researchers were concerned about a different gender gap that emerged in high school where male students were not only out performing female students on average, but male students were outnumbering female students in the 95th and 99th percentile of math test scores (Hyde, 2009). However, recent research has found that differences in gender equity and schooling may account for the gender gap in math scores with women performing on par with men (Hyde, 2009; Kane, 2012). As the gender gap in math and science is still under debate, in this paper I will focus on the reading and verbal gap, in which women consistently outperform men, and which is indicative of the overall trends in male and female academic achievement.

The broader literature on educational attainment and disparities has focused on separating out the effects of inputs (a student's race, family background, and neighborhood) and the effects of schools (teacher quality, school resources, and culture). Among these inputs, a student's SES background is one of the strongest predictive measures of academic achievement (White, 1982; Sirin, 2005). Starting with the Coleman Report (Coleman, 1966), social scientists have argued that social inequalities in a student's background are not wiped away by schools, but rather impact the effectiveness of teachers and thus student achievement. In this case, a student's background has typically been measured by their socioeconomic status, which generally contains measures of parental income, education, and occupation with each measure encapsulating a different aspect of SES (Duncan, 1972). Parental income indicates the amount of resources available to the student but is not a stable measure of a student's available resources throughout school as income can fluctuate wildly over time. To account for this, parental education is used as an additional component of SES as it is a more stable measure of the student's resources and class since parents have typically finished with their education before having children (Hauser, 1994). The occupations of a student's parents also indicate a level of social and economic status, as well as the prestige of the social class they are in, which carries separate cultural weight and association with academic attitudes apart from income or wealth.

While the Coleman Report found that family effects are the most robust determinant of student performance, it also argued that student performance improves when their peers have greater socioeconomic resources and there is some evidence to support this. Using tenth-grade Louisiana GEE scores, Caldas and Bankston (1997) found that the positive change in schoolmates' SES had a positive effect on individual test scores after controlling for family background and school composition. In other words, attending school with schoolmates of high-SES backgrounds improved individual test scores. More generally, Rumberger and Palardy (2005), using the NELS second follow-up, found that school-level SES has as great of an impact on academic achievement as individual SES for both whites and blacks.

Legewie and DiPrete (2012) more explicitly explored the relationship between gender and average school SES using German ELEMENT data, which revealed that fifth grade boys were far more sensitive to school-level SES than girls. They found that an increase in school-level SES had one third the effect on female students' test scores that it did on male students' scores. Both authors argue that the sensitivity to SES indicates that male culture, which is oppositional to academic success at low-SES levels, is suppressed as school-level SES increases. In addition, Crosnoe (2009) found that increasing the number of high-SES students in a school increases the academic achievement of an individual student's reference group. These two effects may be self-reinforcing and explain the difference in academic achievement between the genders.

There is also anthropological evidence that cultural differences between the genders may be partially responsible for the gender gap in academic achievement. As Morris (2008) points out in his study of Clayton High School, among working-class boys masculine behavior includes resistance to school and a lack of ambition for higher-education. This academics-resistant culture provides an incentive for boys to act out or increase their prestige by performing poorly in school. On the other hand, working-class girls do not view resistance to school or academic success as unfeminine (Maccoby, 1998).

This divide in gender expectations then moderates the effects of peer SES on academic achievement as individual students use their peers as a reference group and measure their own performance against those similar to themselves (Crosnoe, 2009). Schools with low-SES males not only have a culture that negatively influences male attitudes towards academic achievement, but that attitude is reinforced by having a reference group with poor academic achievement. This problem is confounded by neighborhood compositional effects as low-SES students are more likely to be in schools with other low-SES students (Caldsas, 1997).

While some studies have also indicated that peer effects were quite small, only recently have social scientists started grappling with the methodological problems of measuring peer effects. The measurement of peer effects suffers because of the difficulty in separating out three different types of social effects: endogenous effects, contextual (exogenous) effects, and correlated effects (Manski, 1993; Gaviria, 2001, Fletcher, 2007). Endogenous effects are the effects that a group's behavior has on an individual. For example, the likelihood of smoking increases as the number of peers who smoke increases. Contextual effects are the effects that a group's exogenous characteristics have on an individual. For example, the likelihood I begin to smoke increases as the number of my peers' parents who smoke increases. Correlated effects are the effects that influence behavior due to individuals sharing similar environments or characteristics. For example, the likelihood I and another classmate begin to smoke is the same because our parents smoke.

In addition to the methodological difficulties, social scientists have also disagreed on whether a student's neighborhood or school is the proper peer reference group. Wilson (1987) argued for a spatial model of behavior where neighborhood institutions and role-models shape behaviors with differences in neighborhood composition being partially responsible for disparate outcomes. However, as Teitler and Weiss (2000) found in their study using the Philadelphia Teen Survey, neighborhood peer effects on sexual initiation disappear once school peer effects are included in the model. Their results indicate that neighborhood effects are only important as they indicate which school a student attends. Rather than peer effects being spatially defined, they are socially defined with schools, where students spend most of their time during the week.

In additional to sexual initiation, there is evidence that peer effects influence a wide range of behaviors. Gaviria and Raphael (2001), using the National Education Longitudinal Study (NELS) for tenth-graders, found significant peer effects for drug use, alcohol use, cigarette smoking, church attendance, and dropping out. For example, in a class of 25 students, an increase in the percentage of parents who have drug problems from 13 to 40 percent leads to an individual tenth-grader being 7.1 percentage points more likely to use drugs. Of that 7.1 percent increase, 5.3 percent was the direct effect of parents using drugs (contextual effect) and 1.8 percent due to the increase in the student's peers who are using drugs (endogenous peer effect).

Similarly, Fletcher (2007), using the NELS second follow-up for 12th graders, found that increasing the percentage of students in a school who have had sex by 10 percent increases the individual likelihood by three percentage points. Once peer effects were broken out by gender, the results showed that peer effects were only present for male students, with an increase in school-level sexual behavior having no effect on individual female behavior. In addition, Fletcher found that peer effects were absent for Hispanic and Black students. These results indicate that peer effects are not homogenous across gender or race and that school composition will affect outcomes differently across groups. Peer effects then affect all sorts of behaviors across all ages and often the effect is different for male students than female students.

III. Data

Data for this paper are from the National Education Longitudinal Study (NELS) Fourth Follow-up, which includes data from 1988 through 2000. The NELS study was designed to track the high school experience of students in the early 1990s. The 1988 survey collected information on the cohort's 8th grade experience, with follow up waves in 1990 and 1992 collecting information on their high school experience. Students were selected from a clustered, stratified national probability sample of public and private schools. The selected students were surveyed in the spring semester of the 1988 school year with subsequent follow-ups in the 2nd semesters of the 1990 and 1992 school years. In addition to students, survey participants also included school principals, two teachers, and one parent of each student. While the NELS dataset contains observations for a total of 24,599 8th graders, in 2000, the final year of the study, there are observations for 12,144 students from 1,475 schools.

The NELS dataset includes information on student characteristics such as race, gender, grades, and scores on standardized tests in subject areas like math, reading, science, and social sciences. Family background data is also compiled and includes information on parental occupation, income, educational attainment of family members, the number of siblings a respondent has, and the composition of the household. School attribute data obtained from school administrators' surveys include the type of school the respondent attended, the school's urbanicity, and the courses offered. Since the students are tracked from 8th grade through 12th grade, it is possible to track their academic and social progress throughout high school. While there are 12,144 students in the NELS data set across all five waves, I drop students with missing observations for math and reading scores, socioeconomic indicators, and behavior and attitude characteristics, which leaves 7,201 observations across 1,037 schools. In addition, the NELS dataset contains survey weights, which when applied to the 10th and 12th grade cohort provide population-level rather than sample-level estimates of the parameters.

Reading Achievement

Reading achievement is measured using standardized tests in reading tests in the base year (8th grade, 1988), first follow-up (10th grade, 1990), and second follow-up (12th grade, 1992). In the first and second follow-ups, there were two different reading tests that a student might have taken based on their previous achievement. Multiple forms were used due to the diversity of experience that students may have had in English based on differing course loads across students and schools. The easier reading test was given to students who scored below the sample mean in the previous test. The reading tests were then standardized to a common continuous ability scale. This allows scores to be compared across schools and student experience. Scores on reading achievement range from 29 to 68 points.

Socioeconomic Status

The student's socioeconomic status is measured by responses from the parental questionnaire regarding the father's education level, mother's education level, father's occupation, mother's occupation, and family income. Family income was measured by summing the number of non-missing household items (dictionary, pocket calculator, a separate place to study, etc.) in the student's home, calculating the mean, and then standardizing to the mean. In the NELS dataset, socioeconomic status ranges from -2.23 to 1.91 in the base year, -2.25 to 2.76 in the first follow-up, and -2.24 to 2.75 in the second follow-up. In this paper, rather than having the mean centered around 0, I recalculated each variable to have a minimum value of 0. As a result, in the base year SES ranges from 0 to 4.14, 0 to 4.26 in the first follow-up, and 0 to 4.25 in the second follow-up. This will ease the interpretation of the SES coefficients in the regression models.

In addition, I generate two aggregate measures of SES. The first is the average SES for each school which is the key variable for testing the first hypothesis. In the 10^{th} grade cohort, school SES ranges from 0.37 to 4.03 with a mean of 2.28. Similarly for the 12^{th} grade cohort, school SES ranges from 0.37 to 4.01 with a mean of 2.27. The lack of variation is expected as SES does not change that significantly over two years. Even though parental income and occupation may change, parental education does not. The second aggregate measure I generated is the standard deviation of a school's average SES, which is the key variable for testing the second hypothesis. In the 10^{th} grade cohort, the school average SES standard deviation ranges from 0.32 to 1.66 with a mean of 0.60. For the 12th grade cohort, the standard deviation variable ranges from 0.32 to 1.65 with a mean 0.60. Again, no significant differences between cohorts as SES, and hence its standard deviation, does not change over such a short time period.

