CollegeBoard
connect to college success™

Research Notes
Office of Research and Analysis RN-36, April 2008

Examining the Relationship Between the SAT®, High School Measures of Academic Performance, and Socioeconomic Status: Turning Our Attention to the Unit of Analysis

Krista D. Mattern, Emily J. Shaw, and Frank E. Williams

Abstract

The purpose of this study was to extend the literature on the relationship between SAT® scores, high school GPA and rank, and socioeconomic status (SES). Many critics claim that the SAT is merely a "wealth test" (Kohn, 2001; Sacks, 1997), though data consistently reveal that all cognitive measures are related to SES. The SAT has likely received the brunt of this criticism due to its high volume of test-takers as compared to that of other tests. Also, in college admissions, SAT scores are often considered in conjunction with a student's high school GPA, and SAT scores tend to have a stronger relationship with SES than high school GPA does. Recently, however, research findings have revealed that the commonly cited higher correlations between SAT scores and SES versus high school GPA and SES may be partly a function of statistical artifacts (Zwick and Greif Green, 2007). This paper extends this line of research by replicating Zwick and Greif Green's findings with new SAT data, which now include SAT writing scores. Similar to Zwick and Greif Green's findings, this study found that the pooled-within-high-school correlations between SAT scores and SES were smaller in comparison to across-high-school correlations. Also, when computed across high schools, the correlations for the three SAT sections with SES were 2.2 times larger, on average, than the correlations between high school measures and SES. However, pooled-within-high-school correlations between SAT scores and SES were only 1.4 times larger than those of high school measures and SES. The implications of the results are discussed and avenues for future research are identified.

Introduction

The relationship between SES and the SAT Reasoning Test™ is often heatedly discussed in the popular media, but much less often understood or appropriately studied (Geiser and Studley, 2002; Kohn, 2001; Sacks, 1997). What is usually missing from these discussions is the prevalence of this positive relationship between most cognitive (and sometimes noncognitive) measures and SES. While this hardly excuses or explains the relationship between SAT scores and SES, it probably points to the importance of social and cultural resources in the academic performance of students in the United States, as well as the current unequal system of education in this country. Recently, a great deal of research has been conducted to address these issues, notably the work of Paul Sackett and his colleagues, as well as the work of Rebecca Zwick and Jennifer Greif Green, described in the sections that follow.

Review of Literature on SES and SAT Scores

The need to accurately and fairly study the relationship between SAT scores and SES is based on sometimes scathing, misleading articles stating that the SAT is simply a "wealth test" or is measuring "the size of students' houses" (as cited in Zwick, 2002, 2004). Though high school grade point average (HSGPA), as well as SAT or ACT scores, are all related to students' SES level, most people do not argue that HSGPA should be abolished from use in college admissions or placement

decisions. Truth be told, research has linked family income to education outcomes such as high school grades, achievement tests, completion of certain courses, student motivation, enrollment in college immediately after high school, greater expectations of attending a four-year college, and acceptance at a four-year college (Camara and Schmidt, 1999; Kobrin, Sathy, and Shaw, 2006; Owings, McMillen, and Burkett, 1995; Zwick, 2002, 2004).

As Zwick and Greif Green (2007) reflected, adequate resources are needed to foster student achievement and many students do not have access to home and school environments with adequate resources that promote learning. Therefore, it is not surprising that scores on such tests as the SAT or ACT are correlated with SES—however, it is surprising that the tests should be admonished for showing these differences in performance among student groups in a public light. When students in the United States have equal access to resources that promote learning, the tests will likely show few, if any, performance differences by SES.

