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Differential Coursework and Grades in High School: Implications for Performance on the ACT Assessment

Julie Noble
Terry McNabb

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ACT

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ABSTRACT

This report examines the relationship between the number and type of college preparatory courses students take, their grades in those courses, and their ACT test scores. Of particular interest is the impact of differential course taking on the ACT scores of sex and racial/ethnic subgroups.

Regression models were developed for the five ACT scores using the expanded course transcript information from the Course Grade Information Section of the ACT Assessment, and selected background variables. A random sample of the ACT-tested graduating class of 1987 was selected for the study; junior and senior data were analyzed separately. Separate analyses by racial/ethnic and sex subgroups were also conducted to determine the relative contribution of each independent variable to the model. An additional analysis determined the reduction in the differences in ACT scores for sex and racial/ethnic groups when high school curricula, performance, and background characteristics were held constant.

DIFFERENTIAL COURSEWORK AND GRADES IN HIGH SCHOOL: IMPLICATIONS FOR PERFORMANCE ON THE ACT ASSESSMENT

Not since the 1950s has the American educational system been the focus of so much consternation, criticism, and commentary. Much of this concern centers on the high school curriculum; critics ask whether students are being adequately prepared to cope with both the demands of postsecondary education and the complexity of an increasingly technological society. This question has been answered with a resounding "No" by several major studies, including the Carnegie Commission's report on secondary education (Boyer, 1983) and the National Commission on Excellence in Education's "A Nation at Risk: The Imperative on Educational Reform" (1983).

The nation's response to these highly critical reports, while not swift, has been consistent. Many states have, for example, legislated more demanding high school graduation requirements, while many others are now doing so. The Condition of Education (1986) reported that as of 1985, 34 states had mandated an increase in the number of required courses by 1 to 8 units. Clearly, the trend seems to be in the direction of increased rigor and renewed emphasis on the "basics" in secondary education.

While students' increased ability to cope in society as a result of a more rigorous high school education cannot be directly assessed, it is possible to estimate the likely improvement in certain areas of academic skills and knowledge. In particular, the ACT Assessment college admissions test battery measures academic knowledge and skills that are typically taught in high school and that are considered essential for success in college (ACT, 1987). Consequently, changes in academic preparation should affect performance on tests like the ACT Assessment. The purpose of this paper is to determine the relationship between the number and type of college-preparatory courses taken by students, their grades in these courses, and their ACT scores. Of course, finding that more rigorous coursework is associated with higher ACT scores does not mean that students should be required to take more courses just to obtain higher test scores. Previous research has shown, however, that ACT test performance is related to achievement in college (American College Testing Program, 1987). This should be considered when interpreting the results of this study.

Earlier Research

Several studies have examined the relationship between coursetaking patterns and students' performance on college entrance examinations. Alexander and Pallas (1984) found that students who had completed the core curriculum recommended by "A Nation at Risk", and had performed well in those courses, had SAT Total scores at least 50 points higher, on the average, than did students who had not taken these core courses. Pallas and Alexander (1983) explored sex differences in SAT-Mathematics scores as they related to differences in high school coursetaking, and found that the male-female gap in SAT-Mathematics performance decreased from 37 points to 14 points when differences in coursework were controlled. A similar investigation with respect to the ACT Assessment was undertaken by Laing, Engen, and Maxey (1987). These authors examined the relationship between the number of courses students had taken in a subject area and their performance on the corresponding ACT Assessment test. When the ACT scores were analyzed by sex and race, subgroup differences were reduced when the number of courses taken was controlled. Two comparable studies looking only at race differences on the ACT Assessment came to a similar conclusion: When other factors, particularly prior coursework, were controlled, racial differences in test performance were greatly reduced (Whitworth, 1987; Chambers, 1988).

All of the previously cited studies examined the relationship of standardized test scores with courses taken in high school, but none examined the relationship of test scores with both courses taken and the grades earned in those courses. By studying the relationship of these course variables and ACT scores, the relative contribution of courses taken, over and above that of course grades, can be assessed. Furthermore, there is a need for current research in this area; two of the studies cited were based on data from the mid-1960's. The purpose of this study, therefore, was to examine the relationship of students' ACT test scores with high school courses taken, high school grades, and selected background variables. Of particular interest was the impact of differential coursetaking on the test scores of members of sex and racial/ethnic subgroups.

Data For The Study

The ACT Assessment is a comprehensive evaluative, guidance, and placement program used by over a million college-bound students each year. It consists of four academic tests, four self-reported high school grades, a Student Profile Section (SPS), and the ACT Interest Inventory. The academic tests measure students' educational development in four areas: English Usage, Mathematics Usage, Social Studies Reading, and Natural Sciences Reading. The ACT Composite is an arithmetic average of the scores of these four tests, and is often used as a measure of overall educational development. Scores are reported on scales ranging from 1 to 36 (the maximum score varies by test).

The test scores used in this study are from the ACT Assessment administered prior to October, 1989. Effective in October, 1989, a new version of the ACT Assessment will be implemented (ACT, 1989). The general character of the ACT Assessment will be maintained in the new version, in that its contents are achievement-oriented and curriculum based; the contents will, however, incorporate recent changes in secondary and postsecondary curricula. It is likely, therefore, that the relationships between ACT test scores and high school coursework and grades will be even stronger than those reported here.

Since the fall of 1985, the specific high school courses and grades of students who register for the ACT Assessment have been collected through the Course/Grade Information Section (CGIS). The CGIS elicits information on 30 specific courses typically found in a college preparatory high school curriculum with respect to the courses students have taken, the courses they plan to take in high school, and the grades they have earned. Coursetaking does not take into consideration the length of the course (half-year vs. full-year), but measures whether or not a student has taken a specific course. Included are five English courses, seven mathematics courses, seven social studies courses, four natural sciences courses, four foreign language courses, and three fine arts courses. With the information provided on the CGIS, it is now possible to compare the ACT scores of students with differential course preparation in these areas. A recent study examining the accuracy of the self-reported CGIS data (Sawyer, Laing, and Houston, 1988) concluded that students report their course grades and courses taken with a high degree of accuracy. The CGIS is reproduced in Appendix A.

Sample

A random sample of the ACT records of all ACT-tested juniors and seniors from the academic year 1986-87 was selected. The sample contained data for 5655 seniors and 5624 juniors from 28 states across the country. Because students who elect to take the ACT Assessment as juniors are different in several ways from students who take the Assessment as seniors, we chose to analyze the data for juniors and seniors separately.

It should be noted that the data in this study pertain only to ACT-tested students, who are, in some respects not representative of students nationally:

* ACT-tested students are located mainly in the Rocky Mountains, Great Plains, Southwest, Midwest, and South, with comparatively fewer on the East Coast and West Coast.
* Not all students take college admissions tests like the ACT. This sample was limited to college-bound students who took the ACT during the 1986-87 national test dates.

Therefore, the results of the study cannot be claimed to reflect precisely those that would be obtained if data could be collected from all high school students in the United States.

Creation of New CGIS Variables

A series of variables were created using the information from the CGIS. First, the total number of courses a student took was computed for each of the six subject areas (English, mathematics, social studies, natural sciences, foreign language, and fine arts). The values ranged from 0 to 3 for fine arts, 0 to 4 for natural sciences and foreign language, 0 to 5 for English, and 0 to 7 for mathematics and social studies.

Students' grade averages were then calculated for each of the six subject areas by assigning the value of "0" for an F, "1" for a D, and so on, and dividing by the number of courses taken. A student must have reported one or more course grades in a subject area to be assigned a value for these variables.

Sums of grades were also calculated for each of the six subject areas by assigning the value for "0" for an F, "1" for a D, and so on, and summing across all courses taken in subject area. The sum values, therefore, could be based on a minimum of no courses, or a maximum of three courses in fine arts, four courses in foreign language or natural sciences, five courses in English, and seven courses in mathematics and social studies. These variables represent both the number of courses taken and the corresponding grades in each subject area. For example, if a student took Algebra 1 and Algebra 2, and received an 'A' in both courses, the sum of grades in mathematics would be 8.

Similar sums of grades were also computed for each of 21 specific course clusters. These clusters, consisting of one or more courses from the same subject area, were selected to reflect both typical high school course sequences and those that maximized the differences in coursetaking patterns among students. (For example, courses such as U.S. History, and English 10 were not included in the clusters, since virtually all students took these courses.) Examples of selected clusters are English 11 + English 12; Algebra 2 + Geometry + Trigonometry + Calculus; Chemistry + Physics. As is true of the previously defined sum of grades variables, a student could have taken none, some, or all of the courses in a cluster. The cluster sum of grades variables, therefore, represented both the number of courses taken and the corresponding grades in the clusters. Appendix B contains a list of the clusters studied.

Using the same 21 clusters of courses, dummy variables were created to indicate whether or not a student had taken all of the courses in each given cluster (1 = all courses taken, 0 = some courses not taken).

