Academic and Noncognitive Variables Related to PLAN® Scores

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Abstract

Primary and secondary schools are responsible for improving the academic performance of all students, with consequences of school reform or closure for those that fail to make progress (U.S. Department of Education, 2002). This study investigated relationships between achievement at grade 10 and high school course work and other background information, after statistically controlling for students' prior achievement at grade 8. Longitudinal data were collected from 42,193 students in 488 high schools. Multiple linear regression was used to determine the extent to which students' PLAN® scores at grade 10 could be explained by high school course work, educational needs, higher education goals, educational background, gender, and race/ethnicity, given their EXPLORE® scores at grade 8.

Students who had taken or planned to take upper-level mathematics and science courses (e.g., trigonometry, geometry, and chemistry) achieved higher PLAN Mathematics, Science, and Composite scores than did students who had not taken or planned to take these courses, given their prior academic achievement, educational needs, educational goals, and background characteristics. Differences between gender and racial/ethnic groups' mean PLAN scores were reduced when these independent variables were statistically controlled. Variation in regression coefficients was found across different types of high schools.

Academic and Noncognitive Variables Related to PLAN® Scores

Improving student achievement by improving the quality of education delivered to students in grades K-12 has been the goal of advocates of school reform for more than 20 years (cf., National Commission on Excellence in Education, 1983). For example, ensuring that schools deliver advanced academic skills and knowledge to all students so that they will contribute to their communities and to the national economy is now mandated through recent congressional legislation. The passage of the No Child Left Behind Act demands that schools show improvement in achievement for all students, with consequences of school reform or closure for those that fail to make progress (U.S. Department of Education, 2002). From primary through secondary education, students will be encouraged to take rigorous course work that is needed to meet the demands of high school exit tests, and that will prepare them with the academic skills and knowledge needed in today's work force or for entrance into higher education.

Research has shown that rigorous course work is related to academic achievement. For example, research on the relationship between PLAN performance (grade 10) and high school courses taken was investigated by Noble and Powell (1995). The study revealed that taking courses in algebra I and II, algebra I and geometry, and any foreign language accounted for the largest percentage of variance in PLAN scores (from 17% to 31%), after statistically controlling for students' educational needs, educational plans, and ethnicity or gender. Moreover, Schiel, Pommerich, and Noble (1996) presented evidence that performance on the ACT Assessment is related to taking math and science courses, after statistically controlling for achievement at grade 10, as measured by PLAN scores. It was concluded that students who had taken rigorous high school courses achieved higher scores on the ACT Assessment than did those who had not taken these courses, regardless of their PLAN scores in grade 10.

Another objective in the transition of schools is to provide equal access and opportunity that will close the achievement gap for gender and ethnic minority groups. Indeed, in recent policy recommendations to schools, it was proposed that to help more disadvantaged students enter higher education, all students, as early as middle school, begin and complete a challenging college-preparatory core curriculum (cf., Noeth and Wimberly, 2002). Research has shown that differences in ACT Assessment scores by gender and race/ethnicity were reduced by statistically controlling for achievement at grade 10, course work taken, educational needs, and educational plans (Schiel, Pommerich, and Noble, 1996). Noble and Powell (1995) also showed that PLAN score differences across gender and racial/ethnic groups were reduced by statistically controlling for course work taken and noncognitive variables (e.g., students' perceptions of themselves and others, family background, needs for help, etc.).

An additional objective in school reform is to alert principals, administrators, and staff about school characteristics (cf., Iversen, 1991) that influence the effectiveness of schools for improving the academic achievement of their students. Schiel, Pommerich, and Noble (1996) showed that students' achievement gains between PLAN and ACT Assessment scores were affected by characteristics of the schools they attended. Noble and Powell (1995) also showed that high school characteristics were key factors in acquiring higher-order thinking skills, as measured by PLAN. Further, the financial status of the school district and the financial status of the family were positively related to PLAN performance. These researchers proposed that a course (e.g., algebra) taken in different high schools might not lead to the same outcomes in learning skills, due to different delivery methods, different course content, or other types of high school characteristics (e.g., public or private, per-pupil expenditure, percent of students below the federal poverty level, etc.).

Despite the evidence gained from these studies, present research lacks certain knowledge about achievement at grade 10. No research has been undertaken to show that the relationship between achievement at grade 10 and course work taken, after statistically controlling for prior achievement at grade 8 and other independent variables, is similar to that obtained when prior achievement is not statistically controlled. Such research would help to determine whether encouraging students to take rigorous course work at grade 8 improves their educational achievement at grade 10. Moreover, research has not been undertaken that shows the effect of high school characteristics on achievement at grade 10, after controlling for students' prior achievement at grade 8. Such knowledge would alert administrators, principals and others concerned with differential effects of high school characteristics on achievement at grade 10. Further, no research has been done to show that differences in achievement between gender and racial/ethnic groups at grade 10 are explained largely by prior achievement at grade 8. Such knowledge would support or reject the hypothesis that taking or planning rigorous high-school course work leads to smaller achievement gaps between gender and racial/ethnic groups at grade 10.

The purpose of this study was to examine relationships among educational and noncognitive variables and achievement at grade 10, after statistically controlling for prior achievement at grade 8. Differential effects on achievement across high schools were also investigated. Using longitudinal data the following five research questions were addressed:

1. To what extent do the courses students take or plan to take explain achievement at grade 10, after statistically controlling for prior achievement at grade 8?
2. To what extent do noncognitive variables explain achievement at grade 10, after statistically controlling for prior achievement at grade 8 and courses taken or planned?

3. Are achievement differences at grade 10 between males and females reduced after statistically controlling for prior achievement at grade 8, courses taken or planned, and noncognitive variables?
4. Are achievement differences at grade 10 between racial/ethnic groups reduced after statistically controlling for prior achievement at grade 8, courses taken or planned, and noncognitive variables?
5. What effect do high school characteristics have on the relationships among prior achievement, courses taken or planned, noncognitive variables, and achievement at grade 10?

Data for the Study

The sample for this study was based on all students (over 175,000 students) who took EXPLORE® in grade 8 in 1997-1998 and PLAN® two years later in 1999-2000. The EXPLORE program is typically administered to students in the 8th or 9th grade, and the PLAN program is administered to students in the 10th grade. Students who were given extended time, high schools with less than 25 student records, and students with missing data on one or more variables were excluded from the study. Initial data screening resulted in a longitudinal sample of 42,193 student records from 488 high schools. There were slightly more females (54%) than males (46%). The majority racial/ethnic group was Caucasian (77%), followed by African-American/Black Non-Hispanic (8%), American Indian/Alaskan Native (3%) Mexican-American/Chicano/Latino (4%), Puerto Rican/Cuban/Other Hispanic (2%), Asian-American/Pacific Islander (2%), and Multiracial/Other (4%). Data including responses to Asian/Pacific Islanders or categories that could include Asian/Pacific Islanders (i.e., Multiracial/Other) were excluded from the analysis. Consequently, high schools represented only by excluded racial/ethnic groups were dropped reducing the number of schools for the within-

school analysis to 433. Due to the small number of students within schools for each racial/ethnic group, race/ethnicity was dichotomously coded as minority or majority (see p. 9).

Students who take EXPLORE are predominantly from schools in the Midwest and Southeast, whereas those who take PLAN are predominantly from the Midwest, Mountain/Plains, Southeast, and Southwest. The sample therefore is not representative of 8th or 10th grade students nationally. No data about school characteristics were collected below the high school level. Of the 433 high schools retained for the within-school analysis, 412 (95%) schools were public and 21 (5%) schools were private. Characteristics of public and private high schools were obtained from a file maintained by Market Data Retrieval, Inc. (Shelton, Connecticut).