Lastly, I created quartiles by student SES, which show the differences across SES groups in both reading achievement and in other social and behavior levels. As I argued in the introduction, different attitudes toward schooling and academic success can be seen across different levels of SES. The quartile groupings of students are used to show how diverse the outcomes between low- and high-SES students can be.

Gender and Race

Gender is a dummy variable where males received a score of 0 and make up 47% of the sample. Race is a nominal variable with five possible answers: Asian (N=471), Hispanic (N=770), Black (N=627), White (N=5268), and American Indian (N=65). Asian is the base category in the regression analysis with the other races included as dummy variables.

Attitudes and Behaviors

In addition, to determine whether differences in reading scores are driven by individual-level characteristics rather than school average SES, variables for how important the student's friends consider grades, how motivated the student is, and how many hours the student spends on homework are included. The NELS student questionnaire includes a question asking the respondent how important among friends it is to get good grades, with responses ranging from 1 "Not Important" to 3 "Very Important", which measures a respondent's peers' attitudes toward school and academic achievement. This question of how important the student's friends consider grades measures the influence friends may have over attitudes towards school versus the overall school average culture. In addition, this question is indicative of the subculture a student is part of as people are usually friends with people of similar values. For example, those who care about grades are likely to be friends with other students who care about grades.

The number of hours students spend on HW out of school is an ordinal variable where a student can respond “none” (with the response coded as 0), “less than 1 hour” (one), “1-3 hours” (two), “4-6 hours” (three), “7-9 hours” (four), “10-12 hours” (five), “13-15 hours” (six), “16-20 hours” (seven), or “over 20 hours” (eight). The number of hours a student spends on homework is indicative of how seriously they take their studies as well as the difficulty of their courses. Students who spend more time on homework are also expected to perform better on the NELS standardized reading test. In addition, student motivation is measured through the NELS teacher questionnaire, which asks each student’s teacher “Is this student motivated to work hard for good grades?” with a response of 0 indicating “No” and a 1 indicating “Yes”. The teacher questionnaire provides a student-independent measure of how seriously the student is taking school and how engaged they are in academics.

School-Level Controls

While I aggregated individual SES to a school average as one of the main variables of interest, there are other school-level variables included as controls. One measure of a school’s academic culture and seriousness toward academics is whether the school offers Advanced Placement (AP) courses or not. In the NELS dataset, the number of AP courses offered by schools ranges from 0 to 80 with 26% of schools in the sample offering no AP courses. This variable was recoded into a dummy variable with 0 indicating no AP courses were offered at the school and 1 indicating that AP courses are offered regardless of the number. While there may be differences between schools that offer only a couple of AP courses and those that offer 80 courses, any school that offers AP courses has already invested resources into student education beyond teaching them the base level of coursework. The AP course dummy variable measures whether or not schools have additional resources to put into student education beyond the basics.

I include control variables for both the urbanicity of a school (N=1,037 schools in the sample), which is whether the school is in an urban (N=344), suburban (N=413), or rural area (N=280), and for whether the school is public or private. Urbanicity controls for differences in school culture that may exist between schools of different localities. In addition to a response of public school (851), private schools are broken up into three different nominal categories: Catholic (N=106), Private – Other Religion (N=32), and Private – non-Religious (N=48).

I also generate three additional variables by aggregating the individual-level attitude and behavior variables to the school-level in order to determine if the effects of school average SES operates independently of any other measured behavior. The school average number of hours that students spend on homework indicates how much time on average students in a school spend on their homework. This is not only indicative of how seriously students on average take their academics in a school but also how many hours of homework the school is assigning to students. Schools that assign more homework could have cultures that are more academically oriented than schools that assign less homework.

The school average of how important each student's friends consider grades is an indicator of the general school attitude toward academics. In schools with cultures of high academic expectations, students and their friends will care about their grades. While I argue that SES is a more encapsulating measure of the school's culture and background of its students, this variable provides an additional control of school culture. Lastly, aggregating student motivation to the school-level is another control for how seriously students take their studies and how academically oriented a school's student culture is.

Descriptive Analysis

Table 1 describes the relationship between a student's socioeconomic status, gender, and score on the standardized reading test in the base year, first follow-up, and second follow-up. Female students perform significantly better than male students across all three waves and SES quartiles with the exception of the first quartile in 8th grade. In addition, students in the highest SES quartile perform over one standard deviation better than students in the lowest for both genders and in all three waves. This pattern holds for male and female students and shows how influential a student's socioeconomic background is on academic outcomes.

Tables 2 and 3 list the average reading achievement scores broken out by gender for the race and school-level controls, which include whether a school offers AP courses, its urbanicity, and the type of school. Among 10th grade students, female students perform better than male students in schools that do and do not offer AP courses as well as in public schools, suburban, and rural schools. However in all types of private schools and urban schools there is no gender gap. This pattern holds among 12th grade students as well. In 10th grade the gender gap is only significant among white students; however, by 12th grade there is also a significant gender gap among black students.

Tables 4 and 5 contain the overall means, gender means, and differences for the individual-level attitude and behavior measures broken out by SES quartiles. Across all quartiles, female students spend more time on homework, care more about their friends' grades, and are more motivated in both 10th grade and 12th grade. The only measure where no gender gap is present is for the time spent on homework in the first quartile of SES, which holds across grade levels. Table 6 presents the school-average means, gender means, and differences for the aggregated attitude and behavior measures. As expected, on average, female students spend more time on homework, care more about friends' grades and are more motivated. However, the gender gap in motivation is not significant among 10^{th} grade students.

IV. Methods

While the descriptive analysis shows that gender gaps exists not only in reading scores but also in attitudes and behavior across schools and races, testing both hypotheses will require regression analysis where the different effects of SES can be measured holding other measures constant. However, the effect of SES on student achievement along with the relevant peer effects cannot be measured with a simple OLS regression due to the nested nature of the data. Students are grouped into schools which confound simple OLS regressions as the error terms become correlated based on shared schools. I use a two-level hierarchical model to examine how average school SES affects male and female students while controlling for both individual- and group-level effects. The two-level model accounts for not only individual-level factors such as a student's SES, grades and gender, and group-level factors like a school's course offerings and urbanicity, but also contextual effects where individual-level variables are aggregated to the school-level. The contextual variable average SES and the interaction term with the respondent's gender are the main variables of interest, which together explain the relationship between gender and academic achievement.

In addition to aggregating the peer effects to the school-level, the hierarchical, multilevel model employed here will control for random group-level variation, which allows for examination of between-group relationships (how schools differ from each other and affect outcomes) and within-group relationships (how differences between students in individual schools affect outcomes). The justification for employing a hierarchical model is first demonstrated by examining school-level variation in reading scores with a simple random effects analysis of variance (ANOVA) model. The one-way ANOVA model expressed in equation (1) determines the degree of resemblance between students in the same school by calculating the Intraclass Correlation Coefficient (ICC). In other words, ICC measures the degree of variation between students that can be attributed to school-level effects.

$$Y_{ij} = \mu + U_j + R_{ij} \qquad (1)$$

In equation (1), Y_{ij} is the achievement score in math or reading that is observed for student i^{th} in the j^{th} school, μ is the population mean across all students, U_j is the specific effect from the j^{th} school, and R_{ij} is the residual effect for student i within the school. The average achievement of each school can be determined by summing $\mu + U_j$, with each student varying from the mean by R_{ij}. The school effect U_j is independent and has a mean of 0 and a variance of τ^2, which is the population between-group variance and represents the variation in means across schools. Similarly, the residuals Rij also have a mean of 0 and a variance of σ^2, which is the population within-group variance or the variance among students. Thus, the total variance of the model is equal to the sum of the population between-groups variance and the population within-groups variance as seen in equation (2).

$$\text{var}(Y_{ij}) = \tau^2 + \sigma^2 \qquad (2)$$

The Interclass Correlation Coefficient (ICC) is the proportion of the total variance that the population between-group variation explains as shown in equation (3). In other words, the ICC explains the amount of variation that school level effects can account for out of the total variation. Table 7 has the complete results of the one-way ANOVA for both 10^{th} grade and 12^{th}

grade reading achievement. For 10^{th} grade reading achievement, the between-group variance (τ^2) is 16.57 and the within-group variance (σ^2) is 76.71, which by equation (3) yield an ICC of 0.18. Calculated similarly, the ICC for 12^{th} grade reading achievement is 0.16. These results indicate that the proportion of variance accounted for by schools is 18% for 10^{th} grade achievement and 16% for 12^{th} grade reading achievement, which matches the results of Hedges and Hedberg's (2007) report on educational performance where the ICC values ranged from 0.10 to 0.25.

$$ICC = \rho_I = \tau^2 / (\tau^2 + \sigma^2) \qquad (3)$$

Since school-level effects explain a significant part of the variance, a multilevel model is necessary to produced unbiased results. The next section introduces the random intercept model and the subsequent section describes the random intercept and slope model. The following analysis examines the relationship between SES and achievement using the two different models and what the results imply.