Finally, an overall high school average was calculated to represent students' grades in the 30 courses included on the CGIS. A student must have reported at least one valid grade in each of the four major academic areas (i.e., English, mathematics, social studies, natural sciences) to be assigned a value for the variable.

Method

Model Selection From CGIS Variables

There were many CGIS independent variables, including those just described, that could have been used to explain ACT test score performance. A major goal of the analysis was to identify from these many variables a parsimonious model, i.e., one that has nearly the maximum explanatory power among possible models, but is based on a minimum number of independent variables. Potential models were evaluated on the basis of simple and multiple correlations, and on the basis of collinearity statistics.

Simple correlations were computed between the five ACT scores (i.e., four test scores and Composite score) and the following CGIS independent variables: individual course grades and courses taken (30); the number of courses taken in English, mathematics, social studies, natural sciences, foreign languages, and fine arts (6); average grades in the same subject areas (6); the sum of grades in the same six subject areas (6); clusters of courses taken/not taken (21); the sum of grades in these clusters (21); and high school average (1). Appendix C contains the correlation coefficients for selected CGIS independent variables. The results of the correlational analysis for both juniors and seniors indicated that the CGIS variables most highly related to ACT test scores were:

a. the number of courses taken in English, mathematics, social studies, and natural sciences (r = .01 to .57);

b. average grades in the same four subject areas (r = .36 to .56),

c. the sum of grades in the same four subject areas (r = .07 to .63), and

d. high school average (r = .42 to .57)

The sum of grades for some of the course clusters also had relatively large correlations; the single cluster in each subject area with the largest correlations across all ACT test scores was selected for further analysis. These clusters were: English 11 + English 12 (r = .13 to .28), Algebra 2 + Geometry + Trigonometry + Calculus (r = .42 to .63), World History + American Government + Economics (r = .15 to .26), and Music (r = .03 to .13). As a result, the 17 CGIS variables with the highest simple correlations with ACT scores were retained for further analysis. The variables related to individual course grades, individual courses taken, and clusters of courses taken/not taken had relatively low correlations with ACT test scores, and were not included in subsequent analyses. Note that, as in any other variable selection technique, this procedure capitalizes on chance. Correlations of this size may not be found with a different sample.

Once the 17 CGIS variables were identified, six preliminary regression models were developed using these variables to explain ACT scores:

1. Number of courses taken in English, mathematics, social studies, and natural sciences

2. Average grades in English, mathematics, social studies, and natural sciences

3. Sum of grades in English, mathematics, social studies, and natural sciences

4. Sum of grades in the following clusters: English 11 + English 12, Algebra 2 + Geometry + Trigonometry + Calculus, World History + American Government + Economics, Biology + Chemistry, Spanish + French, and Music
5. Number of courses taken and average grades in English, mathematics, social studies, and natural sciences
6. High school average and number of courses taken in English, mathematics, social studies, and natural sciences

These models were constructed on the assumption that performance on the individual ACT tests is directly related to high school coursework across several subject areas; skills required to perform well on each test are not unique to that subject area. Combining CGIS variables allowed us to construct the most parsimonious model for explaining ACT scores. In conjunction with this analysis, collinearity diagnostics were examined for each model, and variables associated with condition numbers exceeding 18 were flagged (Belsley, Kuh, and Welsch, 1980, pp. 100-105).

The results of the preliminary regression analyses were evaluated using three criteria: (1) the proportion of variance in ACT scores accounted for (R^2), (2) collinearities among the independent variables, and (3) the degree to which positive and statistically significant regression weights ($p < .001$) were obtained for the independent variables.

The combined model of average grades and number of courses taken in English, mathematics, social studies and natural sciences (Model 5 above) was found to produce the largest R^2 uniformly across all ACT scores ($R^2 = .26$ to .46). The collinearity diagnostics for this eight-variable model revealed, however, that average social studies grade was highly collinear with average English grade. Since average English grade accounted for a greater proportion of the variance in ACT scores, average social studies grade was dropped from the model. The number of English courses taken was also highly collinear with the model's intercept (i.e., was nearly constant for all students) and so was eliminated. In addition, the number of social studies courses taken was not statistically significant ($p < .001$) in explaining most ACT scores, and so was also dropped from the model.

The final CGIS model, then, consisted of five variables: average grades in English, mathematics, and natural sciences, and the numbers of courses taken in mathematics and natural sciences. The condition numbers for this model were all under 18, and all independent variables were positive and statistically significant at the .001 level.

Outlier analyses were conducted on the full eight-variable model, as well as on the final five variable model to determine if extreme values were influencing the results for either model. The DFFITS statistic (Belsley, Kuh, & Welsch, 1980, pp. 27-29) was computed for each model, and no statistically significant outliers were found for either the 8- or 5-variable model.

It should be noted that using this model limited the study in one important respect: Because average grades in English, mathematics, and natural sciences were included in the model, any student who did not take any courses or who did not report grades in any one of these three subject areas could not be included in the analyses. These cases comprised about 10% of the total group, thereby reducing the sample size to 5163 for seniors and 4484 for juniors.

The differences between the original and reduced samples for each grade level were relatively small. Average grade differences did not exceed .03; the high school averages were identical for the original and reduced samples for both juniors and seniors. Mean ACT scores were similar for the original and reduced samples, with differences not exceeding .4 score units. As expected, the average numbers of courses taken for all subject areas were greater (by .09 to .36) for the reduced sample, except for the number of natural sciences courses taken for juniors, which was .15 less for the reduced sample than for the original sample.

Model Selection from Background Variables

Once a parsimonious CGIS model was identified, we followed similar procedures to determine which of several background variables contributed most to explaining ACT scores. To do this, eleven background variables were added to the CGIS regression model: family income, community size, English as a second language, public/parochial schooling, size of graduating class, percent of students of the same race enrolled in the school, high school program (business, vocational/occupational, and college preparatory), and high school rank.

The results of the regression analyses were examined to determine which variables were associated with the greatest increase in R^2, which had statistically significant regression weights ($p < .001$), and which were not collinear with other variables. Collinear variables, and those with statistically non-significant regression weights for the majority of ACT scores were dropped from the model; these included community size, English as a second language, public/parochial schooling, business and vocational high school programs, high school rank, and enrollment. Background variables that were retained for the final model were: family income, size of graduating class, percent of students of the same race enrolled in the school, and college preparatory high school program. All student records with missing data for any of these variables, or for the race or sex variables, were eliminated from subsequent analyses (Final junior N = 4609, Final senior N = 4313).

Calculation of Models for Sex and Racial/Ethnic Groups

A second goal of this study was to determine the relationship between ACT scores, high school course work, and background variables for different sex and racial/ethnic groups. It is conceivable (though not likely) that parsimonious models for the different groups would be completely different, and have few, if any, independent variables in common. The only way to determine this with certainty would be to repeat the analyses previously described for each group separately. To keep the magnitude of the analysis within reasonable bounds, however, we restricted our attention to those independent variables in the total group model. Therefore, each sex and racial/ethnic group could have a different model, but only among the independent variables in the total group model.

Recoding of the Race Variable

The item on the Student Profile Section of the ACT Assessment related to a student's racial/ethnic group contains eight possible responses: Afro-American/Black; American Indian/Alaskan Native; Caucasian-American/White; Mexican-American/Chicano; Asian-American/Pacific Islander; Puerto Rican, Cuban, Other Hispanic origin; Other; Prefer not to respond. In this study, we considered four groups: Afro American/Black ("Black"); (Caucasian-American/White ("White") Asian-American/Pacific Islander ("Asian"); and a fourth group composed of the American Indian/Alaskan Native, Mexican-American/Chicano, and Puerto Rican, Cuban, Other Hispanic ("American Indian/Hispanic"). Combining groups in this manner resulted in subgroups of sufficient size for subsequent analyses. While we realize that pooling clearly distinct ethnicities into the fourth group reduces the interpretability of the findings, it represents an economical solution to a technical problem. Students responding with "Other" or "Prefer not to respond" were not included in the analysis (3% of the total group).

Descriptive Statistics

Means, standard deviations and sample sizes were computed for all CGIS independent variables and ACT scores. These statistics were calculated for juniors and seniors, as well as for the race and sex subgroups within each grade level.

Specific coursetaking patterns were examined by grade level, sex, and race. The percent of students taking specific combinations of courses in English, mathematics, and natural sciences were computed. Students' responses concerning their family income, the size of their graduating class, the percent of students enrolled in their school of similar racial background to theirs, and whether or not they were enrolled in a college preparatory program were also examined. Percentages were computed for each variable by sex, race, and the total group.

Regression Analysis

Multiple regression equations were first developed, by grade level, using the CGIS variables alone to explain ACT score performance. The selected background variables were then added to these equations. Multiple R and standard error of estimate (SEE) were computed by grade level for each model and ACT score, and the statistical significance of each variable's contribution to the model was assessed. Changes in multiple R and SEE were noted for each ACT test when the background variables were added to the model. The total group model was then calculated for each race and sex group, by grade level.