Percentages by type of high school are displayed in Table 1. Percentages of students below the federal poverty level and per-pupil expenditure percentages are based on public high schools only, because this information is not available for private schools. Per-grade student enrollment and metropolitan area percentages are based on both public and private schools. Per-grade student enrollment was collapsed into quartiles to group low frequencies into a smaller ordered scale. The percentage of students below the federal poverty level, per-pupil expenditure, and per-grade enrollment were collapsed into two categories for the within-high school analysis.

TABLE 1

Characteristics of High Schools Attended by EXPLORE/PLAN – Tested Students (Number of schools = 433)

Characteristic	Percentage
Percent of students below the federal poverty level*	
0 – 4.9%	10
5 – 11.9%	34
12 – 24.9%	38
25% or more	13
Per-pupil expediture*	
$0 – 3199.99	< 1
3200 – 4199.99	27
4200 – 5199.99	41
5200 or more	27
Per-grade student enrollment	
1 - 130 students	25
131 - 223 students	25
224 - 450 students	25
451 or more students	25
Metropolitan Area	
Rural	49
Suburban	30
Urban	20

*Public schools only. Percentages may not add to 100% for some variables due to missing data.

Instruments

ACT's Educational Planning and Assessment System® (EPAS) includes three testing programs[1]. EXPLORE measures students' knowledge and academic skills at grades 8 and 9 (ACT, 2001). The next level of assessment is PLAN, which measures students' knowledge and academic skills at grade 10 (ACT, 1999). PLAN is typically administered in the fall of the student's sophomore year. EXPLORE and PLAN provide students and educators with

[1] For a complete description of EPAS, see http://www.act.org/epas/index.html.

information about students' progress in acquiring higher-order thinking skills that are important both during and after high school. For the majority of students tested, a two-year period of academic learning and personal development elapses between EXPLORE and PLAN. The final component to the ACT Assessment is ACT, which measures students' knowledge and academic skills at grades 11 or 12 (ACT, 1997).

Achievement component. EXPLORE scores in English, Reading, Mathematics, and Science range from 1 to 25 and PLAN test scores in these same subjects range from 1 to 32. EXPLORE and PLAN Composite scores are computed as the average of the four subject area scale scores, rounded to the nearest integer. Scores obtained and reported on the four EXPLORE tests were scaled to each of the four corresponding PLAN test scores (ACT, 2001, p. 23). This means that a student with a given score on an EXPLORE test at grade 8 would be expected to receive the same score on the corresponding PLAN test, if he or she had taken PLAN at the same time as EXPLORE.

Course work information. Students' self-reported course work taken by grade 10 or planned to be taken before grade 12 was gathered using the high school Course Information Section (CIS) of PLAN, which collects information on 30 high school college preparatory courses. Table 2 includes a description of the course work variables from the CIS and their coding for this study. Although the data are self-reported, Schiel and Noble (1991) showed a high level of consistency between high school sophomores' reports of courses taken and their school transcripts (median proportion of consistency across schools = .96).

The first five rows of Table 2 provide information about students' course taking and course planning. These data reflect a student's selection from one of three options from PLAN's CIS for each of the courses listed in column 2: Have taken or am taking, have not taken but will,

TABLE 2

Description of Independent Variables in Regression Models

Independent variables	Description	Coding
Courses taken/planned (PLAN)		
English (5 courses)	English 9, English 10, English 11, English 12, and Speech	Set 1 Taken = 1; not taken = 0. Set 2 Taken or planned = 1; not planned = 0.
Mathematics (7 courses)	Algebra I (not pre), Algebra II, Geometry, Trigonometry, Calculus (not pre), Other math beyond Algebra II, Computer math/computer science.	Set 1 Taken = 1; not taken = 0. Set 2 Taken or planned = 1; not planned = 0.
Science (4 courses)	General Science, Biology, Chemistry, Physics.	Set 1 Taken = 1; not taken = 0. Set 2 Taken or planned = 1; not planned = 0.
Social Studies (7 courses)	U.S. History, World History/Civilization, Other History, American Government, Economics, Geography, Psychology.	Set 1 Taken = 1; not taken = 0. Set 2 Taken or planned = 1; not planned = 0.
Art (3 courses)	Art, Music, Drama/Theater.	Set 1 Taken = 1; not taken = 0. Set 2 Taken or planned = 1; not planned = 0.
Foreign Language (4 courses)	Number of years that are planned to take Spanish, French, German, Other Language.	1 Year =1; 2 Years = 2; 3 Years = 3; 4 Years = 4; 5 Years =5
Perception of educational need (EXPLORE & PLAN)		
Educational Need (Course & school related skills)	Expressing ideas in writing. Increasing reading speed. Increasing reading understanding. Developing math skills. Developing study skills. Developing test-taking skills. Understanding and using computers. Investigating my options after high school (EXPLORE only). Choosing a college or tech school (PLAN only).	Little/None = 1; Lot/Some = 0
Higher education goals (PLAN)		
Educational plans after high school (single item)	Dichotomous variable based on students' response to one of nine prompts.	College bound = 1; Non-college bound = 0

TABLE 2 (continued)

Independent variables	Description	Coding
Educational background (EXPLORE)		
Parents' education	Mother's or Father's highest level of education.	Did not complete high school = 1; HS diploma or GED = 2; Job, vocational, or technical training = 3; Attended 2-year college = 4; Attended 4-year college = 5; Attended graduate school = 6.
Primary Language	English is the language most frequently spoken in your home.	Yes = 1; no = 0.
Characteristics of the student		
Gender		Female = 1; Male = 0
Racial/ethnicity		Caucasian = 1; Minority (African-American/Black, American Indian/Alaskan Native,Mexican-American/ Chicano/Latino Puerto Rican/Cuban/Other Hispanic = 0

or have not taken and will not. Column 3 in Table 2 presents two sets of dichotomous coded variables contrasting the responses students gave to each course in the six curriculum areas (English, Mathematics, Science, Social Studies, Art, and Foreign Language). Dichotomous variables in Set 1 were given a value of one if the student had taken or was currently taking one of the courses listed in column 2. Alternatively, Set 1 variables were given a value of zero if the student had not taken, but might be planning to take or not planning to take one of these courses. Dichotomous variables in Set 2 were coded one if the student had not taken but was planning to take one of the courses listed in column 2. Set 2 variables were coded zero if the student did not plan to take one of these courses.

Educational needs and educational goals. In addition to high school course information, data were included from the Needs Assessment Section of both EXPLORE and PLAN. Students were asked to report their needs for help in ten educational needs areas on each test. Of the ten

educational need variables eight were common to both tests. Each of these eight variables were measured on a 3-point ordinal scale that ranged from 0 (I need *little* or *no* help in this area) to 2 (I need a *lot* of help in this area). These variables were recoded as 0 (no help needed in this area) or 1 (need some or lots of help in this area). Students were also asked to indicate their higher education goals. Categories were collapsed into 0 (non-college bound) or 1 (college bound) for this variable.

Parents' highest level of education. Students at grade 8 were asked to report their parents' highest level of education on an ordinal scale ranging from 1 (did not complete high school) to 6 (attended graduate school). Because there was a moderate correlation (r = .57) between the educational background of mothers and fathers, the rank values for the eight levels of formal education were averaged together into a single measure of parental education.

Student background characteristics. Students' gender was coded as 0 (male) and 1 (female). Racial/ethnic group membership was coded as 1 for the majority group (Caucasian) and 0 for minority groups with lower test scores (African American/Black, American Indian/Alaskan, American Mexican/Chicano/Latino, and Puerto Rican/Cuban/Other Hispanic). It should be noted that even with these adjustments, 37% of the high schools in this study had less than five ethnic minority students.