Random Intercept Model

As seen in Table 6, there is significant variation in average reading achievement by schools with 10^{th} grade scores having a two standard deviation range of 32.92 to 71.51 and 12^{th} grade reading scores from 38.19 to 65.95. The random intercept model reflects this variation in average achievement scores by allowing the intercept to vary by group. Equation (4) is the multivariable random intercept model. The fixed effects coefficients γ_{10} through γ_{p0} represent the effect of an individual-level explanatory variable for individual *i* in group *j*. For example, γ_{10} could represent the effect of an individual's SES on math achievement. The fixed effects coefficients γ_{01} through γ_{0q} represent the effect of a group-level explanatory variable for group *j*. For example, γ_{01} could represent the effect a school's average SES has on an individual's math achievement. The variable R_{ij} is the residual, which as in the OLS model is required to be mutually independent with a mean of 0.

$$Yij = \gamma_{00} + \gamma_{10}x_{1ij} + \ldots + \gamma_{p0}x_{pij} + \gamma_{01}z_{1j} + \ldots + \gamma_{0q}z_{qj} + U_{0j} + R_{ij} \quad (4)$$

The random intercept model allows the intercept to vary by group, which captures the unique effect of each school on its students. The coefficient U_{0j} is added to γ_{00}, which is the average intercept for the whole population, to determine each school's intercept. The coefficient U_{0j} represents the unexplained group mechanisms that are believed to operate similarly from one group to the next, but that are also independent between groups. For example, U_{0j} could represent overall school culture that cannot be measured, but each school has an overall academic culture that contributes to its students' achievement. This assumption of similarity between operation and independence means that the residuals are exchangeable and that data from each group can be used for inference in other groups. This is important because there are many schools with less than 25 observations for which inference would be impossible without this assumption.

The intercept then for each school *j* is calculated as $\gamma_{00} + U_{0j}$ and the range in the intercept can be calculated using the level-two variance (τ^2) and a proposed confidence interval. For example, the level-two variance in Table 7 for 10th grade achievement is 16.57 and the average intercept for the population (γ_{00}) is 52.25. A school that is in the bottom 2.5% of the sample will have a value of U_{0j} that is two standard deviations below the average, which means that the school's intercept will be 52.34 - 2 x √16.57 or 44.11. By calculating different intercepts but also calculating coefficients based on population variation, the random intercept model accounts for group variance while also efficiently estimating the fixed effects.

Random Intercept and Slope Model

In the random intercept model, the only random group effect was the intercept which varied by school. In the random intercept and slope model, the slopes for different explanatory variables can also vary by school. For example, the gender gap may be stronger or weaker in some schools versus others. The random intercept and slope model can account for these differences and model the varying effects. Equation (5) explicates the full model. The fixed effects of the model are represented by [$\gamma_{00} + \gamma_{10}x_{1ij} + \ldots + \gamma_{p0}x_{pij} + \gamma_{01}z_{1j} + \ldots + \gamma_{0q}z_{qj}$], while the random effects are represented by [$U_{0j} + U_{1j}\, x_{1ij} + \ldots + U_{(p+q)j}z_{qj} + R_{ij}$]. As with the random intercept model, the level-two residuals U_0 ,U_{1j}, and $U_{(p+q)j}$ along with the level-one residual R_{ij} are all expected to have a mean of 0.

$$Y_{ij} = \gamma_{00} + \gamma_{10}x_{1ij} + \ldots + \gamma_{p0}x_{pij} + \gamma_{01}z_{1j} + \ldots + \gamma_{0q}z_{qj} + U_{0j} + U_{1j}\, x_{1ij} + \ldots + U_{(p+q)j}z_{qj} + R_{ij} \qquad (5)$$

Each regression coefficient (for example: $\gamma_{10}x_{1ij}$) can be interpreted similarly to the average intercept (γ_{00}) with the fixed effects regression coefficient (γ_{10}) representing the population average effect of x_1 on Y and the random coefficient U_{1j} representing the random interaction between group j and x_1. The random coefficient (U_{1j}) is independent but correlated with the random intercept coefficient (U_{0j}) and both are independent at the level-one residuals (R_{ij}). These group effects are again exchangeable, which means that even for schools with few observations, the model will return efficient results.

The Models

Equation (6) below explicates the random intercept model. The main individual-level variables of interest are sex and average school SES as well as the gender interaction term. Individual-level controls for race, the respondent’s previous standardized test score, and the behavioral variables for friends’ grades, motivation, and hours spent on homework are represented by $\beta_{i0}(X_{i0})$. The inclusion of the previous standardized test score accounts for all the time-invariant and innate characteristics that affect reading achievement. If other variables are significant, then their effect is independent of the individual student's past development and only indicates how they have changed between waves. Group-level control variables for the type of school the respondent attends and whether the school is urban or rural are represented by $\delta_{0j}(Z_{0j})$. The full list of control variables can be seen in Table 11. These control variables show the difference in schools as compared to the control school which is a suburban public school.

$$\text{Test Score}_{ij} = \gamma_{00} + \gamma_{10}(\text{female})_{ij} + \gamma_{20}(\text{SES})_{ij} + \gamma_{30}(\text{female x Avg SES})_{ij} + \gamma_{01}(\text{Avg SES})_{j} + \beta_{i0}(X_{i0}) + \delta_{0j}(Z_{0j}) + U_{0j} + R_{ij} \quad (6)$$

Equation (7) is the random intercept and slope model and mirrors equation (6) with the addition of the random coefficient $U_1(female)_j$, which varies the slope for female students by school. The random slope for female students will test whether the gender gap varies by school, which one would expect as the academic culture of schools will be different. In schools where the academic culture incentivizes male students to act out and do poorly, female students as a whole will do better than in schools where male students strive for success. If the random slope for female is not significant after controlling for the school's SES and the interaction between gender and average SES then this result would imply that there are additional factors driving the gender gap.

$$Test\ Score_{ij} = \gamma_{00} + \gamma_{10}(female)_{ij} + \gamma_{20}(SES)_{ij} + \gamma_{30}(female\ x\ Avg\ SES)_{ij} + \gamma_{01}(Avg\ SES)_{j} + \beta_{i0}(X_{i0}) + \delta_{0j}(Z_{0j}) + U_{0j} + U_{1}(female)_{j} + R_{ij} \quad (7)$$

V. Results

Model 1 in Table 8 has the results for the random intercept model, presented in Equation (6), with covariates for an individual's gender, SES, race, previous score, and the average school

SES. In 10^{th} grade, Female students only perform a third of a point better than male students, which is less than half the effect of being Hispanic and less than a fourth the effect of being black. On the other hand, the gender gap is twice as large in 12^{th} grade and on par with the effects of being a White or Hispanic student. In both models an individual's SES and School SES are significant with a one unit increase in either SES variable increasing a student's performance on the reading tests by over 0.8 points in 10^{th} grade and 0.6 in 12^{th} grade as measured by the standardized reading test.

Model 2 in Table 8 presents the same model with the interaction term between the female dummy variable and a school's average SES. In 10^{th} grade, the coefficient for the female students is now 1.6, which is a substantial difference. The effect of being female is now larger than all the coefficients for race save that of being an American Indian and has twice the effect of an individual's SES. Both school average SES and the interaction term are significant in the 10^{th} grade model and the coefficient for the interaction term is negative. The negative coefficient implies that the gender gap is indeed mitigated by the contextual effects in schools. On average, the interaction term coefficient is about 1/3 that of the female coefficient, which means that in schools with sufficiently high-SES, the gender gap ceases to exist! However, these results are only present in the 10^{th} grade model. In the 12^{th} grade model, the gender gap has already disappeared as the female dummy variable coefficient is insignificant as is the interaction term with school average SES. However, the individual SES and school average SES remain significant. Peer effects are still present then in 12^{th} grade but they are no longer affecting male and female students differently.

My second hypothesis was that students were not responding to the average SES of a school, which indicates the how academically oriented a school's culture is, but rather schools with greater diversity in the socioeconomic background of its student body will see a greater gender divide. Models 3 and 4 in Table 9 present the results of the random coefficient model with the same student-level characteristics from the previous model but with the in-school standard deviation of student's SES. The standard deviation variable measures how diverse the student body is and it would be expected that male students are more sensitive to more diverse schools. However the standard deviation variable is not significant in Model 3 in either 10^{th} or 12^{th} grade. On average, student test scores are not affected by how economically diverse a school is. Model 4 includes the female interaction term with school standard deviation in SES and in 10^{th} grade the standard deviation variable is significant, however the interaction term is not. The coefficient for in-school standard deviation is negative which does indicate that students in schools with more diverse student bodies do perform worse but students of both genders are affected similarly.

To further examine the various contextual effects of SES on test performance, Model 5 presents the results of the random intercept model with average school SES, the female interaction term with average SES, and the in-school standard deviation of SES along with other individual-level variables. For 10^{th} grade students, both average SES and the interaction term are significant to roughly the same degree as in Model 2. In addition, the coefficient for in-school standard deviation of SES is not significant. Similarly, in Model 6, which includes the interaction term for female students with in-school standard deviation of SES, neither the coefficient for standard deviation nor the interaction term are significant. For 12^{th} graders, in both Models 5 and 6 none of the SES terms, besides individual student's SES, are significant. As a result I drop the standard deviation variables from future models as these findings imply that the school contextual effect of interest is the overall SES of the school rather than its diversity. Interestingly, average school SES is only significant for 10th grade students and not 12th grade students, the implications of which will be discussed in the conclusion.