The equality of the separate group regression models was tested using F-tests. Differences in the separate race and sex models were examined, by grade level, to determine the increase in the ACT score variance accounted for, which was associated with the addition of race or sex to the model. This analysis also provided mean ACT scores for each race and sex group that were adjusted for all of the other independent variables in the model. Differences in the adjusted means of the race or sex groups were compared to differences in the unadjusted means to determine whether the inclusion of high school coursetaking and background variables reduced the mean differences in ACT scores among race and sex groups.

Results

Descriptive Statistics

Means and standard deviations for the ACT test scores and the nine original CGIS variables are reported in Tables 1 (juniors) and 2 (seniors). For each grade level, statistics are reported by sex, race, and the total group. Approximately 2% of both juniors and seniors did not report grades for social studies courses; this resulted in smaller sample sizes for both average social studies grade and the average of all high school grades.

Juniors. Of the students who took the ACT Assessment as juniors, 46% were male and 54% were female. Mean ACT English Usage scores were similar for males and females; all other mean ACT scores were at least 1.5 ACT score points higher for males than for females. Subject area grade averages were similar for male and females for all areas except English, where females reported higher grades (3.27 vs. 3.02). On average, males took more mathematics courses (3.53 vs. 3.31) than did females, while the mean numbers of courses taken in the other subject areas were similar for both groups.

Of the ACT-tested juniors who reported a specific racial/ethnic category, 6% were Black, 3% were American Indian/Hispanic, 89% were White, and 2% were

Asian. White and Asian students' mean ACT scores were typically three to four score points higher than those of American Indian/Hispanic students, and five to six points higher than those of Black students (see Table 1). The largest differences among race groups was found for ACT Mathematics Usage.

Asian students typically reported higher subject area grade averages and overall grade averages than did students from other racial groups. The largest differences between racial groups was found for average mathematics grade; the mean average mathematics grade for Asian students was .23 points higher than that of White students, .38 points higher than that of American Indian/Hispanic students, and .53 points higher than that of Black students.

The mean numbers of courses taken in English and social studies were similar across race groups. Differences in coursetaking were found, however, in mathematics and in natural sciences: Asian students took an average of 4.04 mathematics courses, compared with 3.42 for White students, 3.26 for American Indian/Hispanic, and 3.13 for Black students. Asians also took a somewhat higher number of natural sciences courses (2.66), when compared to American Indian/Hispanics (2.43) and Blacks (2.41).

Seniors. As shown in Table 2, 44% of the students who took the ACT Assessment as seniors were male. Mean ACT English Usage scores were higher for females than for males by 1.2 points, but mean ACT Mathematics Usage and ACT Natural Sciences Reading scores were higher for males by over 2.0 score points, and mean ACT Social Studies Reading scores were higher for males by 1.5 points. Subject area grade averages were similar for males and females except in English, where females reported somewhat higher grades (3.12 vs. 2.81). Females also obtained slightly higher overall high school grade averages than did males (3.05 vs. 2.86). On average, males took more mathematics courses (3.74 vs. 3.51), and slightly more natural sciences courses (2.77 vs. 2.59) than did females, while the mean numbers of courses taken in English and social studies were similar for both groups.

Of the students who took the ACT as seniors and who reported a specific racial/ethnic category, 5% were American Indian/Hispanic, 1% were Asian, 10% were Black, and 84% were White. Of all ACT-tested students in the sample who reported a specific racial/ethnic category, over 60% of Black and American Indian/Hispanic students took the ACT as seniors, compared to 47% of White students and 37% of Asian students.

White and Asian seniors' mean ACT scores were typically four score points higher than those of American Indian/Hispanic seniors, and six points higher than those of Black seniors (see Table 2). The largest difference among race groups was found for ACT Mathematics Usage.

White students reported higher subject area grade averages and overall grade averages than did Black students. The largest differences between racial groups was found for mathematics grades; the mean average mathematics grade for Asian students was .37 points higher than that of White students, .42 points higher than that of American Indian/Hispanic students, and .84 points higher than that of Black students.

The mean number of courses taken in English was similar across race groups, but Black students took fewer social studies courses than did students from the other race groups. Differences in coursetaking were particularly apparent in mathematics and in natural sciences: Asian students took an average of 4.63 mathematics courses, compared to 3.65 for White students, 3.36 for American Indian/Hispanic students, and 3.21 for Black students. Asians took an average of 3.08 natural science courses, compared to 2.68 for Whites, 2.58 for American Indians/Hispanics, and 2.56 for Blacks.

Several differences were found when the results for juniors and seniors were compared. Juniors typically obtained higher mean ACT scores and mean high school grades than seniors, and somewhat higher mean high school averages. As expected, however, juniors reported taking fewer numbers of courses than seniors.

Coursetaking. Table 3 contains the percentages of juniors and seniors taking specific clusters of high school courses by race and sex subgroups. Results are reported only for clusters related to the variables used in the CGIS model for explaining ACT scores.

For juniors, small differences in coursetaking by sex groups were found for Algebra 1 and Algebra 2; Algebra 1, Geometry, and Algebra 2; and Biology and Chemistry. The percentages of males taking these courses exceeded those of females by at least 5%. The results for seniors, by sex group, revealed two slight differences in coursetaking: somewhat fewer females than males took Algebra 1, Algebra 2, and Trigonometry (20% vs. 25%); and Biology, Chemistry, and Physics (9% vs. 15%).

Greater differences in coursetaking were found among racial groups. For juniors, larger percentages of White and Asian students than Black or American Indian/Hispanic students reported taking Algebra 1 and Algebra 2; and Algebra 1, Geometry, and Algebra 2. This was also true for the Biology and Chemistry cluster. For seniors, smaller percentages of Black and American Indian/Hispanic students than White and Asian students reported taking Algebra 1 and Geometry; Algebra 1, Geometry, and Algebra 2; and Biology and Chemistry.

Background Variables

Descriptive statistics related to the background variables are reported in Table 4. Percentage distributions for each variable are presented for the total groups of juniors and seniors, and by sex and race.

Total Group. Seventy-five percent of the juniors and sixty-five percent of the seniors reported family incomes of $24,000 or greater, and 52% and 53% reported having graduating classes of size 100 to 399. Almost two-thirds of the students reported that over 75% of the students enrolled in their school were of similar race to theirs; 79% of the juniors and 66% of the seniors were enrolled in a college preparatory program.

Sex. There were no differences between sex groups on any of the background variables.

Race. Family income, percent of similar race, and college preparatory program differed among race groups for both juniors and seniors. Black and American Indian/Hispanic seniors reported having lower family incomes than did White and Asian seniors; Black juniors reported having lower incomes than did White and Asian juniors. White juniors and seniors also reported relatively large percentages of students of similar race enrolled in their schools (nearly 70% reported over 75% of similar race); Black, American Indian/Hispanic, and Asian students tended to report much lower percents of students of similar race. In addition, somewhat higher percentages of White and Asian students than Black or American Indian/Hispanic students reported being enrolled in college preparatory programs.

Regression Analysis Results

Total Group. The results of the regression analysis for the total groups of juniors and seniors are reported in Tables 5 and 6. For each ACT test, the unstandardized regression coefficients, their significance levels, and the multiple R and standard error of estimate (SEE) are reported for the model containing only the CGIS variables (CGIS model) and the model including the background variables (FULL model).

The multiple Rs for the CGIS model ranged across ACT tests from .50 to .68 for juniors, and from .51 to .70 for seniors; the largest multiple Rs were associated with ACT Mathematics Usage (.68 and .70). The multiple Rs of models with the background variables included ranged from .53 (ACT Social Studies Reading) to .70 and .71 (ACT Mathematics Usage). The SEEs for the CGIS model ranged from 4.01 to 6.04 for both juniors and seniors; the largest SEEs were associated with Social Studies Reading. Including the background variables reduced the SEEs to values ranging from 3.98 to 5.94 for both juniors and seniors. Both the multiple Rs and SEEs for seniors were somewhat larger than those for juniors.

The number of mathematics courses taken, average grades in English and Natural Sciences, income, college preparatory program, and percentage of students of similar race were strongly related to all ACT test scores for both grade levels. Average grade in English appeared to be strongly related to ACT English Usage and ACT Social Studies Reading scores; each unit increase in average English grade was associated, on average, with an increase of more than 1.5 units in the scores of juniors, and more than 2.0 units in the scores for seniors. Each additional mathematics course taken or mathematics grade increment was associated with an average increase of about 2 units. Each additional natural sciences course taken or natural sciences grade increment was associated with an average increase of one unit on the ACT Natural Sciences Reading test.

Sex. Table 7 contains the results of the full model regression analyses by sex, within grade level. The statistically significant ($p < .01$)

independent variables and the multiple R and SEE are reported by sex and grade level for modeling each ACT score. F-statistics were calculated to test the equality of the regression models for the two sex groups, within each grade level. The results showed statistically significant ($p < .01$) sex group differences in the models of both juniors and seniors for all ACT scores except ACT English Usage. The regression models did not differ for junior males and females for ACT English Usage.