There are numerous studies analyzing the relationship between SAT scores and SES; however, the findings seem to be mixed and dependent upon how the relationship is examined or the methodology used. For example, Geiser and Studley (2002) claimed that the predictive power of the SAT essentially drops to zero when SES is controlled for in a regression analysis. This claim, however, is quite misleading given that the focus of their research was on a comparison of scores on the SAT and SAT Subject Tests™. Based on the nature of their inquiry, both SAT scores and SAT Subject Test scores were included in the regression model. Due to the fact that SAT and SAT Subject Test scores are highly correlated with each other, the regression analysis provided information about the incremental contribution of one test over the other after controlling for SES, not the predictive power of the SAT after controlling for SES. Therefore, they erroneously concluded that the relationship between SAT scores and college GPA decreases to roughly zero when controlling for SES. However, when other researchers reexamined Geiser and Studley's claim using the appropriate methodology, they found that the correlation between SAT scores and college GPA was relatively unaffected when controlled for SES (Sackett, Kuncel, Arneson, Cooper, and Waters, in press; Zwick, Brown, and Sklar, 2004). Therefore, contrary to the notion suggested by Geiser and Studley in their study, the predictive power of the SAT is not an artifact of SES, but is due to the way that the SAT was entered into the regression model along with the SAT Subject Tests.

Sackett et al. (in press) investigated the relationship between SES and SAT scores by testing the common criticism that the SAT is only measuring SES and its predictive validity is merely an artifact of SAT scores' relationship with SES. Implicit in this criticism is the notion that higher SES leads to higher test scores through knowledge of test-taking techniques, for example, versus a true higher level of knowledge and skills of the construct the test is measuring. Sackett et al. tested the veracity of this criticism with two competing models. The first model, in line with the critics' position, posited that SES influences SAT scores and SES influences FYGPA, but that there is no causal relationship between characteristics measured by the test and FYGPA. If this model was found to be valid, then the correlation between test scores and FYGPA would drop to zero after controlling for the effects of SES.

The second model tested by Sackett et al. (in press) posited that SES affects characteristics measured by the SAT, which, in turn, affect FYGPA. In this model, SES was not expected to have a direct relationship with FYGPA but was thought to mediate the role of test scores on FYGPA. If this model was found to be valid, then the correlation between SES and FYGPA would be reduced to near zero after controlling for SAT scores, and there would be a substantial correlation between SAT scores and FYGPA. Sackett et al. tested these relationships among SAT scores and SES, as well as other large-scale test scores and SES. They found that, consistent across multiple large data sets, observed test score–FYGPA correlations are at most modestly affected when controlling for SES. The test score–FYGPA correlation for the SAT was 0.47, and this value dropped to 0.44 when controlling for SES. The SAT retained virtually all of its predictive power after partialling out the effects of SES, thus contradicting the first model posited by critics of the test. Sackett et al. also found that the relationship between SES and FYGPA is largely explained by a mediating mechanism by which SES influences test scores, which are subsequently predictive of FYGPA, consistent with their second model. Therefore, the SAT contains meaningful information predictive of performance, though the societal issue of a higher SES resulting in greater academic advantages remains. This requires future research and the development of effective interventions.

Zwick and Greif Green (2007)

Measurement scholar Rebecca Zwick and her colleague Jennifer Greif Green have also examined the influence of SES on academic outcomes (Zwick and Greif Green, 2007). They adopted a unique yet intuitive methodological approach for studying the

relationship between SAT scores and SES, as well as HSGPA or high school rank (HS rank) and SES. They posited that analyzing the relationship between high school performance indicators and SES at the college or university level, as opposed to within high schools, can be misleading due to differences in grading standards across high schools. That is, correlations are likely to be attenuated due to noise across grading standards. In fact, their study showed that pooled-within-high-school analyses, in comparison to across-high-school analyses, resulted in larger correlations between class rank and SES indicators for the total group. Furthermore, for white students, the pooled-within-high-school correlations between HSGPA and two SES indicators, income and father's education, also increased. However, smaller correlations between SAT scores and SES resulted when computed within high schools as compared to across high schools.

When analyzed across high schools, using the college or university as the unit of analysis, it is overlooked that the HSGPAs received by the college are from a number of different high schools with different grading standards. Largely, these high schools assign the same range of grades to their students (and therefore have similar average grades across high schools), however, high schools do not often have the same average SAT scores, nor do they have the same average family income. Therefore, as expected and was proved, all correlations between SAT scores and SES were smaller within high schools rather than across high schools due to the large between-school variance in average SAT scores. Conversely, the pooled-within-high-school correlations of class rank, SES, and in some instances HSGPA were higher than the across-high-school correlations due to the increased variability in high school indicators within high schools as opposed to across high schools. Therefore, the magnitude of the relationship between SES and SAT scores appears more similar to that of SES and high school indicators than was previously believed.