In order to determine whether school average SES is driving the gender gap, additional variables are added to the model to control for individual- and group-level characteristics that could potentially be responsible for the gender gap. At the individual level, variables for how important a student's friends consider grades, how motivated a student is, and the hours they spend on homework are included. At the school-level, there are controls for whether the school offers AP courses, whether it is a Catholic school or other private school, and whether the school is located in a suburban or rural region as opposed to urban. Model 7 in Table 11 presents the results of this expanded model. For 10th grade students, the gender gap is still prevalent with female students on average performing 1.66 points better on reading tests than male students. All three SES variables are significant even after controlling for student motivation and hours spent on homework, both of which are significant. SES then has a larger effect on academic outcomes besides influencing a student's behavior or effort placed into school work. Similarly, average SES is significant even after adding in school-level control variables. The urbanicity of a school has no effect on average student outcomes nor does the school's religiosity or whether it is private or public. The primary school-level effect remains the average SES of the school. For 12th grade students, the only SES variable that is significant is the individual's SES background.

The gender gap in Model 7 remains moderated by the female interaction term with average school SES. The interaction term's coefficient remains negative with schools that have an average SES of 2.44 exhibiting no gender gap. To further examine the effect of a school's average SES, Table 7 also has the results for the random intercept model broken out by male students only and female students only. For 10th grade students, school average SES is only significant in the male student model while individual SES remains significant in both cases. This finding further supports the hypothesis that male students are influenced by their school environment while female students are not. Interestingly, the variance for the level-two random effect intercept U_{0j} is 3.03 in the male student model, which is twice as large as in the female student model. As a result, a male student in the bottom 2.5% of schools will on average have an intercept that is two standard deviations below the average, which equates to $10.74 – 2* \sqrt{3.03}$ or 7.26 whereas the intercept for female students in the same school is 9.88. This difference of 2.62 points is a full point larger than the average gender gap, which shows the stronger effect that schools have on male students compared to female students. As with previous models, average school SES and the interaction term are not significant among 12th grade students.

One possible reason that SES moderates the gender gap is that there are group behaviors associated with SES that are really driving the difference in outcomes and SES is just a proxy. To test this possibility, Model 8 in Table 10 includes all the previous variables in addition to school averages for how important a student's friends consider grades, motivation of the average student, and the average hours spent on homework in addition to interaction terms for each with the female dummy variable. Among 10th graders the gender gap disappears as the coefficient for the female dummy variable is no longer significant. The lack of a statistically significant gender gap may be due to the inclusion of numerous gender interaction terms. In addition, the only school-average variable that is significant is average SES. None of the coefficients for school average behavioral characteristics or their interaction terms are significant, however, the interaction term with average SES is marginally significant at the 10% level. Model 8 is broken out into separate regressions for male and female students as presented in Table 12. Average SES is only significant for male students with a coefficient of 0.87 while none of the other school average variables are significant for either gender. These results again show that SES moderates the gender gap and is the main school-level variable of interest.

The variation in the gender gap between schools can be measured through a random intercept and random slope model as shown in Equation (7) above where the slope for the female dummy variable is allowed to vary. As none of the school-average variables or their interactions besides SES, the same model employed in Model 7 with the school-level characteristics of whether the school offers AP courses, its religiosity, whether the school is private, and its urbanicity are included. The results are presented in Model 9 in table 13 along with the random intercept model, Model 7. The results are the same with a gender gap of 1.6 points and the coefficient for the female dummy interaction term with average SES negative and significant, representing the moderating effect of SES. In addition the variance for random effects female coefficient (U_{1j}) is 0.95. This means that a female student in the top 2.5% of schools will on average have an intercept two standard deviations below the average. The effect of being a female student in one of these schools is $1.62 + 2 * \sqrt{0.95}$ or 3.56, which is more than 2 points higher than the average across all schools.

A test of the difference in deviances between model 7, the random intercept model, and model 9, the random intercept and slopes model, can determine which model is superior. The deviance test is a hypothesis test determines whether the additional parameters in the random intercept and slope model (the additional random effects coefficients) are significant. The deviance test consists of subtracting the deviance of model 7 from the deviance of model 9 and checking to see if the difference is significant on a chi squared distribution, where the degrees of freedom are equal to the difference in parameters. For both 10^{th} and 12^{th} graders, the difference in deviances between the two models is 15 (28,881 – 28,866 for 10^{th} graders, and 25,365 –

25,350 for 12th graders) and the degrees of freedom is two. The chi squared test statistic for two degrees of freedom at the 0.001 level is 13.816. Since the deviance is greater than 13.816, the deviance test indicates that the random intercept and slope model is a better fit in both cases. The effect then of gender is not fixed but rather gender effects vary by school, which is in itself evidence that there are school effects and that the differences between male and female students are not innate.

Since the school average SES only seems to have an effect on 10th grade male students, it is possible to test how great the effect of SES varies by using a random intercept and slope model for each gender with a random slope for the school average SES variable. Model 10 in Table 14 presents the results of this model for male and female students in the 10th and 12th grades. For male students in the 10th grade, the coefficient for school average SES is 0.89, which is similar to the random intercept model coefficient of 0.91. However the random effects coefficient U1j is 0.07, which means that a one unit increase in school SES for male students in the top 2.5% of schools will have on average an effect of $0.89 + 2 * \sqrt{0.07}$ or 1.43. By comparison, for male students in the bottom 2.5% of schools, a one unit increase in school SES will have on average an effect of 0.35 or about a quarter of the effect. School SES remains insignificant for 10th grade females and all 12th graders.

However, a deviance test between Model 7, the random intercept model, and Model 10, the random intercept and slope model, for male students in the 10th grade implies that there is no difference between the two models. The deviance for both models is 13,744 and thus no difference between the two models. This makes sense though based on my hypothesis. If SES is the driving factor behind the gender gap then its effect should be consistent across all schools. If some schools experienced smaller gains in reading scores with equivalent increases in SES then there may be some other mechanism that is driving the gender gap other than peer effects. Since the random intercept model is capturing school-level effects as well as the random intercept and slope model, there are no other drivers of school differences besides SES.

VI. Conclusion

As expected from my first hypothesis, 10th grade male students' scores, particularly in reading, are much more responsive to school average SES than female student's scores. These findings mirror those by Rumberger and Palardy (2005) and Caldas and Bankston (1997) on the connection between school average SES and academic achievement among 10th graders. While Rumberger and Palardy also used NELS data, they used the Second Follow-Up and cleaned their data differently than the dataset used here. The consistent findings between these two results further validate the data and methods used in this paper. In addition, Legewie and DiPrete (2012) and I both found that school average SES moderates the gender gap. However, while Legewie and DiPrete found school SES was responsible for two-thirds of the gender gap, I find that a one unit increase in SES is only responsible for one-third of the gender gap.

However, this may be due to the different nature of the students observed. Legewie and DiPrete used data on 5th graders for their study while I find an effect only for 10th grade students and no effect for 12th grade students. It is possible that by high school, peer effects decline over time and that by 12th grade, adolescents are already ingrained with a certain belief in masculinity and have a consistent attitude toward school that is unchanged by their peers whereas students in the 5th grade are more open to influence from their peers. In elementary school a student is with the same group of children all day and these students are often their friends. In high school, a student travels between classes which may or may not contain any friends. As a result, what

Legewie and DiPrete found may be that average SES of a school matters in the 5th grade because the children are more likely to be in classes with their friends compared to students in large high schools. The variance that school SES is explaining may instead be the SES of each student's friends rather than the overall culture of the school.

Better data however may allow future researchers to explore whether peer or friend effects are responsible for moderating the gender gap. A dataset containing not only the information contained in the NELS dataset but also network data listing each student's friends and their characteristics would be necessary to explore the effects of SES more explicitly. In addition, the dataset would have to be saturated with observations for each student in the school. Otherwise there could be biased results from any unmeasured connections. The same regressions presented here could be applied with additional independent variables average friend's SES and an interaction term for female students with the average friend's SES. This model would then allow researchers to see whether peer effects are really the effects of friends or if it is the overall culture of the school that drives the gender gap.

In addition to lacking network data, the NELS dataset also had fairly few observations per a school with 47% of schools having less than 10 observations and 7.35% of schools having three or fewer observations. While the results of the hierarchical model are still unbiased even with the low number of observations per a school (see the similarity assumption in the methods section), the low number of observations per a school does mean that there could be a degree of measurement error in variables created through aggregation including the school average SES variable. However, considering that the results have matched previous studies and that schools are often composed of students from similar backgrounds due to neighborhood effects, the low number of observations in some schools does not pose a significant problem.

The presence of peer effects on the gender gap between male and female students then has interesting implications for policy. As Fletcher (2007) also noted, small changes in the composition of schools have an effect on large swathes of the school population. A rise in average SES can narrow the gender gap even with other factors such as teacher effectiveness or spending per a student remaining the same. In addition, policies, such as vouchers or busing, that bring low-performing male students into higher SES schools would on average improve their scores as they catch up to their female student counterparts in addition to other school effects. To test whether moderate changes in environment can influence test scores for male students, future researchers should explore not only the effect of school average SES but also the effect of going from a low- to a high-SES school. This could be tested as students move from elementary schools to middle schools or middle school to high school if there are significant changes in SES. Studies that tracked students who switch schools and their achievement on standardized tests would also be interesting.

In addition to exploring the effects of switching schools or using network data to map friendship networks, another avenue for future research is to test whether competition is the driving force behind the gender gap. Niederle and Vesterlund (2010) found through several experiments, male students perform better in competitive environments than women. In addition to no longer viewing success in school as unmasculine, in high-SES schools male students may even compete over the best grades or academic standing. Male culture then may result in a reverse gender gap with male students out performing female students. To test for whether competition can influence the gender gap, future studies could also offer cash prizes at random schools for academic achievement on tests. If male students are aware that there are direct benefits to scoring well on standardized tests they may perform as well as female students regardless of the school average score or background.