The multiple Rs for males and females were similar across all ACT tests for both grade levels; multiple Rs ranged from .53 to .73 (R^2 = .28 to .50). The smallest multiple Rs were associated with the Social Studies Reading test, and the largest were associated with the Mathematics Usage test. SEEs for all ACT tests were similar for both junior and senior males and females, except for ACT English Usage, where males had slightly larger SEEs than did females. Seniors, however, had larger SEEs than juniors for all ACT tests, when grouped by sex; this was consistent with the larger standard deviations for seniors in the dependent variables, as reported in Table 2.

All nine independent variables were statistically significant ($p < .01$) in explaining all five ACT scores of junior males and females, with two exceptions: first, the number of natural science courses taken was not significant for males in explaining ACT English Usage scores; second, average mathmematics grade was not significant in explaining females' ACT Social Studies Reading scores. In addition, females had a much larger weight for the number of mathematics courses taken than did males for ACT Mathematics Usage (2.19 vs. 1.80). Females also had significantly larger weights for average English grade than did males for ACT Natural Sciences Reading (1.64 vs. .84).

Fewer independent variables were significant in explaining the ACT scores of senior males and females than those of junior males and females. One difference in the regression models for senior males and females was evident: enrollment in a college preparatory curriculum was a significant variable for all five ACT scores for females, but only for ACT English Usage for males. Females also had significantly larger weights than males for the number of natural sciences courses taken (.82 vs. 42) for the ACT Composite.

In summary, the majority of the variables in the model used for this study appeared to explain the ACT scores of both males and females in both grade levels. However, taking more courses in mathematics tended to influence junior females' ACT Mathematics Usage scores more than those of junior males. Further, being in a college preparatory program appears to have more of an impact on the ACT scores of senior females than on those of senior males.

Race. The results of the regression analysis by race are presented in Table 8. The statistically significant independent variables ($p < .01$) and the multiple R and SEE are reported by race and grade level for modeling each ACT score. The F-tests comparing the regression models of the four race groups revealed that the regression planes of these groups were statistically significantly different ($p < .01$) for both juniors and seniors.

For juniors, the multiple Rs ranged from .50 to .75 for all ACT tests. The multiple Rs for American Indian/ Hispanic students were at least .10 higher than those of Black and White students for ACT English Usage; at least .10 higher than those of Black, White, and Asian students for the ACT Natural Sciences Reading; and at least .10 higher than those of Asian students for the ACT Composite.

For seniors, the multiple Rs ranged from .45 to .81 for all ACT test scores. The multiple Rs for Asian students were substantially larger and the multiple Rs of Black students were slightly smaller than were those of the other race groups for all five ACT tests.

Seniors had greater variability in multiple Rs across race groups for all ACT tests than did juniors. In addition, senior Asians consistently obtained larger multiple Rs than junior Asians; multiple Rs were similar across grade levels for the other race groups.

The nine independent variables contributed differently in explaining juniors' ACT scores across the four ethnic groups. For this discussion, only variables that were significant ($p < .01$) for three of the four race groups are identified. Note, however, that because statistical significance is directly related to sample size, the results must be interpreted with consideration for the smaller sample sizes for some race groups. Other differences among race groups can be identified by examining Table 8.

For ACT English Usage, average English grade and income typically had significant weights. For ACT Mathematics Usage, average mathematics grade was significant for three of the four race groups; the number of mathematics courses taken was significant for all race groups. Average English grade, income, and percent of similar race were consistently significant for ACT Social Studies Reading. The model for ACT Natural Sciences Reading revealed no consistently significant independent variables across the race groups. Average mathematics grade, the number of mathematics courses taken, and income were significant variables for explaining ACT Composite scores.

Following are some specific results for juniors that may be of particular interest. College preparatory program, average natural sciences grade, number of natural sciences courses taken, and size of class were significant only for White juniors. Income was consistently non-significant for Black students, but significant for the other three groups. White students obtained significant positive weights ($p < .01$) for percent of similar race across all five test scores, while Blacks obtained significant negative weights ($p < .01$) on the same variable for ACT Social Studies Reading and the ACT Composite. American Indian/Hispanics also obtained significant negative weights ($p < .01$) on this variable for ACT Social Studies Reading, and a weight of borderline significance ($p < .05$) for the ACT Composite. For Asian juniors, income was the only significant variable for explaining ACT English Usage, ACT Social Studies Reading, and ACT Composite scores. This finding is likely due to both the small number of Asians in the sample (N=109) and their homogeneity on the other variables.

For seniors, several of the independent variables obtained consistently significant ($p < .01$) weights across at least three of the four race groups. However, as was the case for juniors, relatively small sample sizes were seen for some race groups, particularly Asians. For ACT English Usage, consistently significant weights were found for average English grade and the number of mathematics courses taken. Average mathematics grade and the number of mathematics courses taken were significant for all race groups for ACT Mathematics Usage. Size of graduating class and percent of similar race were also significant for all but Asian students. For ACT Social Studies Reading, no consistently significant weights were found; whereas for ACT Natural Sciences Reading, the number of mathematics courses taken, income, and college preparatory program were significant for three of the four race groups. The number of mathematics courses taken was significant for explaining ACT Composite scores for all race groups; family income and college preparatory program were significant for three race groups.

As was true for juniors, average natural science grade and number of natural science courses taken were typically significant only for White seniors. In addition, White seniors obtained significant positive weights for percent of same race for all five measures, while Black seniors obtained significant negative weights for all ACT tests except ACT English Usage.

Several variables were significant for explaining ACT scores of at least three of the four race groups for both grade levels. For ACT English Usage, this included only average English grade. For ACT Mathematics Usage, average mathematics grade and the number of mathematics courses taken were significant across almost all race groups and grade levels. In fact, the number of mathematics courses taken was significant for all race groups at both grade levels. For ACT Social Studies and Natural Sciences Reading, none of the variables were consistently significant across race groups and grade levels. The number of mathematics courses taken and family income were consistent in explaining ACT Composite scores across almost all race groups and the two grade levels. Income was not significant for Black juniors and American Indian/Hispanic seniors; the numbers of mathematics courses taken was not significant for Asian juniors.

<u>Adjusted Means for Sex and Race Groups</u>. Tables 9 (juniors) and 10 (seniors) contain adjusted and unadjusted ACT score means by race and sex groups. The adjusted means reflect mean scores that resulted when all independent variables were held constant at the total group mean.

Changes in the differences between the mean scores of males and females were not consistent across ACT tests. The difference between the mean scores of males and females for both grade levels decreased by 25% for ACT English Usage, (.2 and .3 score units), but by only 8% and 14% for ACT Mathematics Usage (.3 and .2 score units). Mean score differences increased by 9% and 21% (.2 and .4 ACT score units) for ACT Social Studies Reading, and 6% and 7% (.1 ACT score units) for the ACT Composite. The differences between males and females for ACT Natural Sciences Reading showed no change when unadjusted and adjusted means were compared.

Race differences in mean ACT scores at each grade level decreased when adjusted means were compared. Differences between the lowest and the highest mean scores across race groups decreased by 34% (juniors) and 33% (seniors) for ACT English Usage (1.3 and 1.6 ACT score units), 56% and 46% for ACT Mathematics Usage (4.9 and 4.1 ACT score units), 22% and 25% for ACT Social Studies Reading (1.3 and 1.4 ACT score units), 33% and 20% for ACT Natural Sciences Reading (2.2 and 1.2 ACT score units), and 26% and 25% for the ACT Composite (1.3 and 1.5 ACT score units). With the exception of ACT Mathematics Usage, the largest decrease in mean ACT score differences was between Black and White students. For ACT Mathematics Usage, the largest decrease occurred between Black and Asian students.

Discussion

The results of this study suggest that increased course-taking, particularly in mathematics and science, is related to improved ACT test performance. The results for the total group regression model showed that, on average, each additional mathematics course taken was associated with two score units on the ACT Mathematics Usage test, and each additional natural sciences course was associated with 1.26 to 1.58 ACT score units on the ACT Natural Sciences Reading score. A common explanation for the relationship between grades, coursetaking and ACT performance has been that coursetaking represents academic ability or past success in a subject area; that is, more academically able students take more courses than do less able students, and have higher ACT scores because of their ability, rather than their coursetaking. Course grades, as expected, were highly related to ACT test scores, but students who took additional courses in mathematics and science had higher scores than those who took fewer courses, even when average course grades were held constant. This finding suggests that increased coursetaking in mathematics and science will result in higher ACT scores, irrespective of the student's academic ability. There may, however, be other potential joint causes not included in the model; the use of non-experimental data limits the conclusions that we can make in this regard. In addition, the model does not account for differences in school programs. Further research that includes quality of education may further delineate the impact of increased coursetaking on ACT test performance.

Type of high school curriculum also appears to affect performance on the ACT Assessment. In general, students enrolled in a college preparatory curriculum tended to achieve higher scores on the ACT Assessment than did students not enrolled in such a curriculum, over and above the number of mathematics and science courses they took and the grades they received. Being enrolled in a college preparatory curriculum added at least one score unit, on the average, to senior females' ACT scores for all four subtests, when coursework and course grades were held constant. Senior males, in contrast, typically added only about one-half of a score unit by being enrolled in a college preparatory curriculum. For juniors, both males and females added at least .9 score units by being enrolled in a college preparatory curriculum.