Method

Multiple linear regression was used to answer the research questions for this study. Simple correlations and regression models based on pooled data were used to identify the final regression models for each PLAN score. Within-school regression models were then developed using final regression models. Regression statistics were then summarized across schools using minimum, median, and maximum values.

Regression Model Development

Each of the five PLAN scores was used as a dependent variable, and the five EXPLORE scores were used to statistically control for prior achievement. EXPLORE scores used to predict each PLAN score were selected on the basis of their paired correlations (see Appendix A). Table 3 contains the correlations for the selected EXPLORE and PLAN score pairs. The EXPLORE Mathematics score was used to statistically control for prior achievement for PLAN Mathematics, and the EXPLORE Composite score was used to statistically control for prior achievement for all other PLAN scores.

TABLE 3

Paired EXPLORE and PLAN Correlations – Pooled Sample

PLAN scores	EXPLORE scores	r	Standard error of estimate
English	Composite	.78	2.84
Mathematics	Mathematics	.76	2.83
Reading	Composite	.74	3.23
Science	Composite	.75	2.37
Composite	Composite	.86	1.93

N = 42,193 longitudinal student records.

Selecting independent variables. EXPLORE scores were entered into each regression equation first to control for prior achievement before entering five sets of independent variables. Independent variables, as shown in Appendix B, were required to share a logical relationship with PLAN scores, have a zero-order correlation greater than .1 or higher PLAN scores, and regression coefficients for course work variables were required to be $\geq$ 0.5. In addition, each independent variable was assessed for collinearity with other independent variables within and across sets of variables (Belsley, Kuh, and Welsch, 1980).

The same criteria of selection used for pooled data was further applied to the within-school regression models. Except for 12th grade English, the English, social studies, arts, and language courses did not meet the criteria for selection; these variables were found to be collinear with other independent variables. PLAN English and Reading within-school regression models, then, contained no course work variables; however, mathematics and science course work variables were included for PLAN Mathematics, Science, and Composite.

Final within-school regression models expressed PLAN scores as a function (*f*) of prior achievement, as measured by EXPLORE scores, and independent variables that met the criteria for selection:

PLAN English	=	*f* (EXPLORE Composite; educational plans; parents' education; gender; majority/minority group membership)
PLAN Mathematics	=	*f* (EXPLORE Mathematics; algebra II (taken); geometry (taken); trigonometry (taken or planned); chemistry (taken or planned); developing test-taking skills; educational plans; parents' education; gender; majority/minority group membership)
PLAN Reading	=	*f* (EXPLORE Composite; increase reading speed; increase reading understanding; educational plans; parents' education; gender; majority/minority group membership)
PLAN Science	=	*f* (EXPLORE Composite; geometry (taken); trigonometry (taken or planned); parents' education; gender; majority/minority group membership)
PLAN Composite	=	*f* (EXPLORE Composite; geometry (taken); trigonometry (taken or planned); educational plans; parents' education; gender; majority/minority group membership)

The amount of time elapsed between EXPLORE and PLAN test administration dates was investigated to determine its effect on PLAN scores, after adjusting for prior achievement. Difference scores were computed between all PLAN and EXPLORE scores. Correlations were

then computed between each of the five difference scores and the number of months that had elapsed between EXPLORE and PLAN test administration dates. The difference in time between EXPLORE and PLAN test administration dates ranged from 13 to 27 months, with an average difference of slightly less than two years (23 months). No correlation was statistically significant ($p > .05$). Moreover, less than 1% of the variance in each of the five difference scores (English, Mathematics, Reading, Science, and Composite) could be attributed to the number of months between test administration dates. Therefore, time between administration dates was excluded from the regression models for this study.

Results

Distributions of descriptive statistics across high schools were summarized using median, minimum, and maximum values. Median percentages of students having taken or planned to take geometry, algebra II, trigonometry, and chemistry ranged from 37% to 99% across schools (see Table 4). The median percentage of sophomores across high schools who were taking or had taken geometry was 70%, where a smaller percentage of sophomores across high schools were taking or had taken algebra II (median = 37%). Moreover, more than half of the students across high schools reported that they were taking, had taken, or planned to take trigonometry (median = 65%) and nearly all students were taking, had taken, or planned to take chemistry (median = 90%).

Percentages of females ranged from 30% to 79% across high schools; the median percentage of females was 54%. Majority racial/ethnic group representation ranged from 1% to 99% across high schools; the median percentage for this group was 89%.

TABLE 4

Median, Minimum, and Maximum Percentage of Students Having Taken or Planned to Take Course Work, Across High Schools

Variable	Med.	Min.	Max.
Course work taken/Planned			
Algebra II	37	2	94
Geometry	70	4	99
Trigonometry	65	2	95
Chemistry	90	56	99
Female	54	30	79
Majority	89	1	99

Median, minimum, and maximum statistics presented in Table 5 summarize within-school means and sample sizes for PLAN and EXPLORE by gender and race/ethnicity. Median EXPLORE means ranged from 15.5 for Reading to 17.1 for Science across schools. Median PLAN means ranged from 17.4 for Reading to 18.5 for Science. Moderate spread in the distribution of PLAN and EXPLORE means across high schools is shown by minimum and maximum values.

Females typically scored higher than males on EXPLORE English, Reading, Science, and the Composite; differences between medians ranged from .3 for Science to 1.3 for English. EXPLORE Mathematics means across high schools were typically higher for males than for females (median difference = .2). Comparisons of PLAN scores showed that females scored higher than males on PLAN English (median difference = 1.8), Reading (median difference = 1.2), and the Composite (median difference = .4). Males typically scored higher than females on PLAN Mathematics (median difference = .6). Median PLAN Science averages across high schools were the same for males and females.

TABLE 5

Distributions of Descriptive Statistics, Across Schools (N = 433), by Gender and Race/Ethnicity

	N		English mean score		Mathematics mean score		Reading mean score		Science mean score		Composite mean score	
	Median	**Min/Max**	**Median**	**Min/Max**	**Median**	**Min/Max**	**Median**	**Min/Max**	**Median**	**Min/Max**	**Median**	**Min/Max**
EXPLORE												
Males	29	6/169	14.9	9.9/20.0	15.7	9.8/20.4	15.1	10.8/18.9	16.9	12.5/19.8	15.8	11.1/19.6
Females	33	8/172	16.2	10.1/20.7	15.5	10.6/19.7	16.0	11.2/20.1	17.2	13.2/20.0	16.3	11.5/19.9
Majority	46	1/307	16.0	9.0/21.1	15.9	9.2/20.2	15.8	9.6/20.4	17.3	13.2/20.1	16.4	10.4/20.3
Minority	8	1/177	13.5	5.0/25.0	14.2	5.0/23.0	13.9	9.0/25.0	16.0	8.0/25.0	14.4	9.0/22.0
Total	61	23/320	15.6	10.1/20.5	15.6	10.3/20.1	15.5	11.4/19.7	17.1	13.6/19.7	16.1	11.5/19.8
PLAN												
Males	29	6/169	16.9	11.9/23.1	17.9	13.1/23.9	16.7	12.4/23.8	18.5	14.5/22.6	17.7	13.3/21.8
Females	33	8/172	18.7	11.8/24.1	17.3	12.6/22.6	17.9	10.5/23.1	18.5	15.1/21.1	18.1	13.1/22.7
Majority	46	1/307	18.3	11.0/24.0	18.0	13.2/23.3	17.8	10.0/23.4	18.8	10.0/21.9	18.4	11.0/23.2
Minority	8	1/177	15.6	7.0/28.0	15.7	5.0/29.0	15.4	7.0/31.0	17.1	11.0/30.0	16.0	9.0/27.0
Total	61	23/320	17.8	11.9/23.8	17.5	13.0/23.2	17.4	12.4/23.4	18.5	14.8/21.6	17.9	13.2/22.9

The majority racial/ethnic group typically scored higher than the minority group on all EXPLORE and PLAN tests. For EXPLORE, the difference between majority and minority medians across schools ranged from 1.3 for Science to 2.5 for English. For PLAN, the difference between majority and minority medians ranged from 1.7 for Science to 2.7 for English across schools.