The results of this paper then confirm that peer effects in education research cannot be ignored and that future studies like those above should be undertaken. While much research has been devoted to the effects that a student's home and socioeconomic background play on academic achievement, greater research is needed in exploring how the context of the school moderates culture and influences outcomes. It appears based on this research that much of the gender gap can be explained by peer effects and school-level variables. However, fully understanding the complex factors at work will require more focused data collection and a greater range of methods.

References

Aud, S., Hussar, W., Johnson, F., Kena, G., Roth, E., Manning, E., . . . Nachazel, T. (2012). The Condition of Education 2012. *National Center for Education Statistics, US Department of Education*.

Caldas, S. J., & Bankston III, C. (1997). Effect of school population socioeconomic status on individual academic achievement. *The Journal of Educational Research*, 269-277.

Coleman, J. S., Campbell, E., Hobson, C., McPartland, J., Mood, A., Weinfeld, F., & York, R. (1966). *Equality of educational opportunity [summary report]*: US Department of Health, Education, and Welfare, Office of Education.

Crosnoe, R. (2009). Low-income students and the socioeconomic composition of public high schools. *American Sociological Review, 74*(5), 709-730.

DiPrete, T. A., & Buchmann, C. (2006). Gender-specific trends in the value of education and the emerging gender gap in college completion. *Demography*, *43*(1), 1-24.

Duncan, O. D., Featherman, D. L., & Duncan, B. (1972). *Socioeconomic background and achievement*.

Fletcher, J. M. (2007). Social multipliers in sexual initiation decisions among US high school students. *Demography, 44*(2), 373-388.

Freeman, C. (2004). Trends in educational equity of girls & women: 2004 (No. NCES 2005-016). Washington, DC: US Government Printing Office: US Department of Education. *National Center for Education Statistics*.

Gaviria, A., & Raphael, S. (2001). School-based peer effects and juvenile behavior. *Review of Economics and Statistics*, *83*(2), 257-268.

Hauser, R. M. (1994). Measuring socioeconomic status in studies of child development. *Child development*, *65*(6), 1541-1545.

Hedges, L. V., & Hedberg, E. C. (2007). Intraclass correlation values for planning group-randomized trials in education. *Educational Evaluation and Policy Analysis*, *29*(1), 60-87.

Hyde, J. S., & Mertz, J. E. (2009). Gender, culture, and mathematics performance. *Proceedings of the National Academy of Sciences*, *106*(22), 8801-8807.

Kane, J. M., & Mertz, J. E. (2012). Debunking myths about gender and mathematics performance. *Notices of the AMS, 59*(1).

Legewie, J., & DiPrete, T. A. (2012). School context and the gender gap in educational achievement. *American Sociological Review*, *77*(3), 463-485.

Maccoby, E. E. (1998). *The two sexes: Growing up apart, coming together*: Harvard University Press.

Manski, C. F. (1993). Identification of endogenous social effects: The reflection problem. *The review of economic studies*, *60*(3), 531-542.

Morris, E. W. (2008). “Rednecks,”“Rutters,” andRithmetic Social Class, Masculinity, and Schooling in a Rural Context. *Gender & Society*, *22*(6), 728-751.

Rumberger, R., & Palardy, G. (2005). Does segregation still matter? The impact of student composition on academic achievement in high school. *The Teachers College Record, 107*(9), 1999-2045.

Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of educational research, 75*(3), 417-453.

Teitler, J. O., & Weiss, C. C. (2000). Effects of neighborhood and school environments on transitions to first sexual intercourse. *Sociology of Education*, 112-132.

Niederle, M., & Vesterlund, L. (2010). Explaining the gender gap in math test scores: The role of competition. *The Journal of Economic Perspectives*, *24*(2), 129-144.

White, K. R. (1982). The relation between socioeconomic status and academic achievement. *Psychological Bulletin; Psychological Bulletin*, *91*(3), 461.

Wilson, W. J. (1987). The Truly Disadvantaged University of Chicago Press. *Chicago, IL*.

Table 1. Reading Achievement over 3 Waves by SES Quartile

Variables	Description	Mean	Mean (male)	Mean (female)	Diff. in Means
8th Grade	1 = First quartile	46.72	46.26	47.10	-0.84
		(8.83)	(8.76)	(8.85)	
	2 = Second quartile	50.61	49.42	51.68	-2.26***
		(9.36)	(9.19)	(9.36)	
	3 = Third quartile	53.15	51.55	54.76	-3.21***
		(9.37)	(9.26)	(9.21)	
	4 = Fourth quartile	57.16	56.08	58.30	-2.22***
		(8.97)	(9.36)	(8.44)	
10th Grade	1 = First quartile	46.20	45.49	46.81	-1.32*
		(9.28)	(9.43)	(9.09)	
	2 = Second quartile	50.37	49.38	51.26	-1.88***
		(9.28)	(9.51)	(8.96)	
	3 = Third quartile	52.96	51.66	54.29	-2.63***
		(8.92)	(8.97)	(8.67)	
	4 = Fourth quartile	56.96	56.33	57.63	-1.30**
		(8.12)	(8.77)	(7.35)	
12th Grade	1 = First quartile	46.04	45.34	46.61	-1.27*
		(9.35)	(9.45)	(9.20)	
	2 = Second quartile	49.95	48.80	50.98	-2.18***
		(9.29)	(9.40)	(9.05)	
	3 = Third quartile	52.77	51.59	53.98	-2.39***
		(8.74)	(9.08)	(8.19)	
	4 = Fourth quartile	56.18	55.19	57.23	-2.04***
		(7.84)	(8.58)	(6.88)	

Source: NELS Fourth Follow-Up data. Standard Deviations in parentheses
Note: N = 7,201 * $p < .05$; ** $p < .01$; *** $p < .001$ (two-tailed t-tests)

Table 2. School-Level and Race Summaries of Grade 10 Reading Achievement

Variables	Description	Mean	Mean (male)	Mean (female)	Diff. in Means
AP Offered	0 = Not offered	51.58	50.62	52.48	-1.86***
		(9.23)	(9.53)	(8.83)	
	1 = One or more offered	52.44	51.78	53.09	-1.31***
		(9.79)	(10.04)	(9.50)	
School Type	1 = Public School	51.76	50.90	52.57	-1.67***
		(9.45)	(9.66)	(9.16)	
	2 = Catholic School	55.91	55.86	55.98	-0.12
		(8.74)	(8.41)	(9.18)	
	3 = Private, Other Religion	56.98	58.40	56.11	2.29
		(9.35)	(10.71)	(8.36)	
	4 = Private, non-Religious	58.37	58.00	58.79	-0.79
		(14.39)	(15.03)	(13.71)	
Urbanicity	1 = Urban	52.87	52.35	53.34	-0.99
		(9.83)	(10.22)	(9.46)	
	2 = Suburban	52.95	52.19	53.72	-1.53***
		(9.78)	(9.96)	(9.53)	
	3 = Rural	50.99	50.10	51.83	-1.73***
		(9.26)	(9.52)	(8.92)	
Race	1 = Asian	54.05	53.04	55.12	-2.08
		(13.45)	(13.94)	(12.75)	
	2 = Hispanic	47.51	46.58	48.42	-1.84
		(10.53)	(10.21)	(10.73)	
	3 = Black	47.25	46.70	47.70	-1.00
		(8.47)	(8.07)	(8.73)	
	4 = White	53.34	52.56	54.10	-1.54***
		(9.12)	(9.54)	(8.63)	
	5 = American Indian	45.82	44.19	47.40	-3.21
		(8.82)	(5.78)	(11.16)	

Source: NELS Fourth Follow-Up data. Standard Deviations in parentheses

Note: N = 7,201 * $p < .05$; ** $p < .01$; *** $p < .001$ (two-tailed t-tests)

Table 3. School-Level and Race Summaries of Grade 12 Reading Achievement

Variables	Description	Mean	Mean (male)	Mean (female)	Diff. in Means
AP Offered	0 = Not offered	50.85	49.74	51.87	-2.13***
		(9.28)	(9.44)	(9.00)	
	1 = One or more offered	52.25	51.46	53.03	-1.57***
		(9.47)	(9.78)	(9.10)	
School Type	1 = Public School	51.42	50.44	52.35	-1.91***
		(9.25)	(9.47)	(8.94)	
	2 = Catholic School	55.68	55.32	56.13	-0.81
		(8.38)	(8.12)	(8.72)	
	3 = Private, Other Religion	56.41	58.20	55.32	2.88
		(8.79)	(10.52)	(7.46)	
	4 = Private, non-Religious	57.82	57.36	58.35	-0.99
		(14.51)	(14.99)	(13.98)	
Urbanicity	1 = Urban	52.68	52.13	53.18	-1.05
		(9.50)	(9.71)	(9.30)	
	2 = Suburban	52.59	51.72	53.49	-1.77***
		(9.49)	(9.79)	(9.07)	
	3 = Rural	50.57	49.48	51.59	-2.11***
		(9.20)	(9.45)	(8.83)	
Race	1 = Asian	54.69	52.92	56.55	-3.63***
		(12.81)	(13.36)	(11.63)	
	2 = Hispanic	47.48	46.84	48.12	-1.28
		(10.57)	(10.50)	(10.59)	
	3 = Black	46.83	46.42	47.16	-0.74
		(0.84)	(8.13)	(8.59)	
	4 = White	52.93	51.96	53.87	-1.91***
		(8.88)	(9.34)	(8.32)	
	5 = American Indian	46.61	45.59	47.60	-2.01
		(9.64)	(6.66)	(12.18)	

Source: NELS Fourth Follow-Up data. Standard Deviations in parentheses
Note: N = 7,201 * $p < .05$; ** $p < .01$; *** $p < .001$ (two-tailed t-tests)