Two possible interpretations of this finding are relevant. First, the college preparatory variable likely reflects the type of coursework taken by students, since only the number, and not the kind of courses are included in the model. This explanation is intuitively satisfying, since it seems likely that a student who took Algebra 2 and Geometry would perform better on the ACT Assessment than would a student who took Business Math and Algebra 1. Second, it could be that beyond the specific courses that a high school curriculum may require, enrollment in a college preparatory track reflects level of aspiration, academic intent, motivation, or other similar variables not represented in our model. Both interpretations merit further exploration.

The sex and grade level differences in the effect of enrollment in a college preparatory curriculum might be attributed to the differences between juniors and seniors in the sample. Students who take the ACT Assessment as juniors are more likely to be college-bound students, and typically obtain higher ACT scores than students who take the ACT as seniors. They are also more likely than seniors to be enrolled in a college preparatory program (79 vs. 66%). Students who take the ACT as seniors appear to be more heterogeneous in terms of their backgrounds and academic ability. The relative homogeneity of juniors' college preparation, or, as hypothesized above, their academic motivation, might result in the similarity of junior males and females with regard to this variable.

A similar interpretation might also be made regarding the differential performance of the college preparatory variable across ethnic groups. For juniors, enrollment in a college preparatory program was a significant variable only for whites. For seniors, however, it was significant for three of the ethnic groups for at least one test. In contrast, for Asians, the college preparatory program variable was never significant for either juniors or seniors. It may be that Asian students, like ACT-tested juniors, are more homogeneous in their coursetaking and motivation than are members of the other three ethnic groups. The lack of significance may also be attributed to the relatively small sample of Asian students.

The role of family income varied by both racial group and ACT test, and produced no clearly interpretable patterns. However, the relationship between the percent of students of similar race in a school and ACT scores was clear: higher percentages of Black or American Indian/Hispanic students in a school were associated with lower test scores. Further research, both sociological and educational, could help to isolate the salient factors contributing to these differences.

One major finding of this study is that there were significant differences in our model's ability to explain the ACT scores of different population subgroups. Differences in explanatory power between males and females were not large or significant. Differences between ethnic groups, however, were considerable: for ACT English Usage, ACT Social Studies Reading, and ACT Natural Sciences Reading, the model accounted for more than twice the variance in Asian seniors' scores than in those of Black seniors. For juniors, the model accounted for 12 to 20% more of the variance in American Indian/Hispanics' scores than in the variance of ACT English Usage, Natural Sciences Reading, and the Composite scores of other ethnic groups. It appears that our model included several of the important factors that contribute to American Indian/Hispanics and Asians' ACT scores, while some of the factors that account for differences in Blacks' test scores remain unidentified.

By controlling for the number of mathematics and science courses taken, course performance, and several background variables, we were able to reduce the mean differences in the ACT scores of different race groups to a considerable extent, and those of males and females to a slight degree. Clearly, the background variables in our model (i.e., income, class size, percent of similar race) were more closely related to race than to sex. The reductions obtained when these variables were statistically controlled are consistent with those obtained when students are matched on similar variables (see, for example, Chambers 1987, 1988). The results of these studies suggest that a considerable proportion of test score differences can be explained by educational and social factors statistically associated with sex and race.

The variables in our model did not differentiate males and females to any appreciable degree; no differences existed on any of the background variables, and coursetaking differences were minimal. Though coursetaking, as defined here, appeared to be similar, no direct comparisons were made of the ACT scores of males and females who took similar patterns of coursework. Comparisons of ACT scores for males and females given specific coursetaking patterns (as measured, for example, by the cluster dummy variables) may yield additional reductions in ACT mean score differences. This may be particularly relevant for advanced mathematics and natural sciences courses, as noted by Chambers (1987). Even so, between 50% and 75% of the variance in ACT scores still remains unaccounted for. It seems likely that motivational and other affective variables, as well as other social factors, are significantly related to ACT test scores.

This study was intended to be wide-ranging in scope, and to help identify pertinent questions to be pursued through further research. Many such questions arose, some of which suggest methodological and statistical innovations, and some of which require conceptual reformulations. First, as has been suggested earlier, we need to identify factors related to motivation, learning style, level of aspiration, etc. that will help further explain the differences in ACT performance. The identification of non-academic factors that differentiate high from low scoring students, or subgroups of students, could help better explain the differences in their test scores.

Second, we need to compare the test scores of students matched on specific courses taken, within schools, to be able to explore sex and race differences further. As noted earlier, a comparison of students with equivalent coursetaking patterns, particularly in advanced courses, may lead to a reduction in the differences in ACT scores. An alternate approach would be to construct linear regression models within high schools, and then summarize the results across high schools. This procedure would control for differences among high schools without the loss of data that would occur with matching.

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Appendix A

The Course/Grade Information Section

of the ACT Assessment Registration Folder

PAGE 2

USE A SOFT LEAD PENCIL ONLY

HIGH SCHOOL COURSE/ GRADE INFORMATION

This section lists 30 high school courses. Indicate whether or not you have taken or plan to take each course and, if you have taken it, the last grade you earned. You may wish to refer to your previous high school grade reports or a copy of your current high school transcript. The information you provide will be sent to the colleges you indicate on page 4 of this folder.

For further instructions, see page 4 of *Registering for the ACT Assessment.* After you have completed this section, sign the certification statement at the top of this page.

STUDENT'S SIGNATURE: I hereby certify that the course and grade information provided below is accurate and complete to the best of my knowledge. (I realize that this information may be verified at a later time by college personnel.)

Student's Signature ______________________ *Date* __________

COURSES TAKEN OR PLANNED

Indicate whether or not you have taken each of the high school courses listed below and, if not, whether you plan to take the courses before you finish high school. Be sure to blacken one oval for **EACH** subject, **even those you have not taken.**

GRADES EARNED

For each course you have completed or have taken for a full term (semester, quarter, etc.) indicate the **final** grade (last grade) you received. If you took the course for more than one term, report only the **LAST** term grade you received. Convert numeric grades to the corresponding letter grades. Round to the closest letter grade if necessary. Leave blank if you have not yet completed a full term of the subject or if a grade was not awarded for the course.

		HAVE TAKEN OR AM TAKING: (I have completed or am now enrolled in this subject.)	HAVE NOT TAKEN, BUT WILL: (I have not taken this subject, but plan to take it prior to graduation.)	HAVE NOT TAKEN, AND WILL NOT: (I have not taken and do not plan to take this subject.)	A	B	C	D	F
ENG.	English taken during the 9th grade	O	O	O	O	O	O	O	O
	English taken during the 10th grade	O	O	O	O	O	O	O	O
	English taken during the 11th grade	O	O	O	O	O	O	O	O
	English taken during the 12th grade	O	O	O	O	O	O	O	O
	Speech	O	O	O	O	O	O	O	O
MATH	First-year Algebra (Algebra I; not pre-Algebra)	O	O	O	O	O	O	O	O
	Second-year Algebra (Algebra II)	O	O	O	O	O	O	O	O
	Geometry	O	O	O	O	O	O	O	O
	Trigonometry	O	O	O	O	O	O	O	O
	Calculus (not pre-Calculus)	O	O	O	O	O	O	O	O
	Other Math beyond Algebra II	O	O	O	O	O	O	O	O
	Computer Math/Computer Science	O	O	O	O	O	O	O	O
NAT. SCI.	General/Physical/Earth Science	O	O	O	O	O	O	O	O
	Biology	O	O	O	O	O	O	O	O
	Chemistry	O	O	O	O	O	O	O	O
	Physics	O	O	O	O	O	O	O	O
SOC. STUDIES	U.S. History (American History)	O	O	O	O	O	O	O	O
	World History/World Civilization	O	O	O	O	O	O	O	O
	Other History (European, State, etc.)	O	O	O	O	O	O	O	O
	American Government/Civics	O	O	O	O	O	O	O	O
	Economics (Consumer Economics)	O	O	O	O	O	O	O	O
	Geography	O	O	O	O	O	O	O	O
	Psychology	O	O	O	O	O	O	O	O
LANG.	Spanish	O	O	O	O	O	O	O	O
	French	O	O	O	O	O	O	O	O
	German	O	O	O	O	O	O	O	O
	Other Language	O	O	O	O	O	O	O	O
ARTS	Art (painting, etc.)	O	O	O	O	O	O	O	O
	Music (vocal or instrumental)	O	O	O	O	O	O	O	O
	Drama/Theater (if taken as a course)	O	O	O	O	O	O	O	O

INTEREST INVENTORY

The ACT Interest Inventory and the Student Profile Section (on page 5) are important parts of the ACT Assessment. The items in each deal with you—your educational interests, goals, plans, and accomplishments.