This study extended the work of Zwick and Greif Green (2007) by replicating their study on the relationship between SES, SAT scores, HSGPA, and class rank with data from the new SAT introduced in March 2005. This test includes a writing section in addition to the critical reading and mathematics sections.

Method

Sample

The 2007 College-Bound Seniors database was analyzed for this study. This database includes nearly 1.5 million students' SAT scores as well as their responses to the optional SAT Questionnaire filled out at the time of test registration. The SAT Questionnaire requests information from students on their academic and demographic backgrounds. Only students with data on all study variables were included in the analyses, resulting in a sample size of 494,241. Table 1 provides a summary of the sample characteristics, along with the characteristics of the complete 2007 SAT cohort. The sample used in the current study mirrors the national sample in terms of gender, race/ethnicity, and other demographic variables. The only notable difference is that the study sample is more academically able than the national sample in terms of SAT scores and high school GPA.

Table 1

Comparison of the Analysis Sample to the Complete 2007 College-Bound Senior Cohort

	Current Analyses	*2007 Cohort*
Number of Students	***494,241***	***1,494,531***
	Percentage of Students by Categories	
Female	53	53
Race/Ethnicity		
American Indian or Alaskan Native	1	1
Asian, Asian American, or Pacific Islander	8	10
Black or African American	11	12
Mexican or Mexican American	5	4
Puerto Rican	1	1
Other Hispanic, Latino, or Latin American	6	6
White	64	61
Other	4	4
Cumulative GPA		
A+ (97–100) 4.33	10	7
A (93–96) 4.00	23	18
A- (90–92) 3.67	19	18
B (80–89) 3.00	39	45
C (70–79) 2.00	9	11
D, E, or F (below 70) 0.00	0	0
Class Rank		
Top Tenth	30	32
Second Tenth	27	26
Second Fifth	21	20
Final Three-Fifths	23	22
Family Income		
Less than $10,000	3	4
$10,000–$20,000	7	8
$20,000–$30,000	6	6
$30,000–$40,000	9	9
$40,000–$50,000	8	8
$50,000–$60,000	9	8
$60,000–$70,000	8	8
$70,000–$80,000	9	9
$80,000–$100,000	15	14
More than $100,000	26	26
Highest Level of Parental Education		
No High School Diploma	4	4
High School Diploma	31	31
Associate Degree	9	9
Bachelor's Degree	30	30
Graduate Degree	25	26
	Mean Values by Performance Variables	
SAT-CR	512	502
SAT-M	526	515
SAT-W	503	494
HSGPA	3.44	3.33

Measures

SAT Scores. Official SAT scores were obtained from the College-Bound Seniors database. Students' most recent SAT mathematics, critical reading, and writing scores were used, and each score was reported on a 200- to 800-point scale. In this sample, the mean score for the mathematics section was 526 (SD = 111), the mean score for the critical reading section was 512 (SD = 109), and the mean score for the writing section was 503 (SD = 106).

High School GPA. High school GPA (HSGPA) was a self-reported measure obtained from the SAT Questionnaire. The particular item used a 12-point scale ranging from grades of A+ to F, which were transformed into numeric values (e.g., C = 2.00), with a grade of F corresponding to 0.00 and a grade of A+ corresponding to 4.33. In this sample, the mean HSGPA was 3.44.

High School Rank. High school rank was also a self-reported measure obtained from the SAT Questionnaire. It was coded on a six-point scale, with 1 representing the top tenth and 6 representing the bottom fifth of the student's class. Because this variable was coded so that lower values corresponded to a higher rank, correlations between high school rank and SES indicators were negative.

Socioeconomic Status (SES). Three indicators were used to measure SES. These included each student's father's education, mother's education, and parents' combined household income. All measures were self-reported by the student and obtained from the SAT Questionnaire. Parental education was coded on a six-point rating scale ranging from 1 ("no high school diploma") to 5 ("graduate degree"). Income was reported on a 10-point scale with 1 indicating "less than $10,000" and 10 indicating "more than $100,000."