Table 4. 10th Grade Male and Female Attitudes and Behaviors by SES Quartile

Variables	Description	Mean	Mean (male)	Mean (female)	Diff. in Means
Homework	1 = First quartile	2.12	2.03	2.19	-0.16
		(1.59)	(1.61)	(1.57)	
	2 = Second quartile	2.29	1.99	2.57	-0.58***
		(1.60)	(1.47)	(1.67)	
	3 = Third quartile	2.60	2.35	2.85	-0.50***
		(1.64)	(1.56)	(1.68)	
	4 = Fourth quartile	3.07	2.76	3.39	-0.63***
		(1.77)	(1.73)	(1.77)	
Friends Grades	1 = First quartile	2.42	2.32	2.50	-0.18***
		(0.63)	(0.63)	(0.62)	
	2 = Second quartile	2.43	2.34	2.50	-0.16***
		(0.59)	(0.60)	(0.57)	
	3 = Third quartile	2.42	2.35	2.49	-0.14***
		(0.59)	(0.61)	(0.57)	
	4 = Fourth quartile	2.49	2.41	2.58	-0.18***
		(0.56)	(0.57)	(0.53)	
Motiviation	1 = First quartile	0.59	0.50	0.68	-0.18***
		(0.52)	(0.53)	(0.50)	
	2 = Second quartile	0.63	0.53	0.71	-0.19***
		(0.48)	(0.49)	(0.45)	
	3 = Third quartile	0.70	0.63	0.77	-0.13***
		(0.45)	(0.48)	(0.42)	
	4 = Fourth quartile	0.77	0.72	0.82	-0.10***
		(0.41)	(0.44)	(0.37)	

Source: NELS Fourth Follow-Up data. Standard Deviations in parentheses

Note: N = 7,201 * $p < .05$; ** $p < .01$; *** $p < .001$ (two-tailed t-tests)

Table 5. 12th Grade Male and Female Attitudes and Behaviors by SES Quartile

Variables	Description	Mean	Mean (male)	Mean (female)	Diff. in Means
Homework	1 = First quartile	2.93	2.83	3.02	-0.18
		(2.02)	(2.14)	(1.92)	
	2 = Second quartile	3.10	2.79	3.38	-0.59**
		(1.91)	(1.91)	(1.86)	
	3 = Third quartile	3.29	3.09	3.50	-0.41***
		(1.85)	(1.90)	(1.77)	
	4 = Fourth quartile	3.77	3.53	4.02	-0.49***
		(1.89)	(1.96)	(1.79)	
Friends Grades	1 = First quartile	2.43	2.28	2.54	-0.26***
		(0.63)	(0.64)	(0.59)	
	2 = Second quartile	2.40	2.30	2.49	-0.19***
		(0.62)	(0.62)	(0.60)	
	3 = Third quartile	2.38	2.24	2.52	-0.28***
		(0.63)	(0.62)	(0.61)	
	4 = Fourth quartile	2.42	2.31	2.53	-0.22***
		(0.62)	(0.64)	(0.59)	
Motiviation	1 = First quartile	0.62	0.55	0.68	-0.13*
		(0.51)	(0.53)	(0.48)	
	2 = Second quartile	0.66	0.55	0.76	-0.21***
		(0.47)	(0.50)	(0.43)	
	3 = Third quartile	0.65	0.56	0.74	-0.18***
		(0.48)	(0.49)	(0.44)	
	4 = Fourth quartile	0.78	0.70	0.87	-0.17***
		(0.40)	(0.45)	(0.33)	

Source: NELS Fourth Follow-Up data. Standard Deviations in parentheses
Note: N = 7,201 * $p < .05$; ** $p < .01$; *** $p < .001$ (two-tailed t-tests)

Table 6. School-Level Aggregated Variables

Variables	Description	Mean	Mean (male)	Mean (female)	Diff. in Means
10th Grade Avg Hours of HW	Avg number of hours student's spend on HW	2.58 (0.89)	2.53 (0.85)	2.63 (0.93)	-0.10***
12th Grade Avg Hours of HW	Avg number of hours student's spend on HW	3.35 (0.95)	3.31 (0.96)	3.39 (0.93)	-0.08*
10th Grade Avg Friends Grades	Avg of how imp. a student's friends consider grades	2.45 (0.28)	2.44 (0.28)	2.46 (0.28)	-0.02*
12th Grade Avg Friends Grades	Avg of how imp. a student's friends consider grades	2.41 (0.29)	2.39 (0.31)	2.44 (0.27)	-0.05***
10th Grade Avg Motivation	Avg of how motivated a school's students are	0.69 (0.24)	0.68 (0.24)	0.69 (0.24)	-0.01
12th Grade Avg Motivation	Avg of how motivated a school's students are	0.70 (0.24)	0.68 (0.24)	0.71 (0.24)	0.03***

Source: NELS Fourth Follow-Up data. Standard Deviations in parentheses
Note: N = 1,037. * $p < .05$; ** $p < .01$; *** $p < .001$ (two-tailed t-tests)

Table 7. One-Way ANOVA for 10th and 12th Grade Achievement

	10th Grade Achievement		12th Grade Achievement	
Fixed Effects	**Coefficients**	**t-value**	**Coefficients**	**t-value**
Intercept	52.25***	300.90	52.04***	310.60
Random Effects	**Var**	**Std. Dev**	**Var**	**Std. Dev**
Lvl-two variance = var(U0j)	16.57	4.07	14.74	3.84
Lvl-one variance = var(Rij)	76.71	8.76	76.34	8.74
Deviance	52554.00		52458.00	

Source: NELS data. Standard Deviations in parentheses

Note: N = 7,201. * $p < .05$; ** $p < .01$; *** $p < .001$ (two-tailed t-tests)

Table 8: Model 1 and Model 2 for 10th and 12th Grade Achievement

	Model #1				Model #2			
	10th Grade Achievement		12th Grade Achievement		10th Grade Achievement		12th Grade Achievement	
Fixed Effects	**Coefficients**	**t-value**	**Coefficients**	**t-value**	**Coefficients**	**t-value**	**Coefficients**	**t-value**
Intercept	10.27***	18.99	9.66***	18.36	9.61***	15.66	10.08***	16.95
Female	0.32*	2.46	0.80***	6.26	1.60	2.76	-0.05	-0.08
SES	0.84***	7.42	0.62***	5.51	0.84***	7.44	0.61***	5.49
Hispanic	-0.85*	-2.48	-0.89**	-2.67	-0.86**	-2.52	-0.88**	-2.64
Black	-1.3***	-3.65	-2.10***	-6.08	-1.31***	-3.68	-2.09***	-6.06
White	-0.36	-1.33	-0.72**	-2.69	-0.37**	-1.37	-0.71**	-2.67
American Indian	-1.74*	-2.34	-1.33	-1.84	-1.73	-2.33	-1.34	-1.85
Previous Score	0.73***	99.44	0.76***	102.35	0.73***	99.49	0.76***	102.36
Importance of Friends' Grades	-	-	-	-	-	-	-	-
Motivation in School	-	-	-	-	-	-	-	-
Hrs Spent on Homework	-	-	-	-	-	-	-	-
AP Offered	-	-	-	-	-	-	-	-
Catholic	-	-	-	-	-	-	-	-
Private, Other Religion	-	-	-	-	-	-	-	-
Private, Non-Religious	-	-	-	-	-	-	-	-
Suburban School	-	-	-	-	-	-	-	-
Rural School	-	-	-	-	-	-	-	-
Average School SES	0.89***	4.77	0.62***	3.48	1.17*	5.22	0.43*	1.99
Female x Avg SES	-	-	-	-	-0.56	-2.26	0.38	1.54
Random Effects	**Var**	**Std. Dev**	**Var**	**Std. Dev**	**Var**	**Std. Dev**	**Var**	**Std. Dev**
Lvl-two variance = var(U0j)	1.98	1.41	1.45	1.20	1.99	1.41	1.46	1.21
Lvl-one variance = var(Rij)	28.87	5.37	27.80	5.27	28.85	5.37	27.79	5.27
Deviance	45024.00		44,675.00		45,019.00		44673.00	

Source: NELS data. Standard Deviations in parentheses

Note: N = 7,201. * $p < .05$; ** $p < .01$; *** $p < .001$ (two-tailed t-tests)

Table 9: Model 3 and Model 4 for 10th and 12th Grade Achievement

	Model #3				Model #4			
	10th Grade Achievement		12th Grade Achievement		10th Grade Achievement		12th Grade Achievement	
Fixed Effects	**Coefficients**	**t-value**	**Coefficients**	**t-value**	**Coefficients**	**t-value**	**Coefficients**	**t-value**
Intercept	11.9***	21.59	10.78***	19.85	12.26***	20.64	10.6***	18.09
Female	0.32*	2.38	0.82***	6.31	-0.37	-0.84	1.14**	2.67
SES	1.11***	11.25	0.78***	8.09	1.12***	11.28	0.78***	8.08
Hispanic	-0.96**	-2.76	-1.03**	-3.03	-0.96**	-2.78	-1.02**	-3.03
Black	-1.34***	-3.69	-2.16***	-6.12	-1.35***	-3.70	-2.16***	-6.12
White	-0.35	-1.24	-0.73**	-2.69	-0.35	-1.27	-0.73**	-2.68
American Indian	-1.71*	-2.26	-1.34	-1.82	-1.72*	-2.28	-1.34	-1.82
Previous Score	0.73***	98.89	0.77***	102.12	0.73***	98.92	0.77***	102.12
Importance of Friends' Grades	-	-	-	-	-	-	-	-
Motivation in School	-	-	-	-	-	-	-	-
Hrs Spent on Homework	-	-	-	-	-	-	-	-
AP Offered	-	-	-	-	-	-	-	-
Catholic	-	-	-	-	-	-	-	-
Private, Other Religion	-	-	-	-	-	-	-	-
Private, Non-Religious	-	-	-	-	-	-	-	-
Suburban School	-	-	-	-	-	-	-	-
Rural School	-	-	-	-	-	-	-	-
In-School Std. Dev. SES	-0.5	-1.20	-0.43	-1.09	-1.12*	-1.99	-0.14	-0.25
Female x In-School Std. Dev. SES	-	-	-	-	-	1.64	-	-0.80
Random Effects	**Var**	**Std. Dev**	**Var**	**Std. Dev**	**Var**	**Std. Dev**	**Var**	**Std. Dev**
Lvl-two variance = var(U0j)	2.09	1.45	1.55	1.24	2.08	1.44	1.54	1.24
Lvl-one variance = var(Rij)	28.96	5.38	27.88	5.28	28.96	5.38	27.88	5.28
Deviance	44215.00		43,872.00		44,212.00		43871.00	