You should complete the Interest Inventory and the Student Profile Section as carefully and accurately as you can. Much of the information on the reports sent to you and to the colleges you select is based on your responses to these two sections.

1	D	I	L	31	D	I	L	61	D	I	L
2	D	I	L	32	D	I	L	62	D	I	L
3	D	I	L	33	D	I	L	63	D	I	L
4	D	I	L	34	D	I	L	64	D	I	L
5	D	I	L	35	D	I	L	65	D	I	L
6	D	I	L	36	D	I	L	66	D	I	L
7	D	I	L	37	D	I	L	67	D	I	L
8	D	I	L	38	D	I	L	68	D	I	L
9	D	I	L	39	D	I	L	69	D	I	L
10	D	I	L	40	D	I	L	70	D	I	L
11	D	I	L	41	D	I	L	71	D	I	L
12	D	I	L	42	D	I	L	72	D	I	L
13	D	I	L	43	D	I	L	73	D	I	L
14	D	I	L	44	D	I	L	74	D	I	L
15	D	I	L	45	D	I	L	75	D	I	L
16	D	I	L	46	D	I	L	76	D	I	L
17	D	I	L	47	D	I	L	77	D	I	L
18	D	I	L	48	D	I	L	78	D	I	L
19	D	I	L	49	D	I	L	79	D	I	L
20	D	I	L	50	D	I	L	80	D	I	L
21	D	I	L	51	D	I	L	81	D	I	L
22	D	I	L	52	D	I	L	82	D	I	L
23	D	I	L	53	D	I	L	83	D	I	L
24	D	I	L	54	D	I	L	84	D	I	L
25	D	I	L	55	D	I	L	85	D	I	L
26	D	I	L	56	D	I	L	86	D	I	L
27	D	I	L	57	D	I	L	87	D	I	L
28	D	I	L	58	D	I	L	88	D	I	L
29	D	I	L	59	D	I	L	89	D	I	L
30	D	I	L	60	D	I	L	90	D	I	L

Appendix B

Cluster Variables Used

in the Study

Cluster	Description
E3E4	English 11 + English 12
E3E5	English 11 + Speech
E3E4E5	English 11 + English 12 + Speech
M2M4	Algebra 2 + Trigonometry
M3M4	Geometry + Trigonometry
M2M3M4	Algebra 2 + Geometry + Trigonometry
M2M3M4M5	Algebra 2 + Geometry + Trigonometry + Calculus
S2S4	World History + American Government
S2S6	World History + Geography
S2S4S5	World History + American Government + Economics
S2S4S5S6	World History + American Government + Economics + Geography
S4S5	American Government + Economics
S4S5S6	American Government + Economics + Government
N2N3	Biology + Chemistry
N2N3N4	Biology + Chemistry + Physics
N3N4	Chemistry + Physics
F1	Spanish
F1F2	Spanish + French
ART1	Art
ART2	Music
ART1ART2	Art + Music

Appendix C

Correlation Coefficients for Selected CGIS Independent Variables and ACT Assessment Scores

Predictor variable	Class level	N-count	ACT test: English	Mathematics	Social Studies	Natural Sciences	Composite
Number of English courses taken	Junior	5624	.08	.06	.07	.06	.08
	Senior	5655	.10	.05	.06	.05	.07
Number of mathematics courses taken	Junior	5624	.40	.55	.37	.42	.50
	Senior	5655	.40	.57	.38	.42	.52
Number of social studies courses taken	Junior	5624	.04	.01	.07	.03	.04
	Senior	5655	.08	.02	.08	.05	.06
Number of natural sciences courses taken	Junior	5624	.23	.30	.24	.32	.31
	Senior	5655	.27	.34	.26	.32	.35
Average English grade	Junior	5405	.50	.45	.42	.40	.51
	Senior	5219	.48	.42	.42	.36	.48
Average mathematics grade	Junior	5313	.41	.56	.37	.43	.51
	Senior	5011	.39	.55	.36	.38	.49
Average social studies grade	Junior	5307	.44	.43	.43	.39	.48
	Senior	5165	.43	.43	.44	.39	.49
Average natural sciences grade	Junior	5362	.42	.46	.40	.41	.48
	Senior	5157	.39	.43	.36	.37	.45
Average of all high school grades	Junior	5163	.51	.55	.45	.46	.57
	Senior	4884	.50	.52	.45	.42	.55

(Continued on next page)

Predictor variable	Class level	N-count	ACT test English	Mathematics	Social Studies	Natural Sciences	Composite
Sum of English grades	Junior	5624	.37	.35	.32	.31	.39
	Senior	5655	.31	.25	.25	.21	.29
Sum of mathematics grades	Junior	5624	.46	.63	.43	.49	.58
	Senior	5655	.45	.61	.42	.45	.56
Sum of social studies grades	Junior	5624	.37	.42	.39	.41	.46
	Senior	5655	.34	.38	.34	.35	.41
Sum of natural sciences grades	Junior	5624	.09	.08	.10	.07	.10
	Senior	5655	.12	.09	.11	.09	.12
English 11 + English 12	Junior	5624	.26	.25	.24	.23	.28
	Senior	5655	.20	.15	.17	.13	.18
Algebra 2 + Geometry + Trigonometry + Calculus	Junior	5624	.48	.64	.43	.49	.59
	Senior	5655	.46	.63	.42	.45	.57
World History + American Government + Economics	Junior	5624	.36	.39	.37	.37	.43
	Senior	5655	.34	.37	.33	.34	.40
Music	Junior	5624	.10	.04	.03	.04	.06
	Senior	5655	.13	.05	.06	.06	.08

TABLE 1

Means and Standard Deviations for Selected Variables - Juniors

Variable	Males (N=2113)		Females (N=2496)		Black (N=267)		Amer Ind/Hisp (N=137)		White (N=4096)		Asian (N=109)		Total (N=4609)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
ACT English	19.2	4.96	20.0	4.57	16.2	5.35	17.5	5.32	20.0	4.57	19.8	5.67	19.7	4.77
ACT Mathematics	20.7	7.12	18.5	7.00	14.3	7.14	16.8	7.85	19.9	6.96	23.4	6.33	19.5	7.14
ACT Social Studies	19.9	6.79	17.8	6.89	14.1	6.81	15.8	7.05	19.1	6.77	19.9	7.59	18.8	6.92
ACT Natural Sciences	24.4	6.08	21.7	5.82	17.6	5.81	20.4	6.39	23.3	5.92	24.2	6.07	22.9	6.09
ACT Composite	21.2	5.44	19.6	5.26	15.7	5.37	17.8	5.73	20.7	5.21	22.0	5.67	20.3	5.40
Average English grade	3.02	.69	3.27	.63	2.90	.71	3.05	.73	3.17	.66	3.30	.62	3.16	.67
Average mathematics grade	2.93	.84	2.96	.81	2.66	.88	2.81	.89	2.96	.82	3.19	.77	2.94	.82
Average social studies grade	3.19 (2074)	.73	3.26 (2447)	.70	2.99 (258)	.76	3.14 (136)	.75	3.24 (4021)	.71	3.42 (106)	.60	3.23 (4521)	.72
Average natural sciences grade	3.06	.75	3.12	.72	2.83	.78	3.00	.78	3.11	.73	3.34	.68	3.09	.73
Number of English courses taken	3.31	.50	3.31	.51	3.19	.48	3.23	.48	3.32	.51	3.35	.52	3.31	.51
Number of mathematics courses taken	3.53	1.15	3.31	1.07	3.13	1.13	3.26	1.14	3.42	1.10	4.04	1.22	3.41	1.11
Number of social studies courses taken	2.71	1.06	2.68	1.08	2.70	1.01	2.66	1.06	2.70	1.07	2.61	1.11	2.70	1.07
Number of natural sciences courses taken	2.55	.66	2.43	.68	2.41	.72	2.43	.70	2.49	.67	2.66	.67	2.48	.67
Average of all high school grades	3.07 (2074)	.62	3.21 (2447)	.56	2.89 (258)	.60	3.05 (136)	.63	3.16 (4021)	.58	3.35 (106)	.50	3.14 (4521)	.59