Within-school regression results. Median, minimum, and maximum regression statistics for each of the five PLAN models are displayed in Tables 6 and 7. A separate table was constructed for PLAN English and Reading, since no course work variables met the criteria for selection for these tests. The typical number of students for each model was 61, and ranged from 25 to 320 across schools. The multiple R medians ranged from .73 for PLAN Science to .87 for PLAN Composite.

Regression coefficients of dichotomously-coded variables (e.g., course work variables) reflect statistically adjusted mean test score differences between each identified group coded as one and the comparison group coded as zero (cf., Pedhazur, 1997, p. 356). For example, as shown in Table 6, positive high school median regression coefficients for the PLAN Mathematics test were associated with taking algebra II, given all other variables in the model. Adjusted mean PLAN Mathematics scores of students taking algebra II were typically 1.53 scale score units higher than those of students who did not take algebra II. In addition, adjusted mean PLAN Mathematics scores of students taking geometry were on average, 1.37 scale score units higher than those of students not taking geometry. Smaller adjusted mean differences were associated with taking or planning to take trigonometry (.35) or chemistry (.10). Positive regression coefficients on the PLAN Science test were, on average, associated with taking geometry (.52) or taking or planning to take trigonometry (.33). Results also indicated, as shown

TABLE 6

Distributions, Across Schools, of Regression Statistics for Modeling PLAN Mathematics, Science, and Composite Scores – Gender and Racial/Ethnicity

	PLAN Mathematics			PLAN Science			PLAN Composite		
Statistic	**Med.**	**Min.**	**Max.**	**Med.**	**Min.**	**Max.**	**Med.**	**Min.**	**Max.**
R	0.83	0.63	0.95	0.73	0.31	0.90	0.87	0.58	0.97
SEE	2.37	1.20	4.60	2.20	1.24	3.55	1.78	0.97	2.56
Intercept	4.66	-7.40	15.66	6.82	-1.91	18.36	1.83	-6.78	14.32
Regression coefficients									
EXPLORE Mathematics /Composite	0.64	-0.06	1.38	0.68	0.11	1.14	0.92	0.23	1.35
Taken									
Algebra II	1.53	-6.93	9.33	---	---	---	---	---	---
Geometry	1.37	-8.52	7.85	0.52	-5.18	4.75	0.60	-3.05	3.55
Taken or Planned									
Trigonometry	0.35	-3.19	4.80	0.33	-3.44	3.48	0.31	-3.41	3.57
Chemistry	0.10	-7.52	8.57	---	---	---	---	---	---
Developing test-taking skills	0.64	-2.46	3.35	---	---	---	---	---	---
Educational plans	0.36	-7.09	8.73	---	---	---	0.44	-5.53	5.73
Parents' education	0.10	-1.01	1.33	0.07	-0.58	1.31	0.10	-0.51	0.74
Gender	-0.53	-5.63	4.48	-0.43	-3.30	1.93	-0.08	-1.81	2.85
Majority/Minority	0.53	-12.70	6.60	0.22	-6.98	5.02	0.33	-5.11	3.78

TABLE 7

Distributions, Across Schools, of Regression Statistics for Modeling PLAN English and Reading Scores – Gender and Racial/Ethnicity

	PLAN English			PLAN Reading		
Statistic	**Med.**	**Min.**	**Max.**	**Med.**	**Min.**	**Max.**
R	0.81	0.45	0.93	0.76	0.37	0.93
SEE	2.67	1.73	3.91	3.06	1.03	4.35
Intercept	-1.89	-14.59	13.34	-0.55	-14.33	15.32
Regression coefficients						
EXPLORE Composite	1.11	0.36	1.69	1.00	0.15	1.97
Increasing reading speed	---	---	---	0.72	-3.94	4.66
Increasing reading understanding	---	---	---	0.70	-2.55	6.23
Educational plans	0.68	-5.73	7.00	0.60	-6.82	6.83
Parents' education	0.16	-1.93	1.23	0.13	-0.94	1.55
Gender	0.85	-2.40	3.97	0.36	-3.10	4.44
Majority/Minority	0.46	-5.53	6.61	0.23	-7.94	9.19

in Tables 6 and 7, that positive regression coefficients were, on average, associated with planning to attend college for PLAN English (.68), Mathematics (.36), Reading (.60), and Composite (.44) scores.

The regression coefficients for gender in Tables 6 and 7 showed that for the typical high school, PLAN adjusted means for females were higher than those for males for PLAN English and Reading (median regression coefficients = .85 and .36), whereas adjusted means for females were typically lower than those for males for PLAN Mathematics and Science (median regression coefficients = -.53 and -.43). Compared to the unadjusted means in Table 5, after statistically controlling for prior achievement and the other independent variables, gender differences decreased, on average, by 53% (English), 12% (Mathematics), 70% (Reading,) and 80% (Composite). Mathematics continued to show higher average scores for males. To a much lesser degree, English and Reading continued to show higher average scores for females. Although Composite median adjusted means for males were slightly higher than those for females (median regression coefficient = -.08), the gender difference between median unadjusted means was substantially reduced (92%) by statistically controlling for prior achievement and the other independent variables. For Science, statistically controlling for prior achievement and the other independent variables resulted in an increase in gender differences. Possible reasons for this finding are presented in the Discussion section of this report. After statistically controlling for prior achievement and the other independent variables in this study, PLAN scores continued to show higher averages for the majority group. Compared to the unadjusted means shown in Table 5, however, mean differences were reduced by 81% (English), 77% (Mathematics), 90% (Reading), 87% (Science), and 86% (Composite) by statistically controlling for these variables.

Regression models were also constructed using gender, but excluding race/ethnicity from the equation, and using race/ethnicity, but excluding gender. Results indicated that the regression statistics from the gender-group only model and racial/ethnic group-only model were comparable to those for the joint model.

Median regression coefficients by school characteristics. Median regression coefficients were compared across each high school characteristic, as shown in Appendices C through G. Because no course work variables met the criteria for selection for PLAN English and Reading, comparisons were made only for PLAN Mathematics, Science, and Composite. To simplify the interpretation and presentation of comparisons, all regression coefficients reflect the relationship between an independent variable and PLAN test score, after statistically controlling for prior achievement, course work, educational needs, educational plans, gender, and racial/ethnic groups.

The following four benchmarks were set for differences between school types in the association of course work taken with PLAN scores: similar (< .10), somewhat different (.10 to < .30), moderately different (.30 to < .50), and very different (≥ .50). These benchmark ranges are intended to reflect practically important differences.

Public and Private Schools (Appendix C)

Course work regression coefficients were compared between public high schools and private high schools. In general, public high schools typically showed moderately higher adjusted PLAN Mathematics and Composite means associated with course work taken in geometry, compared to private high schools (median difference = .50 and .48). In comparison, private high schools typically showed moderately higher adjusted PLAN Science means for course work taken in geometry (median difference = .40). Public and private high school

regression coefficients were similar for course work taken in algebra II for PLAN Mathematics (median difference = .06) and course work taken or planned in trigonometry for Mathematics and Science (median difference =.01 and .04). Public and private high school regression coefficients for course work taken or planned in trigonometry were somewhat different for the Composite (median difference = .12). In comparison, private high schools typically showed moderately higher adjusted PLAN Mathematics means associated with course work taken or planned in chemistry (median difference = .43). It should be noted that the number of private schools in this sample was small; estimated regression coefficients from a small sample might not be sufficient to represent the distribution across all private schools.