Source: NELS data. Standard Deviations in parentheses

Note: N = 7,201. * $p < .05$; ** $p < .01$; *** $p < .001$ (two-tailed t-tests)

Table 10: Model 5 and Model 6 for 10th and 12th Grade Achievement

	Model #5				Model #6			
	10th Grade Achievement		12th Grade Achievement		10th Grade Achievement		12th Grade Achievement	
Fixed Effects	**Coefficients**	**t-value**	**Coefficients**	**t-value**	**Coefficients**	**t-value**	**Coefficients**	**t-value**
Intercept	9.61***	13.62	10.35***	15.21	9.92***	13.00	10.18***	13.78
Female	1.78**	2.99	-0.15	-0.26	1.21	1.51	0.15	0.19
SES	0.85***	7.49	0.61***	5.42	0.86***	7.51	0.61***	5.40
Hispanic	-0.82*	-2.34	-0.91**	-2.68	-0.82*	-2.35	-0.91**	-2.67
Black	-1.27***	-3.51	-2.11***	-5.97	-1.28***	-3.51	-2.11***	-5.97
White	-0.33	-1.19	-0.71**	-2.61	-0.33	-1.20	-0.70**	-2.60
American Indian	-1.63*	-2.16	-1.32	-1.79	-1.64*	-2.18	-1.31	-1.78
Previous Score	0.73***	98.31	0.77***	101.31	0.73***	98.32	0.77***	101.31
Importance of Friends' Grades	-	-	-	-	-	-	-	-
Motivation in School	-	-	-	-	-	-	-	-
Hrs Spent on Homework	-	-	-	-	-	-	-	-
AP Offered	-	-	-	-	-	-	-	-
Catholic	-	-	-	-	-	-	-	-
Private, Other Religion	-	-	-	-	-	-	-	-
Private, Non-Religious	-	-	-	-	-	-	-	-
Suburban School	-	-	-	-	-	-	-	-
Rural School	-	-	-	-	-	-	-	-
Average School SES	1.23***	5.28	0.35	1.56	1.19***	5.10	0.37	1.62
Female x Avg SES	-0.64*	-2.50	0.43	1.72	-0.59*	-2.26	0.40	1.58
In-School Std. Dev. SES	-0.20	-0.47	-0.24	-0.62	-0.61	-1.07	-0.03	-0.05
Female x In-School Std. Dev. SES	-	-	-	-	0.76	1.07	-0.40	-0.57
Random Effects	**Var**	**Std. Dev**	**Var**	**Std. Dev**	**Var**	**Std. Dev**	**Var**	**Std. Dev**
Lvl-two variance = var(U0j)	2.01	1.42	1.48	1.22	2.00	1.41	1.48	1.22
Lvl-one variance = var(Rij)	28.91	5.38	27.88	5.28	28.91	5.38	27.89	5.28
Deviance	44187.00		43,859.00		43,859.00		43859.00	

Source : NELS data. Standard Deviations in parentheses

Note : N = 7,201. * p < .05; ** p < .01; *** p < .001 (two-tailed t-tests)

Table 11: Model 7 for 10th and 12th Grade Achievement

	Model #7				Model #7 for 10th Grade Achievement				Model #7 For 12th Grade Achievement			
	10th Grade Achievement		12th Grade Achievement		Male Students		Female Students		Male Students		Female Students	
Fixed Effects	Coefficients	t-value	Coefficients	t-value	Coefficients	t-value	Coefficients	t-value	Coefficients	t-value	Coefficients	t-value
Intercept	10.73***	11.68	11.59***	12.86	10.74***	8.53	12.30***	11.34	10.75***	8.81	12.21***	11.54
Female	1.66*	2.22	-0.11	-0.14	-	-	-	-	-	-	-	-
SES	0.76***	5.48	0.57***	3.98	0.93***	4.21	0.60**	3.27	0.38	1.66	0.78***	4.23
Hispanic	-1.01*	-2.29	-1.13**	-2.73	-1.25	-1.84	-0.74	-1.32	-0.23	-0.35	-1.69**	-3.21
Black	-1.62***	-3.59	-2.05***	-4.78	-2.43***	-3.40	-1.14*	-2.00	-1.97**	-2.87	-2.28***	-4.30
White	-0.28	-0.83	-0.72*	-2.32	-0.41	-0.78	-0.22	-0.50	-0.12	-0.25	-1.29**	-3.29
American Indian	-1.70	-1.76	-2.03*	-2.07	-1.96	-1.13	-1.63	-1.43	-1.66	-1.15	-2.36	-1.78
Previous Score	0.70***	76.49	0.73***	73.39	0.71***	51.24	0.70***	56.86	0.73***	48.90	0.74***	54.74
Importance of Friends' Grades	-0.13	-0.91	-0.05	-0.35	-0.25	-1.19	-0.02	-0.08	0.01	0.07	-0.12	-0.69
Motivation in School	1.11***	6.11	0.89***	4.79	1.4***	5.31	0.76**	3.00	1.13***	4.17	0.59*	2.28
Hrs Spent on Homework	0.32***	6.41	0.22***	5.12	0.22**	2.82	0.40***	6.04	0.25***	3.81	0.19***	3.40
AP Offered	0.12	0.55	0.15	0.66	0.14	0.41	0.07	0.27	-0.06	-0.20	0.34	1.22
Catholic	-0.11	-0.27	0.31	0.80	-0.70	-1.15	0.31	0.61	0.34	0.67	0.41	0.84
Private, Other Religion	-0.09	-0.14	-0.14	-0.22	-0.56	-0.53	0.14	0.19	-0.89	-0.95	0.3	0.42
Private, Non-Religious	0.38	0.72	-0.04	-0.08	0.48	0.66	0.23	0.33	-0.35	-0.54	0.01	0.02
Suburban School	-0.27	-1.02	-0.16	-0.63	-0.48	-1.22	-0.18	-0.56	0.09	0.26	-0.40	-1.30
Rural School	-0.19	-0.67	-0.14	-0.51	-0.12	-0.29	-0.32	-0.95	-0.10	-0.25	-0.11	-0.32
Average School SES	0.93**	2.96	0.15	0.51	0.91*	2.22	0.38	1.19	0.5	1.30	0.28	0.88
Female x Avg SES	-0.68*	-2.15	0.34	1.10	-	-	-	-	-	-	-	-
Random Effects	Var	Std. Dev	Var	Std. Dev	Var	Std. Dev	Var	Std. Dev	Var	Std. Dev	Var	Std. Dev
Lvl-two variance = var(U0j)	2.06	1.44	1.69	1.30	3.03	1.74	1.46	1.21	0.00	0.00	1.54	1.24
Lvl-one variance = var(Rij)	27.55	5.25	25.42	5.04	30.20	5.50	24.95	5.00	31.80	5.64	21.28	4.61
Deviance	28881.00		25,365.00		13744.00		15,109.00		12408.00		12,908.00	

Source: NELS data. Standard Deviations in parentheses

Note: N = 7,201. * *p* < .05; ** *p* < .01; *** *p* < .001 (two-tailed t-tests)