Analyses and Results

The primary method for analyzing the data was computing correlations between performance indicators and SES factors. These correlations were first computed across high schools and then within high schools and aggregated (pooled-within-high-school correlations), similar to the methods used by Zwick and Greif Green (2007). These correlations were also analyzed by gender and race/ethnicity. Furthermore, for each variable, the amount of variance explained within schools versus between schools was provided for the total group and for each subgroup. The total variance can be decomposed into the between-school variance, which is the variance of the school means, and the within-school variance, which is the variance of the deviations from the school mean.

For the total group, descriptive statistics and correlations are provided in Table 2. In accordance with findings from other studies (e.g., Sackett, Kuncel, Arneson, Cooper, and Waters, 2008; Zwick, Brown, and Sklar, 2004; Zwick and Greif Green, 2007) SAT scores were moderately correlated with SES, with coefficients ranging from 0.30 to 0.37 across the three SAT sections and the three SES indicators. Also similar to previous research, there were weaker associations between SES and HSGPA (range = 0.13 to 0.20) and high school rank (range = –0.10 to –0.18).

Next, the pooled-within-high-school correlation matrix was computed (see Table 3). Similar to the findings of Zwick and Greif Green (2007), the magnitude of the correlations between SAT scores and SES was drastically reduced (range = 0.16 to 0.24) in comparison to the overall correlations at the college level noted above. This constituted anywhere from a change in r of 0.12 to 0.15. See Table 4 for the change in r, as well as the z-value testing whether the across-school correlations and the within-school correlations are significantly

Table 2

Correlations and Descriptive Statistics for Study Variables Computed Across Schools

Variable	*Mean*	*SD*	*SAT-M*	*SAT-CR*	*SAT-W*	*HSGPA*	*HS Rank*	*Income*	*Mother's Education*
SAT-M	525.58	111.41	—						
SAT-CR	512.08	109.04	0.72	—					
SAT-W	503.40	106.40	0.73	0.85	—				
HSGPA	3.44	0.63	0.51	0.48	0.51	—			
HS Rank	2.43	1.24	–0.49	–0.45	–0.48	–0.70	—		
Income	7.64	3.85	0.30	0.31	0.32	0.13	–0.10	—	
Mother's Education	3.00	1.24	0.31	0.33	0.33	0.17	–0.15	0.42	—
Father's Education	3.05	1.31	0.35	0.36	0.37	0.20	–0.18	0.47	0.56

Note: Listwise N = 494,241.
All $p < 0.01$.

Table 3

Correlations and Descriptive Statistics for Study Variables Pooled Within Schools

Variable	*Mean*	*SD*	*SAT-M*	*SAT-CR*	*SAT-W*	*HSGPA*	*HS Rank*	*Income*	*Mother's Education*
SAT-M	525.58	96.61	—						
SAT-CR	512.08	95.81	0.66	—					
SAT-W	503.40	92.78	0.67	0.81	—				
HSGPA	3.44	0.58	0.53	0.48	0.53	—			
HS Rank	2.43	1.18	–0.53	–0.48	–0.52	–0.71	—		
Income	7.64	3.30	0.16	0.16	0.17	0.09	–0.11	—	
Mother's Education	3.00	1.12	0.19	0.21	0.21	0.14	–0.16	0.32	—
Father's Education	3.05	1.15	0.21	0.23	0.24	0.17	–0.18	0.36	0.47

Note: Listwise N = 494,241.
All $p < 0.01$.