Per-Grade Enrollment (Appendix D)

For PLAN Science and the Composite, taking or planning to take trigonometry was associated with somewhat higher adjusted PLAN means for schools with smaller per-grade enrollment, compared to larger schools (median difference = .16 and .10). In contrast, schools with larger per-grade enrollments typically showed moderately higher adjusted PLAN means associated with course work taken in geometry for PLAN Mathematics and the Composite than schools with smaller per-grade enrollments (median difference = .23 and .18).

Metropolitan Area (Appendix E)

High schools in suburban and urban areas typically showed somewhat higher adjusted PLAN Mathematics means associated with course work taken in algebra II than high schools in rural areas (median difference = .15 and .24). High schools in suburban areas typically showed somewhat higher adjusted PLAN Mathematics means for course work taken or planned in chemistry, compared to high schools in rural areas (median difference = .10). In addition, high schools in rural areas typically showed somewhat higher adjusted PLAN Science and Composite

means for course work taken or planned in trigonometry than suburban or urban schools (median Science difference = .14 and .19; median Composite difference = .13 and .17). High schools in urban areas typically showed somewhat larger regression coefficients for course work taken in geometry for PLAN Science, compared to high schools in rural areas (median difference = .12).

Percent Below Federal Poverty Level (Appendix F)

High schools with less than 12% of their students below the federal poverty level typically showed a moderately higher adjusted PLAN Mathematics mean associated with course work taken in algebra II, compared to high schools with 12% or more of their students below the federal poverty level (median difference = .30). Schools with less than 12% of their students below the federal poverty level typically showed somewhat lower adjusted PLAN Mathematics means for course work taken or planned in trigonometry and somewhat higher adjusted PLAN Science mean for course work taken or planned in trigonometry, compared to high schools with 12% or more of their students below the federal poverty level (median difference = .18 and .15).

Per-Pupil Expenditure (Appendix G)

High schools with less than $4,200 per-pupil expenditure typically showed moderately higher adjusted PLAN Mathematics means for course work taken in algebra II, compared to high schools with higher per-pupil expenditure (median difference = .43). High schools with less than $4,200 per-pupil expenditure typically showed somewhat lower adjusted PLAN Science and Composite means for course work taken in geometry, compared to high schools with higher per-pupil expenditure (median difference = .13 and .21). In additional comparisons, however, high schools with less than $4,200 per-pupil expenditure typically showed somewhat larger regression coefficients for course work taken or planned in trigonometry for PLAN Science and Composite, compared to high schools with higher per-pupil expenditure (median difference = .21 and .11).

In summary, a few moderate differences in adjusted means associated with course work taken and course work taken or planned were shown between school types for PLAN Mathematics, Science, and Composite test scores. The majority of the adjusted means, however, were about the same across school types.

Discussion

Course Work

Results of this study showed that students who take or plan to take rigorous mathematics and science courses (e.g., algebra II, geometry, trigonometry, and chemistry), on average, achieve higher PLAN Mathematics, Science, and Composite scores than students who do not take these courses, regardless of prior achievement, perceived educational needs, educational plans, educational background, and personal characteristics of the student. These findings are consistent with prior research that investigated the effects of course work taken and planned, noncognitive variables, gender, and racial/ethnic groups on PLAN scores (Noble and Powell, 1995), and on ACT Assessment scores after statistically controlling for PLAN scores (Schiel, Pommerich, and Noble, 1996). Unlike previous work, this study controlled for students' prior achievement at grade 8.

Given the benchmarks set for this study, few relationships were detected between PLAN English and Reading scores and courses taken or planned in English and social studies. It should not be concluded, however, that these types of courses are not important to ACT performance simply based on the criteria of selection used for this study. Exclusion of English and social studies course work occurred largely because of insufficient variability and problems of highly redundant relationships with other independent variables. For example, most students take or plan to take 11th grade (98%) English and 12th grade English (96%), as shown in Appendix B.

Although the percentage of students that had taken or planned to take course work in social studies was more evenly distributed for some courses (e.g., psychology showed 45% of those who took or planned to take these courses), social studies course work was also related to mathematics and science course work, which were more related to PLAN test performance, after including all other independent variables in the model. These findings are not new. Problems of low variability, collinearity, and small regression coefficients were shown in previous research on the ACT Assessment and English or social studies course work (cf., Noble, Davenport, Schiel, and Pommerich, 1999; Schiel, Pommerich, and Noble, 1996).

Weak relationships between PLAN English and course work taken or planned might be attributed to the delivery of curriculum that places less emphasis on writing skills. More than half of the items on PLAN English reflect usage and mechanics questions. Yet, a recent survey shows high school teachers rank grammar and usage skills least important for their students to attain (see http://www.act.org/news/releases/2003/4-08-03.html). College faculty, however, consider grammar and usage skills as most important for students to attain before entering college. Further research is needed to understand why college faculty and high school teachers disagree on what needs to be emphasized in high school instruction regarding writing skills.

Gender and Race/Ethnicity

Findings from this study showed that, except for PLAN Science, PLAN mean differences across schools between males and females (as measured by the median regression coefficients for gender) were reduced by 53% to 80% after statistically controlling for prior achievement, course work taken or planned, educational needs and plans, parents' education, and race/ethnicity. Although gender differences across schools on PLAN Mathematics means were

reduced after adjusting for the other variables in the model, the slight .07 reduction in differences could simply be attributed to a lack of precision in parameter estimates.

An increased gender difference in PLAN Science means was found after adjusting for the other variables in the model. Additional regression models were developed to explore effects that might contribute to an increased gender difference. Regressing EXPLORE Composite on gender alone showed that within most schools, females were about half a point higher than males (.56) at grade 8. Regressing PLAN Science on gender after controlling for EXPLORE Composite scores only resulted in an average adjusted mean difference of -.45 across schools, which is only slightly higher than the result shown with the inclusion of other predictors in the model (see Table 6). Results indicate that within most schools, females score higher than males at grade 8 on EXPLORE Composite, but by grade 10 males have caught up and score slightly higher than females on PLAN Science. Other research into relationships between gender and achievement provides evidence that males tend to outperform females in mathematics and science over time on the Iowa Test of Basic Skills from grades 3 through 8 and on the Iowa Test of Educational Development from grades 9 through 12 (Becker and Forsyth, 1990; Martin and Hoover, 1987). It is possible females begin to lose interest in Science by grade 10 and focus their attention on other subject areas. Future research is needed to find if the effect of subject area interest and motivation on PLAN Science is the same for males and females.

Majority/minority adjusted PLAN mean differences on all tests were reduced substantially by statistically controlling for the variables under investigation. Reduction in majority/minority PLAN mean differences ranged from 1.5 points for PLAN Science to 2.2 points for PLAN English, after controlling for the other variables in each model. Although the

representation of minority racial/ethnic groups was small compared to the majority group, this is typical for the ACT-tested population.

In summary, these results offer an encouraging direction to take in narrowing the gap between female, male, and racial/ethnic group differences in student achievement. The results suggest that it is important for students to develop an academic plan that includes taking rigorous upper-level course work throughout high school to successfully achieve academic skills needed for education and work, regardless of their gender, racial/ethnicity, or prior achievement.

Although student-level variables under investigation in this study explained from 53% to 76% of the variability in PLAN scores, 24% to 52% of the variability remained unexplained. Future research could identify additional student-level variables related to academic performance at grade 10. Other variables could further reduce differences between males and females and racial/ethnic groups.