TABLE 2

Means and Standard Deviations for Selected Variables - Seniors

Variable	Males (N=1906)		Females (N=2407)		Black (N=432)		Amer Ind/Hisp (N=209)		White (N=3608)		Asian (N=64)		Total (N=4313)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
ACT English	17.6	5.43	18.8	5.05	14.1	5.30	15.0	5.45	19.0	4.91	17.2	5.91	18.3	5.25
ACT Mathematics	17.9	7.63	15.5	7.45	10.5	6.42	14.1	7.76	17.4	7.37	19.5	8.48	16.6	7.62
ACT Social Studies	17.8	7.19	16.3	6.76	11.7	5.96	13.4	6.88	17.8	6.76	16.3	7.41	17.0	6.99
ACT Natural Sciences	22.1	6.39	19.5	5.77	15.4	5.05	17.5	5.66	21.5	5.97	21.5	6.41	20.7	6.19
ACT Composite	19.0	5.84	17.7	5.38	13.1	4.52	15.1	5.56	19.0	5.34	18.8	6.08	18.2	5.62
Average English grade	2.81	.71	3.12	.65	2.69	.67	2.89	.71	3.02	.69	3.13	.65	2.98	.70
Average mathematics grade	2.65	.86	2.73	.86	2.27	.83	2.69	.80	2.74	.85	3.11	.72	2.69	.86
Average social studies grade	2.99 (1888)	.76	3.10 (2383)	.72	2.76 (416)	.76	3.03 (206)	.72	3.09 (3885)	.73	3.17	.72	3.05 (4271)	.74
Average natural sciences grade	2.82	.77	2.93	.75	2.60	.78	2.85	.75	2.92	.75	2.97	.83	2.88	.76
Number of English courses taken	4.21	.56	4.24	.55	4.18	.54	4.20	.52	4.23	.56	4.14	.43	4.22	.55
Number of mathematics courses taken	3.74	1.46	3.51	1.37	3.21	1.36	3.36	1.48	3.65	1.40	4.63	1.39	3.61	1.41
Number of social studies courses taken	3.68	1.13	3.65	1.12	3.43	1.11	3.73	1.04	3.69	1.13	3.86	1.08	3.67	1.13
Number of natural sciences courses taken	2.77	.85	2.59	.81	2.56	.84	2.58	.83	2.68	.83	3.08	.76	2.67	.83
Average of all high school grades	2.86 (1888)	.63	3.05 (2383)	.58	2.65 (416)	.57	2.92 (206)	.60	3.00 (3885)	.60	3.15	.58	2.96 (4271)	.61

TABLE 3

Percent of Sex and Race Groups Who Took Specific High School Course Clusters, by Grade Level

Grade level	Course clusters	Males	Females	Black	Amer Ind/Hisp	White	Asian	Total
Junior	English 9 and English 10	98	98	96	95	98	100	98
	Algebra 1 and Algebra 2	74	69	63	65	72	82	72
	Algebra 1 and Geometry	88	86	81	86	87	94	87
	Algebra 1, Geometry, and Algebra 2	70	64	58	59	67	81	67
	Algebra 1, Algebra 2, and Trigonometry	24	20	16	18	22	43	22
	Biology	94	96	90	88	95	94	95
	Biology and Chemistry	63	55	53	50	59	73	58
	Biology, Chemistry, and Physics	9	5	5	9	6	17	7
Senior	English 10 and English 11	97	97	96	97	97	97	97
	Algebra 1 and Algebra 2	70	67	59	66	69	81	68
	Algebra 1 and Geometry	81	79	72	71	81	92	80
	Algebra 1, Geometry, and Algebra 2	64	60	50	54	63	78	62
	Algebra 1, Algebra 2, and and Trigonometry	25	20	18	21	23	45	22
	Biology	93	95	91	96	95	94	94
	Biology and Chemistry	56	53	49	45	55	69	54
	Biology, Chemistry, and Physics	15	9	12	10	11	33	12

TABLE 4

Percentages of Students With Selected Background Characteristics, by Race, Sex, and Grade Level

Background characteristics	Juniors (N = 4609)							Seniors (N = 4313)						
	Males	Females	Black	Amer Ind/ Hisp	White	Asian	Total	Males	Females	Black	Amer Ind/ Hisp	White	Asian	Total
Income														
Less than $24,000	24	27	56	38	23	32	26	32	39	64	58	31	31	36
$24,000-$41,999	37	38	28	37	39	28	38	40	36	26	31	40	39	38
42,000 and over	39	35	16	25	38	39	37	28	25	10	11	29	30	27
Size of graduating class														
Less than 100	20	21	17	23	21	4	21	25	24	19	28	25	11	25
100 to 399	53	53	58	47	53	53	53	52	53	63	48	51	55	52
400 and over	27	26	24	29	26	43	27	23	23	18	23	23	34	23
Percent of students of similar race														
25% or less	11	9	31	52	5	93	10	11	10	25	44	6	89	11
26% to 50%	4	4	28	15	6	4	8	9	10	26	17	8	3	8
51% to 75%	14	16	12	9	16	0	15	16	16	16	9	17	3	16
Over 75%	68	67	28	24	73	4	68	64	63	34	31	70	5	63
College preparatory program														
Yes	81	78	74	70	80	81	79	66	66	59	59	67	73	66
No	19	22	26	30	20	19	21	34	34	41	41	33	27	34

TABLE 5

Regression Coefficients for Modeling ACT Scores - Juniors

			Regression coefficients										
			Average grade			Number of courses							
Dependent variable	Model	Int.	English	Math	Nat. Sci.	Math	Nat. Sci.	Income	Size of class	% Same race	College prep.	Mult R	SEE
ACT English	CGIS	6.20	2.06 (.0001)	.54 (.0001)	.57 (.0001)	.80 (.0001)	.36 (.0001)					.54	4.01
	FULL	3.61	1.93 (.0001)	.55 (.0001)	.59 (.0001)	.65 (.0001)	.24 (.009)	.18 (.0001)	.17 (.0001)	.26 (.0001)	1.04 (.0001)	.57	3.93
ACT Mathematics	CGIS	-2.70	.58 (.0003)	2.69 (.0001)	.65 (.0001)	2.32 (.0001)	1.03 (.0001)					.68	5.23
	FULL	-6.50	.43 (.006)	2.73 (.0001)	.70 (.0001)	2.12 (.0001)	.90 (.0001)	.18 (.0001)	.46 (.0001)	.30 (.0001)	1.17 (.0001)	.70	5.13
ACT Soc. Std.	CGIS	.42	1.96 (.0001)	.47 (.002)	1.17 (.0001)	1.29 (.0001)	1.10 (.0001)					.50	6.01
	FULL	-3.35	1.78 (.0001)	.50 (.0006)	1.19 (.0001)	1.07 (.0001)	.92 (.0001)	.24 (.0001)	.33 (.0001)	.33 (.0001)	1.67 (.0001)	.53	5.89
ACT Nat. Sci.	CGIS	5.43	.77 (.0001)	1.13 (.0001)	1.02 (.0001)	1.26 (.0001)	1.70 (.0001)					.55	5.07
	FULL	1.79	.62 (.0001)	1.14 (.0001)	1.05 (.0001)	1.10 (.0001)	1.58 (.0001)	.18 (.0001)	.28 (.0001)	.41 (.0001)	1.06 (.0001)	.58	4.98
ACT Composite	CGIS	2.47	1.34 (.0001)	1.22 (.0001)	.85 (.0001)	1.42 (.0001)	1.04 (.0001)					.65	4.11
	FULL	- .99	1.19 (.0001)	1.24 (.0001)	.88 (.0001)	1.24 (.0001)	.91 (.0001)	.19 (.0001)	.31 (.0001)	.33 (.0001)	1.23 (.0001)	.67	3.99

Note: Numbers in parentheses are p-values associated with the regression coefficents.

TABLE 6

Regression Coefficients for Modeling ACT Scores - Seniors

Dependent variable	Model	Regression coefficients										Mult R	SEE
		Int.	Average grade			Number of courses		Income	Size of class	% Same race	College prep.		
			English	Math	Nat. Sci.	Math	Nat. Sci.						
ACT English	CGIS	5.39	2.43 (.0001)	.35 (.0001)	.36 (.003)	.78 (.0001)	.31 (.0008)					.54	4.41
	FULL	3.15	2.25 (.0001)	.36 (.0008)	.40 (.0008)	.62 (.0001)	.17 (.06)	.22 (.0001)	.06 (.25)	.36 (.0001)	.96 (.0001)	.57	4.31
ACT Mathematics	CGIS	-3.01	.35 (.03)	2.26 (.0001)	.70 (.0001)	2.26 (.0001)	.85 (.0001)					.70	5.47
	FULL	-6.73	.18 (.26)	2.30 (.0001)	.79 (.0001)	2.05 (.0001)	.75 (.0001)	.29 (.0001)	.41 (.0001)	.33 (.0001)	.86 (.0001)	.71	5.34
ACT Soc. Std.	CGIS	1.11	2.35 (.0001)	.27 (.07)	.65 (.0001)	1.14 (.0001)	.80 (.0001)					.51	6.04
	FULL	-1.51	2.15 (.0001)	.28 (.05)	.70 (.0001)	.95 (.0001)	.65 (.0001)	.28 (.0001)	.13 (.06)	.35 (.0001)	1.12 (.0001)	.53	5.94
ACT Nat. Sci.	CGIS	6.70	.66 (.0001)	.53 (.0001)	.97 (.0001)	1.14 (.0001)	1.37 (.0001)					.54	5.23
	FULL	3.82	.48 (.002)	.53 (.0001)	1.02 (.0001)	.99 (.0001)	1.26 (.0001)	.26 (.0001)	.07 (.23)	.46 (.0001)	.74 (.0001)	.56	5.13
ACT Composite	CGIS	2.70	1.44 (.0001)	.86 (.0001)	.65 (.0001)	1.33 (.0001)	.84 (.0001)					.65	4.26
	FULL	- .12	1.26 (.0001)	.87 (.0001)	.71 (.0001)	1.16 (.0001)	.71 (.0001)	.26 (.0001)	.16 (.0008)	.37 (.0001)	.92 (.0001)	.68	4.14

Note: Numbers in parentheses are p-values associated with the regression coefficients.