Table 4

Correlation of SAT Scores and High School Measures with SES Across and Within High Schools

Variables	*Across*	*Within*	*Δr*	*z*
SAT-M				
Income	0.30	0.16	0.14	104.14*
Mother's Education	0.31	0.19	0.12	90.13*
Father's Education	0.35	0.22	0.13	99.68*
SAT-CR				
Income	0.31	0.16	0.15	111.89*
Mother's Education	0.33	0.21	0.12	91.15*
Father's Education	0.36	0.23	0.13	100.32*
SAT-W				
Income	0.32	0.17	0.15	112.47*
Mother's Education	0.33	0.21	0.12	91.15*
Father's Education	0.37	0.24	0.13	100.99*
HSGPA				
Income	0.13	0.09	0.04	28.47*
Mother's Education	0.17	0.14	0.03	21.61*
Father's Education	0.20	0.17	0.03	21.84*
HS Rank				
Income	–0.10	–0.11	**0.01**	7.11*
Mother's Education	–0.15	–0.16	**0.01**	7.20*
Father's Education	–0.18	–0.18	0.00	0.00

Note: Δr is the difference between the magnitude of a correlation coefficient computed across schools versus within schools. Bolded values indicate an increase in magnitude. The z value indicates whether the two correlation coefficients are significantly different from each other.
*$p < 0.05$.

different from one another. As expected, all of the SAT correlations were significantly smaller when computed within schools.

The relationships between HSGPA and SES indicators were also reduced, but to a much lesser degree, with the change in r ranging from 0.03 to 0.04, resulting in significantly smaller correlations as indicated by the z-value. Conversely, the correlation of high school rank with both income and mother's education increased slightly (Δr = 0.01), while the correlation for high school rank and father's education was unaffected by the method of computation. Table 5 presents the decomposition of variance components for each study variable, and the results corroborate the correlational findings. As expected, there was more between-school variation in SAT scores as compared to high school indicators. For HSGPA and rank, only a small portion of variance was between schools (13 percent and 9 percent, respectively).

In sum, when computed across high schools, the correlations for the scores on the three SAT sections with SES were 2.2 times larger, on average, than the correlations between the high school variables and SES. However, when computed within high schools and aggregated, the SAT score–SES correlations were only 1.4 times larger, on average, than the high school measure–SES correlations. That is to say, the

Table 5

Variance Decomposition of Study Variables for the Total Group

Variable	*Total Variance*	*Between-School Variance*	*% of Total*	*Within-School Variance*	*% of Total*
SAT-M	12,412.04	3,079.28	25%	9,332.76	75%
SAT-CR	11,889.02	2,709.22	23%	9,179.81	77%
SAT-W	11,319.99	2,712.06	24%	8,607.93	76%
HSGPA	0.39	0.05	13%	0.34	87%
HS Rank	1.53	0.13	9%	1.40	91%
Income	14.81	3.90	26%	10.91	74%
Mother's Education	1.53	0.28	18%	1.26	82%
Father's Education	1.72	0.40	23%	1.32	77%

magnitude of the relationship between SAT scores and SES was much more similar to the relationship between HSGPA/HS rank and SES when examining pooled-within-school correlations.

Subgroups

Analyses were next computed by gender and racial/ethnic subgroups. Descriptive statistics by subgroup are provided in Table 6. Descriptive statistics for Native American students are provided; however, correlational analyses were not conducted due to the small sample size per institution. There were fewer than two Native American students per institution; therefore, the within-school analyses would not be stable and generalizability of results would be limited.

Gender. Correlational analyses were computed by gender and are presented in Table 7. Interestingly, the correlations between performance indicators and SES factors were slightly yet consistently higher for females than for males. As for the change in magnitude when comparing correlations computed across high schools versus within high schools, a similar pattern emerged for males and females. Again, we saw large reductions for the three SAT sections, with the change in *r* ranging from 0.11 to 0.15, and much smaller changes for HSGPA and rank, with the change in *r* ranging from 0.00 to 0.04. Furthermore, with high school rank, the correlation between income and father's education became significantly larger for both males and females, whereas the correlation with mother's education remained the same. Again, these findings can be attributed to the larger between-school variation in SAT scores as compared to the high school indicators, specifically rank. See Table 8 for the percentage of between-school variance by gender. Similar to the findings for the total sample, the size of the correlations between SAT sections and SES, when computed within school, was much more similar to that of high school indicators and SES than when computed overall.