School Characteristics

This study yielded evidence that the relationship between course work taken or planned to be taken and achievement gains from grade 8 to grade 10 differ by school characteristics, given all other variables considered. For some schools, taking particular courses, at best, was weakly related to PLAN scores. The reason for a weak relationship could be due to restriction of range; that is, the lack of within-school variability on one or more variables will weaken a correlation between variables. For example, percentages as high as 99% of students reported taking geometry for some schools, where only 4% of students reported taking geometry for other schools. Yet, schools having low variability on course taking patterns should be offset by schools with greater variability on these variables; therefore, results reflected in median regression coefficients across schools indicated important positive relationships between rigorous course

taking patterns and PLAN scores. Variability in the rigor of a course could also account for differences that were found between schools with respect to the proportion of students who were taking or planning to take upper-level course work at a particular school.

Investigation of school characteristics revealed some differences between public and private schools in the relationships between course work taken or planned and PLAN tests. Due to the small number of private schools in this study, these results should be considered preliminary. Future research with a larger representation of private schools is recommended.

Other school characteristics under investigation in this study were per-grade enrollment, high school location, percent of students below the poverty level, and per-pupil expenditure. The results suggest that these characteristics affect the relationship between PLAN tests and academic and noncognitive variables. Effects of school characteristics on PLAN performance were examined individually instead of in combination, however; therefore, it is difficult to assess the combination of these effects for the typical school. It is likely that the combined effects of individual school characteristics on PLAN performance would be different from one school to another.

Schools are under pressure to provide evidence that all students have equal access to higher education and learning. It is important for high school educators, counselors, and parents to assess their students' progress in achievement of academic skills and knowledge. Results of this study show that early planning and taking rigorous courses will help students acquire the advanced skills and higher-level thinking needed for success throughout and after high school.

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Appendix A

Correlation Coefficients Between EXPLORE and PLAN Scores

		EXPLORE scores					PLAN scores				
	Variable	**E**	**M**	**R**	**S**	**C**	**E**	**M**	**R**	**S**	**C**
EXPLORE	English	—									
	Mathematics	.67	—								
	Reading	.74	.63	—							
	Science	.71	.69	.71	—						
	Composite	.90	.85	.88	.87	—					
PLAN	English	.77	.65	.69	.67	.79	—				
	Mathematics	.65	.76	.60	.67	.76	.69	—			
	Reading	.68	.58	.68	.64	.73	.74	.62	—		
	Science	.63	.63	.61	.65	.71	.69	.69	.68	—	
	Composite	.78	.75	.74	.75	.86	.90	.86	.88	.85	—
	Mean	15.78	15.94	15.75	17.31	16.32	18.12	18.10	17.68	18.74	18.28
	SD	4.15	3.52	3.85	2.86	3.17	4.67	4.43	4.75	3.42	3.79

N = 42,193 longitudinal student records.

Appendix B

Percentages and Zero-order Correlation Coefficients for Blocks of Independent Variables That Met the Criteria of Selection

Independent variable	%	English r	Mathematics r	Reading r	Science r	Composite r
1. High School Courses Taken/Planned						
Courses Taken						
Algebra I (not pre).	.95	.18	.18	.16	.16	.20
Algebra II.	.42	.34	.44	.30	.34	.41
Geometry.	.72	.38	.43	.33	.35	.43
Trigonometry.	.06	.20	.28	.19	.22	.25
Other Math Beyond Algebra.	.03	.07	.10	.06	.08	.09
General Science.	.82	-.06	-.10	-.07	-.07	-.08
Biology.	.89	.10	.09	.08	.08	.10
Chemistry.	.22	.22	.29	.22	.23	.27
Art.	.58	.10	.10	.09	.08	.11
German.	.43	.12	.06	.09	.07	.10
Courses Taken or Planned						
English 11.	.98	.10	.10	.09	.09	.11
English 12.	.96	.11	.10	.10	.09	.12
Algebra II.	.94	.17	.17	.15	.15	.18
Geometry.	.95	.18	.18	.16	.16	.20
Trigonometry.	.66	.26	.30	.23	.26	.30
Calculus (not pre).	.51	.25	.34	.23	.27	.31
Other Math Beyond Algebra.	.57	.19	.25	.18	.20	.23
General Science.	.87	-.10	-.14	-.10	-.10	-.12
Chemistry.	.91	.16	.16	.14	.14	.17
Physics.	.73	.15	.19	.14	.17	.19
Psychology.	.45	.12	.06	.12	.07	.11
French.	.57	-.09	-.09	-.08	-.09	-.10
2. Educational Need						
EXPLORE						
Expressing ideas in writing.	.52	.13	.04	.12	.07	.10
Increasing reading speed.	.53	.27	.11	.27	.18	.24

Appendix B (continued)

Independent variable	%	English r	Mathematics r	Reading r	Science r	Composite r
Increasing reading understanding.	.52	.24	.18	.27	.21	.26
Developing math skills.	.41	.11	.29	.06	.17	.17
Developing study skills.	.35	.13	.12	.11	.12	.14
Developing test-taking skills.	.45	.25	.25	.23	.24	.28
PLAN						
Expressing ideas in writing.	.46	.14	.02	.13	.06	.10
Increasing reading speed.	.48	.23	.07	.25	.15	.21
Increasing reading understanding.	.45	.23	.15	.27	.21	.25
Developing math skills.	.36	.15	.37	.10	.22	.24
Developing study skills.	.28	.14	.15	.12	.14	.16
Developing test-taking skills.	.35	.26	.28	.24	.27	.30
Investigating my options after high school.	.27	-.11	-.11	-.10	-.10	-.12
3. Higher Education Goals						
Educational Plans (EXPLORE)	.93	.19	.16	.17	.15	.19
Educational Plans (PLAN)	.94	.22	.19	.19	.18	.22
4. Educational Background						
Parents' level of education.*		.28	.30	.27	.26	.32
5. Student Characteristics						
Student's gender	.55	.15	-.08	.10	-.03	.05
Black/White Ethnic Group Comparison	.08	-.23	-.25	-.21	-.23	-.26
Hispanic/White Ethnic Group Comparison	.05	-.13	-.09	-.10	-.10	-.12
Asian/White Ethnic Group Comparison	.02	.05	.10	.05	.06	.07
Other/White Ethnic Group Comparison	.06	-.08	-.08	-.07	-.07	-.08

N = 42,193 students with no missing data on all variables. *Mean = 3.79 and standard deviation = 1.43 for parent's level of education. Independent variables with r < .1 are not shown in the table.

Appendix C

Distribution, Across Schools, of Within-School Regression Statistics, by Public and Private High Schools