Table 12: Model 8 for 10th and 12th Grade Achievement

	Model #8				Model #8 10th Grade Achievement				Model #8 12th Grade Achievement			
	10th Grade Achievement		12th Grade Achievement		Male Students		Female Students		Male Students		Female Students	
Fixed Effects	Coefficients	t-value	Coefficients	t-value	Coefficients	t-value	Coefficients	t-value	Coefficients	t-value	Coefficients	t-value
Intercept	11.29***	7.45	13.66***	9.17	11.41***	6.29	12.37***	7.77	12.96***	7.69	11.71***	7.65
Female	1.09	0.62	-2.79	-1.56	-	-	-	-	-	-	-	-
SES	0.75***	5.35	0.57***	3.95	0.90***	4.04	0.61***	3.30	0.38	1.63	0.77***	4.21
Hispanic	-1.02*	-2.25	-1.12**	-2.68	-1.26	-1.78	-0.78	-1.36	-0.13	-0.21	-1.72**	-3.27
Black	-1.66***	-3.58	-2.03***	-4.71	-2.47***	-3.36	-1.15*	-1.98	-1.85**	-2.69	-2.31***	-4.34
White	-0.25	-0.72	-0.71*	-2.28	-0.40	-0.73	-0.19	-0.42	-0.07	-0.14	-1.31***	-3.32
American Indian	-1.69	-1.70	-2.06*	-2.10	-2.20	-1.26	-1.53	-1.29	-1.74	-1.20	-2.41	-1.82
Previous Score	0.70***	75.06	0.73***	73.33	0.71***	50.52	0.70***	55.60	0.73***	48.88	0.74***	54.71
Importance of Friends' Grades	-0.11	-0.74	0.01	0.06	-0.23	-1.07	0	0.00	0.20	0.88	-0.14	-0.76
Motivation in School	1.11***	6.03	0.88***	4.25	1.42***	5.28	0.76**	2.96	1.20***	3.89	0.48	1.67
Hrs Spent on Homework	0.31***	6.06	0.21***	4.63	0.19*	2.40	0.40***	5.89	0.23***	3.29	0.19**	3.09
AP Offered	0.04	0.16	0.15	0.65	0.09	0.27	-0.06	-0.21	-0.07	-0.22	0.34	1.23
Catholic	-0.27	-0.62	0.25	0.64	-1.19	-1.86	0.42	0.79	0.25	0.48	0.38	0.78
Private, Other Religion	-0.22	-0.32	-0.10	-0.17	-0.98	-0.87	0.13	0.16	-0.85	-0.90	0.31	0.44
Private, Non-Religious	0.48	0.86	-0.08	-0.17	0.41	0.53	0.45	0.62	-0.38	-0.59	-0.05	-0.09
Suburban School	-0.41	-1.51	-0.15	-0.59	-0.83*	-2.02	-0.18	-0.53	0.08	0.21	-0.37	-1.21
Rural School	-0.29	-0.99	-0.13	-0.46	-0.39	-0.87	-0.3	-0.84	-0.10	-0.24	-0.09	-0.27
Avg School SES	0.87*	2.52	0.11	0.35	0.87*	2.01	0.42	1.23	0.48	1.21	0.24	0.73
Avg Imp of Friends' Grades	-0.02	-0.04	-0.97	-1.86	-0.10	-0.19	0.05	0.10	-1.12*	-1.96	0.12	0.25
Avg Motivation in School	-0.98	-1.80	0.13	0.22	-1.13	-1.88	-0.63	-1.23	-0.25	-0.38	0.55	0.94
Avg Hrs Spent on Homework	0.14	0.81	0.05	0.30	0.20	1.10	0.09	0.60	0.08	0.46	0.02	0.11
Female x Avg SES	-0.55	-1.48	0.37	1.05	-	-	-	-	-	-	-	-
Female x Avg Imp of Friends Grades	0.07	0.10	1.10	1.64	-	-	-	-	-	-	-	-
Female x Avg Motivation in School	0.41	0.58	0.04	0.05	-	-	-	-	-	-	-	-
Female x Avg Hrs Spent on Homework	-0.06	-0.30	-0.02	-0.10	-	-	-	-	-	-	-	-
Random Effects	Var	Std. Dev	Var	Std. Dev	Var	Std. Dev	Var	Std. Dev	Var	Std. Dev	Var	Std. Dev
Lvl-two variance = var(U0j)	2.08	1.44	1.71	1.31	3.18	1.78	1.44	1.20	0.00	0.00	1.55	1.25
Lvl-one variance = var(Rij)	27.62	5.26	25.41	5.04	30.14	5.49	25.04	5.00	31.80	5.64	21.29	4.61
Deviance	28073.00		25,361.00		13320.00		14,721.00		12404.00		12,907.00	

Source: NELS data. Standard Deviations in parentheses

Note: N = 7,201. * $p < .05$; ** $p < .01$; *** $p < .001$ (two-tailed t-tests)

Table 13: Model 7 & 9 for 10th and 12th Grade Achievement

	Model #7 Random Intercept				Model #9 Random Slope			
	10th Grade Achievement		12th Grade Achievement		10th Grade Achievement		12th Grade Achievement	
Fixed Effects	**Coefficients**	**t-value**	**Coefficients**	**t-value**	**Coefficients**	**t-value**	**Coefficients**	**t-value**
Intercept	10.73***	11.68	11.59***	12.86	10.69***	11.34	11.61***	12.52
Female	1.66*	2.22	-0.11	-0.14	1.62*	2.13	-0.16	-0.21
SES	0.76***	5.48	0.57***	3.98	0.77***	5.50	0.57***	3.99
Hispanic	-1.01*	-2.29	-1.13**	-2.73	-0.96*	-2.18	-1.19**	-2.89
Black	-1.62***	-3.59	-2.05***	-4.78	-1.57***	-3.49	-2.06***	-4.84
White	-0.28	-0.83	-0.72*	-2.32	-0.28	-0.81	-0.76*	-2.47
American Indian	-1.7	-1.76	-2.03*	-2.07	-1.69	-1.77	-2.04*	-2.08
Previous Score	0.7***	76.49	0.73***	73.39	0.7***	76.62	0.73***	73.62
Importance of Friends' Grades	-0.13	-0.91	-0.05	-0.35	-0.1	-0.75	-0.05	-0.37
Motivation in School	1.11***	6.11	0.89***	4.79	1.1***	6.08	0.89***	4.79
Hrs Spent on Homework	0.32***	6.41	0.22***	5.12	0.32***	6.41	0.22***	5.06
AP Offered	0.12	0.55	0.15	0.66	0.12	0.52	0.19	0.82
Catholic	-0.11	-0.27	0.31	0.80	0.01	0.03	0.32	0.83
Private, Other Religion	-0.09	-0.14	-0.14	-0.22	-0.06	-0.09	0.04	0.07
Private, Non-Religious	0.38	0.72	-0.04	-0.08	0.36	0.67	0.02	0.05
Suburban School	-0.27	-1.02	-0.16	-0.63	-0.25	-0.96	-0.18	-0.74
Rural School	-0.19	-0.67	-0.14	-0.51	-0.22	-0.78	-0.13	-0.48
Average School SES	0.93**	2.96	0.15	0.51	0.93**	2.85	0.1	0.33
Female x Avg SES	-0.68*	-2.15	0.34	1.10	-0.67*	-2.08	0.36	1.16
Random Effects	**Var**	**Std. Dev**	**Var**	**Std. Dev**	**Var**	**Std. Dev**	**Var**	**Std. Dev**
Level-two variance								
var(U0j)	2.06	1.44	1.69	1.30	3.83	1.96	3.50	1.87
var(U1j) for Female					0.95	0.97	1.04	1.02
cov(U0j,U1j)					-1.90		-1.91	
Lvl-one variance=var(Rij)	27.55	5.25	25.42	5.04	27.32	5.23	25.09	5.01
Deviance	28881.00		25,365.00		28866.00		25,350.00	

Source: NELS data. Standard Deviations in parentheses

Note: N = 7,201. * $p < .05$; ** $p < .01$; *** $p < .001$ (two-tailed t-tests)

Table 14: Model 10 Random Intercept and Random Average SES Slope

	10th Grade Students				12th Grade Students			
	Male Students		Female Students		Male Students		Female Students	
Fixed Effects	**Coefficients**	**t-value**	**Coefficients**	**t-value**	**Coefficients**	**t-value**	**Coefficients**	**t-value**
Intercept	10.81***	8.58	12.32***	11.33	10.78552886	8.59	12.19***	11.50
Female	-	-	-	-	-	-	-	-
SES	0.93***	4.22	0.60***	3.28	0.37	1.61	0.78***	4.24
Hispanic	-1.29	-1.89	-0.76	-1.35	-0.42	-0.65	-1.69***	-3.22
Black	-2.44***	-3.41	-1.1	-1.94	-2.00**	-2.88	-2.28***	-4.31
White	-0.43	-0.82	-0.23	-0.53	-0.14	-0.29	-1.29***	-3.30
American Indian	-1.99	-1.14	-1.66	-1.46	-1.62	-1.11	-2.36	-1.78
Previous Score	0.71***	51.19	0.70***	56.85	0.73***	49.07	0.74***	54.76
Importance of Friends' Grades	-0.24	-1.16	-0.02	-0.10	0.03	0.17	-0.12	-0.71
Motivation in School	1.41***	5.32	0.76**	3.01	1.13***	4.19	0.60*	2.29
Hrs Spent on Homework	0.22**	2.81	0.40***	6.07	0.24***	3.76	0.19***	3.39
AP Offered	0.14	0.42	0.08	0.31	-0.02	-0.06	0.34	1.25
Catholic	-0.69	-1.14	0.33	0.66	0.31	0.58	0.44	0.89
Private, Other Religion	-0.56	-0.53	0.15	0.21	-0.84	-0.88	0.28	0.40
Private, Non-Religious	0.48	0.68	0.3	0.45	-0.24	-0.36	0.01	0.01
Suburban School	-0.47	-1.20	-0.14	-0.45	0.11	0.31	-0.4	-1.32
Rural School	-0.12	-0.29	-0.3	-0.87	-0.13	-0.31	-0.11	-0.31
Average School SES	0.89*	2.20	0.37	1.16	0.4	1.01	0.29	0.91
Female x Avg SES	-	-	-	-	-	-	-	-
Random Effects	**Var**	**Std. Dev**	**Var**	**Std. Dev**	**Var**	**Std. Dev**	**Var**	**Std. Dev**
Level-two variance								
var(U0j)	5.55	2.36	5.53	2.35	7.12	2.67	3.19	1.79
var(U1j) for Female	0.07	0.27	0.27	0.52	0.32	0.57	0.39	0.62
cov(U0j,U1j)	-0.64		-1.22		-1.52		-0.83	
Lvl-one variance=var(Rij)	30.23	5.50	24.95	5.00	29.99	5.48	21.30	4.62
Deviance	13744.00		15,107.00		12400.00		12,908.00	

Source: NELS data. Standard Deviations in parentheses

Note: N = 7,201. * p < .05; ** p < .01; *** p < .001 (two-tailed t-tests)