Race/Ethnicity. Similarly, the analyses were computed by racial/ethnic group (see Tables 9–12). Table 9 provides the results for white students and shows that the correlations between the three SAT sections and SES indicators all decrease when computed within high schools versus across high schools. The change in *r* ranged from 0.08 to 0.11, all indicating a significant change. The opposite finding occurred, however, for the two high school performance measures, as all correlations increased or remained constant. As for HSGPA, the relationship with income increased

Table 6

Descriptive Statistics of Study Variables by Subgroups

Variable	*Male*	*Female*	*White*	*African American*	*Hispanic*	*Asian American*	*Native American*	*Other*	*Total*
n	232,041	262,200	318,113	56,040	58,832	41,217	3,918	16,121	494,241
SAT-M									
Mean	544.70	508.65	543.62	434.61	477.13	583.79	501.93	519.42	525.58
SD	113.30	106.90	101.35	97.04	102.86	122.56	104.33	113.27	111.41
SAT-CR									
Mean	514.83	509.65	532.63	436.33	466.64	524.84	490.82	508.38	512.08
SD	110.28	107.86	100.97	96.87	102.75	125.74	105.84	112.50	109.04
SAT-W									
Mean	498.66	507.59	522.42	428.93	459.81	522.85	476.72	502.81	503.40
SD	107.70	105.05	99.44	92.73	97.83	122.46	99.30	108.95	106.40
HSGPA									
Mean	3.36	3.52	3.51	3.10	3.33	3.58	3.34	3.41	3.44
SD	0.65	0.59	0.60	0.67	0.63	0.58	0.65	0.63	0.63
HS Rank									
Mean	2.53	2.35	2.36	2.89	2.57	2.13	2.60	2.44	2.43
SD	1.25	1.22	1.21	1.25	1.26	1.18	1.25	1.26	1.24
Income									
Mean	7.99	7.32	8.59	5.28	5.53	6.74	7.03	7.13	7.64
SD	3.81	3.86	3.57	3.44	3.56	4.00	3.82	3.91	3.85
Mother's Education									
Mean	3.06	2.94	3.17	2.71	2.35	3.02	2.82	3.00	3.00
SD	1.24	1.24	1.18	1.16	1.25	1.36	1.19	1.27	1.24
Father's Education									
Mean	3.15	2.97	3.24	2.56	2.37	3.29	2.79	3.14	3.05
SD	1.31	1.31	1.25	1.15	1.33	1.42	1.25	1.35	1.31

Table 7

Correlation of SAT Scores and High School Measures with SES Across and Within High Schools by Gender

	Males				*Females*			
Variables	***Across***	***Within***	**Δr**	**z**	***Across***	***Within***	**Δr**	**z**
SAT-M								
Income	0.27	0.14	0.13	65.48*	0.31	0.16	0.15	76.67*
Mother's Education	0.28	0.17	0.11	55.88*	0.32	0.20	0.12	62.10*
Father's Education	0.33	0.20	0.13	67.48*	0.36	0.22	0.14	73.81*
SAT-CR								
Income	0.29	0.16	0.13	66.08*	0.32	0.17	0.15	77.06*
Mother's Education	0.31	0.21	0.10	51.72*	0.34	0.22	0.12	62.83*
Father's Education	0.35	0.23	0.12	63.23*	0.37	0.23	0.14	74.29*
SAT-W								
Income	0.30	0.17	0.13	66.40*	0.34	0.19	0.15	77.92*
Mother's Education	0.32	0.21	0.11	57.07*	0.35	0.23	0.12	63.23*
Father's Education	0.36	0.23	0.13	68.74*	0.39	0.25	0.14	75.33*
HSGPA								
Income	0.12	0.09	0.03	14.61*	0.16	0.12	0.04	19.66*
Mother's Education	0.16	0.14	0.02	9.86*	0.19	0.16	0.03	14.91*
Father's Education	0.19	0.17	0.02	9.96	0.22	0.18	0.04	20.07*
HS Rank								
Income	–0.08	–0.10	**0.02**	9.71*	–0.13	–0.14	**0.01**	4.91*
Mother's Education	–0.14	–0.14	0.00	0.00	–0.17	–0.17	0.00	0.00
Father's Education	–0.17	–0.18	**0.01**	4.97*	–0.19	–0.20	**0.01**	5.01*

Note: Δ*r* is the difference between the magnitude of correlation coefficient computed across schools versus within schools. Bolded values indicate an increase in magnitude. The *z* value indicates whether the two correlation coefficients are significantly different from each other.
*$p < 0.05$. For males, $n = 232{,}041$. For females, $n = 262{,}200$.