	Public High Schools (N = 412)			Private High Schools (N = 21)		
Statistic	**Med.**	**Min.**	**Max.**	**Med.**	**Min.**	**Max.**
N	61	25	320	49	29	147
PLAN Mathematics Scores						
R	0.83	0.63	0.95	0.81	0.69	0.91
SEE	2.37	1.20	4.60	2.47	1.79	3.52
Intercept	4.58	-7.40	15.66	5.42	-4.01	11.95
Regression coefficients						
EXPLORE Mathematics	0.64	-.06	1.38	0.70	0.37	1.02
Algebra II taken	1.52	-6.93	9.33	1.58	-1.24	3.59
Geometry taken	1.39	-8.52	7.85	0.89	-1.77	2.34
Trigonometry taken or planned	0.36	-3.19	4.80	0.35	-1.50	2.04
Chemistry taken or planned	0.10	-7.52	8.57	0.53	-1.77	4.73
Developing test-taking skills	0.64	-2.46	3.35	0.75	-.11	2.55
Educational plans	0.38	-7.09	8.73	-0.28	-4.66	3.56
Parents' education	0.10	-1.07	1.33	0.12	-0.72	.68
Gender	-0.53	-5.63	4.48	-0.50	-2.54	0.56
Majority/minority	0.54	-12.70	6.60	0.28	-3.75	3.69
PLAN Science Scores						
R	0.73	0.31	0.90	0.68	0.52	0.88
SEE	2.20	1.24	3.55	2.33	1.61	3.12
Intercept	6.82	-1.08	18.36	7.53	-1.91	14.53
Regression coefficients						
EXPLORE Composite	0.68	0.11	1.14	0.64	0.21	1.05
Geometry taken	0.51	-5.18	4.75	0.91	-1.37	3.48
Trigonometry taken or planned	0.33	-3.44	3.48	0.37	-1.95	1.87
Parents' education	0.07	-0.58	1.31	0.08	-0.51	0.71
Gender	-0.40	-2.67	1.93	-0.62	-3.30	0.60
Majority/minority	0.22	-6.98	5.01	0.12	-3.80	5.02
PLAN Composite Scores						
R	0.88	0.57	0.97	0.86	0.77	0.96
SEE	1.79	0.97	2.56	1.75	0.99	2.23
Intercept	1.87	-6.78	14.33	1.25	-1.96	9.22
Regression coefficients						
EXPLORE Composite	0.92	0.23	1.35	0.94	0.67	1.12
Geometry taken	0.62	-3.05	3.55	0.14	-0.82	2.40
Trigonometry taken or planned	0.32	-3.41	3.57	0.20	-0.87	1.92
Educational plans	0.44	-5.53	5.73	0.45	-3.77	3.92
Parents' education	0.10	-0.51	0.74	0.09	-0.32	0.58
Gender	-0.08	-1.81	2.85	-0.21	-1.62	0.43
Majority/minority	0.34	-5.11	2.99	-.06	-1.69	3.78

Appendix D

Distribution, Across Schools, of Within-School Regression Statistics, by Per-Grade Enrollment

	Per-Grade Enrollment					
	Less than 223 students (N = 215)			224 Students or more (N = 218)		
Statistic	**Med.**	**Min.**	**Max.**	**Med.**	**Min.**	**Max.**
N	41	25	247	113	25	320
PLAN Mathematics Scores						
R	0.84	0.63	0.95	0.82	0.63	0.92
SEE	2.25	1.19	3.69	2.48	1.75	4.60
Intercept	4.78	-7.40	15.66	4.34	-7.06	15.30
Regression coefficients						
EXPLORE Math	0.60	-0.06	1.38	0.66	0.05	1.27
Algebra II taken	1.51	-6.93	9.33	1.53	-3.22	7.85
Geometry taken	1.20	-8.52	6.24	1.43	-1.28	4.69
Trigonometry taken or planned	0.41	-3.19	4.80	0.33	-2.94	3.12
Chemistry taken or planned	0.10	-7.52	8.57	0.10	-4.10	4.41
Developing test-taking skills	0.50	-2.46	3.35	0.76	-1.04	2.25
Educational plans	0.27	-6.70	5.64	0.39	-7.09	8.73
Parents' education	0.07	-1.07	1.33	0.11	-0.61	0.83
Gender	-0.61	-5.63	4.48	-0.52	-2.57	1.85
Majority/minority	0.37	-12.70	6.60	0.61	-5.10	3.30
PLAN Science Scores						
R	0.74	0.31	0.90	0.72	0.41	0.88
SEE	2.11	1.24	3.45	2.29	1.49	3.55
Intercept	7.58	-1.91	18.36	6.43	1.24	15.62
Regression coefficients						
EXPLORE Composite	0.64	0.11	1.13	0.71	0.25	1.14
Geometry taken	0.52	-3.84	4.75	0.51	-5.18	3.67
Trigonometry taken or planned	0.43	-3.44	3.48	0.27	-1.33	2.13
Parents' education	0.08	-0.58	0.73	0.06	-0.43	1.31
Gender	-0.35	-3.30	1.93	-0.46	-2.23	0.81
Majority/minority	0.19	-6.98	5.02	0.24	-4.40	2.43
PLAN Composite Scores						
R	0.88	0.72	0.97	0.86	0.58	0.93
SEE	1.69	0.97	2.56	1.82	1.33	2.40
Intercept	2.20	-6.78	10.05	1.57	-4.07	14.33
Regression coefficients						
EXPLORE Composite	0.90	0.41	1.35	0.93	0.23	1.21
Geometry taken	0.54	-3.02	3.55	0.72	-3.05	2.32
Trigonometry taken or planned	0.40	-3.41	3.57	.30	-1.43	2.39
Educational plans	0.53	-5.53	5.73	0.43	-3.81	5.32
Parents' education	0.09	-0.51	0.74	0.10	-0.43	0.50
Gender	-0.03	-1.80	2.85	-0.10	-1.81	1.19
Majority/minority	0.25	-5.11	3.78	0.38	-3.47	2.17

Appendix E

Distribution, Across Schools, of Within-School Regression Statistics, by Metropolitan Area

	Rural (N = 212)			Suburban (N = 129)			Urban (N = 87)		
Statistic	**Med.**	**Min.**	**Max.**	**Med.**	**Min.**	**Max.**	**Med.**	**Min.**	**Max.**
N	44	25	290	101	25	320	86	25	296
PLAN Mathematics Scores									
R	0.84	0.65	0.95	0.80	0.63	0.91	0.82	0.64	0.94
SEE	2.24	1.27	3.57	2.50	1.20	4.60	2.44	1.51	3.52
Intercept	4.58	-7.40	14.60	4.48	-7.06	15.66	5.35	-4.01	15.29
Regression coefficients									
EXPLORE Math	0.62	-0.06	1.38	0.66	0.25	1.28	0.64	0.04	1.12
Algebra II taken	1.41	-6.93	9.33	1.56	-3.22	3.93	1.65	-1.67	3.59
Geometry taken	1.32	-8.52	6.24	1.40	-1.89	4.69	1.35	-1.77	7.85
Trigonometry taken or planned	0.40	-3.19	4.80	0.33	-2.94	4.35	0.34	-1.64	2.60
Chemistry taken or planned	0.09	-7.52	8.57	0.19	-4.88	6.85	0.10	-3.66	4.73
Developing test-taking skills	0.57	-2.46	3.35	0.69	-0.82	2.25	0.75	-1.04	3.30
Educational plans	0.32	-5.91	6.05	0.47	-6.70	8.73	0.15	-7.09	7.31
Parents' education	0.08	-1.07	1.33	0.12	-0.48	0.68	0.10	-0.72	0.83
Gender	-0.55	-5.63	4.48	-0.56	-2.14	1.85	-0.50	-2.57	1.82
Majority/minority	0.45	-12.70	6.60	0.45	-5.01	3.63	0.64	-6.65	3.69
PLAN Science									
R	0.74	0.31	0.90	0.71	0.52	0.84	0.71	0.41	0.88
SEE	2.11	1.24	3.55	2.27	1.64	3.09	2.28	1.61	3.45
Intercept	7.33	-1.08	18.36	6.40	1.84	13.08	6.49	-1.91	15.62
Regression coefficients									
EXPLORE Composite	0.65	0.11	1.13	0.71	0.36	0.99	0.69	0.25	1.14
Geometry taken	0.46	-3.84	4.75	0.52	-1.44	3.67	0.58	-5.18	2.22
Trigonometry taken or planned	0.42	-3.44	3.48	0.28	-2.30	2.26	0.23	-1.94	2.05
Parents' education	0.09	-0.52	0.73	0.04	-0.58	1.31	0.08	-0.51	0.71
Gender	-0.36	-2.67	1.93	-0.45	-2.23	1.38	-0.55	-3.31	1.76
Majority/minority	0.15	-6.43	5.01	0.22	-3.43	3.40	0.33	-6.98	5.02