TABLE 7

Statistically Significant (p < .01) Independent Variables for Modeling ACT Scores, by Grade Level and Sex Group

Dependent variable	Independent variable	Juniors		Seniors	
		Males	Females	Males	Females
ACT English	Average English grade	X	X	X	X
	Average math grade	X	X		X
	Average nat. sci. grade	X	X	X	
	Number of math courses	X	X	X	X
	Number of nat. sci. courses		X	X	
	Income	X	X	X	X
	Size	X	X		
	% same race	X	X	X	X
	College prep. curriculum	X	X	X	X
	Mult. R	.57	.56	.58	.56
	SEE	4.09	3.79	4.44	4.18
ACT Mathematics	Average English grade	X	X	X	X
	Average math grade	X	X	X	X
	Average nat. sci. grade	X	X	X	X
	Number of math courses	X	X	X	X
	Number of nat. sci. courses	X	X	X	X
	Income	X	X	X	X
	Size	X	X	X	X
	% same race	X	X	X	X
	College prep. curriculum	X	X	X	X
	Mult. R	.71	.69	.73	.71
	SEE	5.06	5.05	5.22	5.27

Note: Statistically significant regression coefficients ($p < .01$) are flagged with an "x".

(Continued on next page)

TABLE 7 (Continued)

Dependent variable	Independent variable	Juniors Male	Juniors Females	Seniors Males	Seniors Females
ACT Social Studies	Average English	X	X	X	X
	Average math grade	X			
	Average nat. sci. grade	X	X	X	X
	Number of math courses	X	X	X	X
	Number of nat. sci. courses	X	X	X	
	Income	X	X	X	X
	Size	X	X		
	% same race	X	X	X	X
	College prep. curriculum	X	X		X
	Mult. R	.55	.53	.55	.53
	SEE	5.70	5.86	6.00	5.76
ACT Natural Sciences	Average English grade	X	X	X	X
	Average math grade	X	X		X
	Average nat. dci. grade	X	X	X	X
	Number of math courses	X	X	X	X
	Number of nat. sci. courses	X	X	X	X
	Income	X	X	X	X
	Size	X	X		
	% same race	X	X	X	X
	College prep. curriculum	X	X		X
	Mult. R	.61	.57	.60	.55
	SEE	4.85	4.77	5.14	4.83

Note: Statistically significant regression coefficients ($p < .01$) are flagged with an "x".

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TABLE 7 (Continued)

Dependent variable	Independent variable	Juniors		Seniors	
		Males	Females	Males	Females
ACT Composite	Average English grade	X	X	X	X
	Average math grade	X	X	X	X
	Average nat. sci. grade	X	X	X	X
	Number of math courses	X	X	X	X
	Number of nat. sci. courses	X	X	X	X
	Income	X	X	X	X
	Size	X	X	X	X
	% same race	X	X	X	X
	College prep. curriculum	X	X		X
	Mult. R	.69	.67	.70	.68
	SEE	3.94	3.90	4.20	3.97

Note: Statistically significant regression coefficients ($p < .01$) are flagged with an "x".

TABLE 8

Statistically Significant (p < .01) Independent Variables for Modeling ACT Scores by Grade Level and Race Group

Dependent variable	Independent variable	Juniors				Seniors			
		Black	White	Amer Ind/ Hisp	Asian	Black	White	Amer Ind/ Hisp	Asian
ACT English	Average English grade	X	X	X		X	X		X
	Average math grade		X				X		
	Average nat. sci. grade		X				X		
	Number of math courses	X	X			X	X	X	
	Number of nat. sci. courses		X						
	Income		X	X	X	X	X		
	Size		X						
	% same race		X				X		
	College prep. curriculum		X				X	X	
	Mult. R	.56	.55	.67	.61	.49	.55	.60	.71
	SEE	4.49	3.81	4.07	4.69	4.68	4.10	4.47	4.51
ACT Mathematics	Average English grade								
	Average math grade	X	X	X		X	X	X	X
	Average nat. sci. grade		X				X		
	Number of math courses	X	X	X	X	X	X	X	X
	Number of nat. sci. courses		X				X		
	Income		X		X		X		
	Size		X			X	X	X	
	% same race		X			X	X	X	
	College prep. curriculum		X			X	X		
	Mult. R	.69	.69	.73	.70	.62	.71	.76	.81
	SEE	5.27	5.03	5.57	4.72	5.07	5.19	5.13	5.43

Note: Statistically significant regression coefficients (p < .01) are flagged with an "x".

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TABLE 8 (Continued)

Dependent variable	Independent variable	Juniors				Seniors			
		Black	White	Amer Ind/ Hisp	Asian	Black	White	Amer Ind/ Hisp	Asian
ACT Social Studies	Average English grade	X	X		X	X	X		
	Average math grade		X						
	Average nat. sci. grade		X				X		
	Number of math courses		X			X	X		
	Number of nat. sci. courses		X				X		
	Income		X	X	X	X			X
	Size		X						
	% same race	X	X	X		X	X		
	College prep. curriculum	X	X				X		
	Mult. R	.54	.52	.58	.57	.45	.51	.56	.57
	SEE	5.81	5.81	5.95	6.52	5.38	5.81	5.84	6.52
ACT Natural Sciences	Average English grade		X						
	Average math grade	X	X				X		
	Average nat. sci. courses		X			X	X		
	Number of math courses		X	X		X	X		X
	Number of nat. sci. courses		X	X					
	Income			X	X	X		X	X
	Size		X						
	% same race		X			X	X		
	College prep. curriculum		X			X	X	X	
	Mult. R	.50	.57	.67	.56	.50	.57	.67	.56
	SEE	5.12	4.85	4.90	5.26	5.12	4.85	4.90	5.26

Note: Statistically significant regression coefficients ($p < .01$) are flagged with an "x".

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TABLE 8 (Continued)

Dependent variable	Independent variable	Juniors				Seniors			
		Black	White	Amer Ind/ Hisp	Asian	Black	White	Amer Ind/ Hisp	Asian
ACT Composite	Average English grade	X	X			X	X		
	Average math grade	X	X	X			X		
	Average nat. sci. grade		X				X		
	Number of math courses	X	X	X		X	X	X	X
	Number of nat. sci. courses		X				X		
	Income		X	X	X	X	X		X
	Size		X				X	X	
	% same race	X	X			X	X		
	College prep. curriculum		X			X	X	X	
	Mult. R	.66	.67	.75	.64	.66	.67	.75	.64
	SEE	4.08	3.87	3.95	4.55	4.08	3.87	3.95	4.55

Note: Statistically significant regression coefficients ($p < .01$) are flagged with an "x".

TABLE 9

Unadjusted and Adjusted Mean ACT Scores by Sex and Race - Juniors

Score	Type	Males	Females	Black	Amer Ind/ Hisp	White	Asian
ACT English	Unadjusted	19.2	20.0	16.2	17.5	20.0	19.8
	Adjusted	19.2	19.8	17.2	17.7	19.7	18.4
ACT Mathematics	Unadjusted	20.7	18.5	14.3	16.8	19.9	23.4
	Adjusted	20.3	18.4	15.4	16.9	19.4	18.3
ACT Social Studies	Unadjusted	19.9	17.8	14.1	15.8	19.1	19.9
	Adjusted	19.8	17.5	14.9	15.3	18.8	19.4
ACT Natural Sciences	Unadjusted	24.4	21.7	17.6	20.4	23.3	24.2
	Adjusted	24.1	21.4	18.5	20.7	22.9	19.8
ACT Composite	Unadjusted	21.2	19.6	15.7	17.8	20.7	22.0
	Adjusted	21.0	19.3	16.6	17.8	20.3	19.1

TABLE 10

Unadjusted and Adjusted Mean ACT Scores by Sex and Race - Seniors

Score	Type	Males	Females	Black	Amer Ind/ Hisp	White	Asian
ACT English	Unadjusted	17.6	18.8	14.1	15.0	19.0	17.2
	Adjusted	17.5	18.4	15.2	15.3	18.5	15.1
ACT Mathematics	Unadjusted	17.9	15.5	10.5	14.1	17.4	19.5
	Adjusted	17.2	15.0	11.5	13.8	16.4	12.7
ACT Social Studies	Unadjusted	17.8	16.3	11.7	13.4	17.8	16.3
	Adjusted	17.6	15.7	12.5	13.3	17.2	12.5
ACT Natural Sciences	Unadjusted	22.1	19.5	15.4	17.5	21.5	21.5
	Adjusted	21.7	19.1	15.9	17.8	20.8	20.2
ACT Composite	Unadjusted	19.0	17.7	13.1	15.1	19.0	18.8
	Adjusted	18.6	17.2	13.9	15.2	18.3	15.2