0.02 ($z = 11.34$) and remained the same for both mother's and father's education. For rank, the correlation increased significantly for all three SES indicators (Δ*r* ranged from 0.01 to 0.03).

Table 10 presents the results for African American students. Like the results for other groups, the SAT correlations were reduced significantly when computed within versus across high schools, with the change in *r* ranging from 0.08 to 0.10. Furthermore, for HSGPA, there were small reductions in correlations (Δ*r* ranged from 0.01 to 0.02). Finally, similar to white students, the correlations between high school rank and the three SES indicators all increased slightly.

Table 8

Percentage of Between-School Variance by Gender and the Total Group

Variable	***Total***	***Male***	***Female***
SAT-M	25%	26%	27%
SAT-CR	23%	24%	26%
SAT-W	24%	26%	27%
HSGPA	13%	16%	17%
HS Rank	9%	12%	11%
Income	26%	28%	29%
Mother's Education	18%	20%	21%
Father's Education	23%	25%	26%

Table 9

Correlation of SAT Scores and High School Measures with SES Across and Within High Schools by Race/Ethnicity—White Students

Variables	***Across***	***Within***	**Δr**	**z**
SAT-M				
Income	0.21	0.12	0.09	52.22*
Mother's Education	0.27	0.18	0.09	53.51*
Father's Education	0.30	0.20	0.10	60.23*
SAT-CR				
Income	0.18	0.09	0.09	51.74*
Mother's Education	0.28	0.20	0.08	47.91*
Father's Education	0.31	0.21	0.10	60.56*
SAT-W				
Income	0.21	0.10	0.11	63.64*
Mother's Education	0.29	0.20	0.09	54.05*
Father's Education	0.32	0.21	0.11	66.82*
HSGPA				
Income	0.06	0.08	**0.02**	–11.34*
Mother's Education	0.14	0.14	0.00	0.00
Father's Education	0.16	0.16	0.00	0.00
HS Rank				
Income	–0.07	–0.10	**0.03**	17.04*
Mother's Education	–0.15	–0.16	**0.01**	5.78*
Father's Education	–0.16	–0.18	**0.02**	11.62*

Note: Δ*r* is the difference between the magnitude of correlation coefficient computed across schools versus within schools. Bolded values indicate an increase in magnitude. The *z* value indicates whether the two correlation coefficients are significantly different from each other.
*$p < 0.05$. $n = 318{,}113$.

Table 10

Correlation of SAT Scores and High School Measures with SES Across and Within High Schools by Race/Ethnicity—African American Students

Variables	*Across*	*Within*	*Δr*	z
SAT-M				
Income	0.23	0.15	0.08	19.66*
Mother's Education	0.22	0.13	0.09	22.00*
Father's Education	0.24	0.15	0.09	22.17*
SAT-CR				
Income	0.25	0.15	0.10	24.68*
Mother's Education	0.24	0.16	0.08	19.74*
Father's Education	0.26	0.16	0.10	24.79*
SAT-W				
Income	0.25	0.15	0.10	24.68*
Mother's Education	0.24	0.15	0.09	22.17*
Father's Education	0.26	0.16	0.10	24.79*
HSGPA				
Income	0.07	0.06	0.01	2.38*
Mother's Education	0.11	0.09	0.02	4.78*
Father's Education	0.13	0.11	0.02	4.80*
HS Rank				
Income	–0.06	–0.08	**0.02**	4.76*
Mother's Education	–0.08	–0.09	**0.01**	2.38*
Father's Education	–0.11	–0.12	**0.01**	2.40*

Note: Δ*r* is the difference between the magnitude of correlation coefficient computed across schools versus within schools. Bolded values indicate an increase in magnitude. The *z* value indicates whether the two correlation coefficients are significantly different from each other.
*$p < 0.05$. $n = 56{,}040$.