Appendix E (Continued)

Statistic	Rural (N = 212) Med.	Min.	Max.	Suburban (N = 129) Med.	Min.	Max.	Urban (N = 87) Med.	Min.	Max.
N	44	25	290	101	25	320	86	25	296
PLAN Composite									
R	0.88	0.72	0.97	0.86	0.75	0.94	0.86	0.58	0.96
SEE	1.72	0.97	2.51	1.81	1.20	2.56	1.82	0.99	2.45
Intercept	2.04	-6.78	10.05	1.51	-4.07	8.72	1.93	-2.20	14.33
Regression coefficients									
EXPLORE Composite	0.91	0.41	1.35	0.93	0.58	1.21	0.93	0.23	1.18
Geometry taken	0.60	-3.02	3.55	0.60	-1.74	2.22	0.63	-3.05	2.40
Trigonometry taken or planned	0.41	-3.41	2.36	0.28	-1.02	3.57	0.24	-1.43	1.65
Educational plans	0.54	-3.78	5.73	0.39	-5.53	5.32	0.29	-3.81	3.92
Parents' education	0.11	-0.51	0.74	0.10	-0.43	0.50	0.91	-0.41	0.58
Gender	-0.08	-1.79	2.85	-0.08	-1.81	1.65	-0.07	-1.62	0.98
Majority/minority	0.33	-5.11	2.79	0.17	-2.94	2.99	0.40	-3.07	3.78

Appendix F

Distribution, Across Schools, of Within-School Regression Statistics, by Percent Below Federal Poverty Level (Public Schools Only)

	Less Than 12% (N = 190)			12% or More (N = 221)		
Statistic	**Med.**	**Min.**	**Max.**	**Med.**	**Min.**	**Max.**
N	87	25	320	54	25	227
PLAN Mathematics Scores						
R	0.83	0.63	0.93	0.83	0.63	0.95
SEE	2.48	1.40	4.60	2.29	1.20	3.69
Intercept	4.17	-7.40	15.66	5.01	-6.18	15.29
Regression coefficients						
EXPLORE Math	0.67	-0.06	1.27	0.61	-0.00	1.38
Algebra II taken	1.69	-3.22	6.45	1.39	-6.93	9.33
Geometry taken	1.40	-1.89	5.23	1.35	-8.52	7.85
Trigonometry taken or planned	0.29	-2.94	4.36	0.47	-3.19	4.80
Chemistry taken or planned	0.15	-4.88	8.57	0.08	-7.52	6.77
Developing test-taking skills	0.73	-1.11	3.30	0.49	-2.46	3.35
Educational plans	0.60	-6.70	8.73	0.20	-7.09	5.05
Parents' education	0.13	-0.83	1.18	0.07	-1.07	1.33
Gender	-0.58	-5.63	2.41	-0.47	-4.30	4.48
Majority/minority	0.32	-6.65	5.81	0.68	-12.70	6.60
PLAN Science Scores						
R	0.73	0.46	0.88	0.72	0.31	0.90
SEE	2.26	1.53	3.55	2.15	1.24	3.45
Intercept	6.53	0.21	14.38	7.26	-1.08	18.36
Regression coefficients						
EXPLORE Composite	0.71	0.27	0.95	0.65	0.11	1.14
Geometry taken	0.51	-1.64	3.67	0.50	-5.18	4.75
Trigonometry taken or planned	0.42	-3.44	3.00	0.27	-3.16	3.48
Parents' education	0.07	-0.48	1.31	0.07	-0.58	0.71
Gender	-0.45	-2.57	1.93	-0.36	-2.67	1.76
Majority/minority	0.20	-6.98	3.97	0.28	-5.66	5.01
PLAN Composite Scores						
R	0.87	0.72	0.95	0.87	0.58	0.97
SEE	1.82	1.20	2.39	1.73	0.97	2.56
Intercept	1.45	-4.31	8.72	2.38	-6.78	14.33
Regression coefficients						
EXPLORE Composite	0.94	0.41	1.21	0.89	0.23	1.35
Geometry taken	0.58	-1.65	2.49	0.63	-3.05	3.55
Trigonometry taken or planned	0.33	-2.50	3.57	0.31	-3.41	2.36
Educational plans	0.44	-5.53	5.73	0.43	-3.81	4.35
Parents' education	0.12	-0.32	0.67	0.08	-0.51	0.74
Gender	-0.12	-1.81	2.85	-0.04	-1.79	2.20
Majority/minority	0.25	-3.28	2.31	0.41	-4.42	2.99

Appendix G

Distribution, Across Schools, of Within-School Regression Statistics, by Per-Pupil Expenditure (Public Schools Only)

	Less than $4200 (N = 118)			$4200 or more (N = 294)		
Statistic	**Med.**	**Min.**	**Max.**	**Med.**	**Min.**	**Max.**
N	48	23	292	65	23	320
PLAN Mathematics Scores						
R	0.83	0.63	0.94	0.83	0.64	0.95
SEE	2.24	1.46	4.60	2.42	1.20	3.69
Intercept	4.80	-7.40	14.69	4.34	-7.06	15.66
Regression coefficients						
EXPLORE Math	0.62	-.00	1.21	0.65	-0.06	1.38
Algebra II taken	1.83	-3.19	9.33	1.40	-6.93	6.45
Geometry taken	1.35	-5.38	6.24	1.41	-8.52	7.85
Trigonometry taken or planned	0.33	-2.94	2.50	0.37	-3.19	4.80
Chemistry taken or planned	0.18	-7.52	4.48	0.09	-4.88	8.57
Developing test-taking skills	0.64	-2.46	3.30	0.63	-2.10	3.35
Educational plans	0.26	-5.11	5.64	0.41	-7.09	8.73
Parents' education	0.09	-1.07	0.84	0.09	-0.99	1.33
Gender	-0.58	-2.25	4.48	-0.52	-5.63	3.31
Majority/minority	0.23	-6.65	6.26	0.64	-12.70	6.60
PLAN Science Scores						
R	0.73	0.48	0.90	0.73	0.31	0.88
SEE	2.14	1.32	3.10	2.23	1.24	3.55
Intercept	7.05	-1.08	14.22	6.73	-0.35	18.36
Regression coefficients						
EXPLORE Composite	0.69	0.25	1.07	0.68	0.11	1.14
Geometry taken	0.43	-3.84	2.61	0.56	-5.18	4.75
Trigonometry taken or planned	0.49	-2.30	3.48	0.28	-3.44	3.00
Parents' education	0.06	-0.45	0.73	0.07	-0.58	1.31
Gender	-0.37	-2.16	1.90	-0.44	-2.67	1.93
Majority/minority	0.08	-6.98	3.97	0.30	-6.43	5.01
PLAN Composite Scores						
R	0.87	0.72	0.95	0.87	0.58	0.97
SEE	1.76	1.03	2.51	1.79	0.97	2.56
Intercept	1.83	-4.31	7.19	1.88	-6.78	14.33
Regression coefficients						
EXPLORE Composite	0.93	0.49	1.19	0.92	0.23	1.35
Geometry taken	0.48	-3.02	3.55	0.69	-3.05	2.79
Trigonometry taken or planned	0.42	-2.14	1.58	0.31	-3.41	3.57
Educational plans	0.55	-2.03	5.32	0.41	-5.53	5.73
Parents' education	0.09	-0.51	0.65	0.11	-0.45	0.74
Gender	-0.08	-1.81	1.90	-0.07	-1.79	2.85
Majority/minority	0.19	-2.32	2.31	0.39	-5.11	2.99