Table 11

Correlation of SAT Scores and High School Measures with SES Across and Within High Schools by Race/Ethnicity—Hispanic Students

Variables	*Across*	*Within*	*Δr*	z
SAT-M				
Income	0.29	0.16	0.13	33.27*
Mother's Education	0.26	0.14	0.12	30.36*
Father's Education	0.28	0.15	0.13	33.12*
SAT-CR				
Income	0.32	0.17	0.15	38.80*
Mother's Education	0.29	0.16	0.13	33.27*
Father's Education	0.31	0.17	0.14	36.11*
SAT-W				
Income	0.32	0.17	0.15	38.80*
Mother's Education	0.28	0.16	0.12	30.63*
Father's Education	0.30	0.16	0.14	35.93*
HSGPA				
Income	0.10	0.05	0.05	12.20*
Mother's Education	0.14	0.10	0.04	9.85*
Father's Education	0.15	0.11	0.04	9.87*
HS Rank				
Income	–0.05	–0.07	**0.02**	4.87*
Mother's Education	–0.10	–0.11	**0.01**	2.45*
Father's Education	–0.11	–0.13	**0.02**	4.92*

Note: Δ*r* is the difference between the magnitude of correlation coefficient computed across schools versus within schools. Bolded values indicate an increase in magnitude. The *z* value indicates whether the two correlation coefficients are significantly different from each other.
*$p < 0.05$. $n = 58{,}832$.

Table 12

Correlation of SAT Scores and High School Measures with SES Across and Within High Schools by Race/Ethnicity—Asian American Students

Variables	*Across*	*Within*	*Δr*	z
SAT-M				
Income	0.24	0.13	0.11	23.15*
Mother's Education	0.30	0.16	0.14	30.07*
Father's Education	0.36	0.20	0.16	35.36*
SAT-CR				
Income	0.34	0.23	0.11	24.34*
Mother's Education	0.35	0.23	0.12	26.65*
Father's Education	0.39	0.25	0.14	31.75*
SAT-W				
Income	0.35	0.23	0.12	26.65*
Mother's Education	0.37	0.24	0.13	29.16*
Father's Education	0.41	0.27	0.14	32.23*
HSGPA				
Income	0.08	0.04	0.04	8.15*
Mother's Education	0.16	0.12	0.04	8.28*
Father's Education	0.19	0.15	0.04	8.36*
HS Rank				
Income	–0.08	–0.08	0.00	0.00
Mother's Education	–0.16	–0.14	0.02	–4.15*
Father's Education	–0.19	–0.16	0.03	–6.28*

Note: Δ*r* is the difference between the magnitude of correlation coefficient computed across schools versus within schools. The *z* value indicates whether the two correlation coefficients are significantly different from each other.
*$p < 0.05$. $n = 41{,}217$.

The results for Hispanic students are provided in Table 11. Again, a similar pattern emerged with large decreases for the correlations between SAT scores and SES. Similar to findings for white and African American students, the correlations between high school rank and SES factors increased, with a change in *r* from 0.01 to 0.02. As for the relationship between HSGPA and SES, all correlations decreased in magnitude when computed within high school.

Finally, results for Asian American students are presented in Table 12. Unlike the other groups, none of the correlations increased in magnitude when computed within versus across high schools. Similar to the previous finding, the largest decreases were found for the SAT tests, with the change in *r* ranging from 0.11 to 0.16. Much smaller changes were found for the high school indicators (Δ*r* ranged from 0.00 to 0.04). As before, the between-school variance was calculated by race/ethnicity and is displayed in Table 13. Much like the pattern of results for the total group and by gender, the between-school variance was higher for the SAT sections than the high school indicators. Furthermore, as with the findings of Zwick and Greif Green (2007), there were differences in the magnitude of between-school variance by race/ethnicity, with it being the lowest for white students and highest for Asian American students. See Zwick and Greif Green

Table 13

Percentage of Between-School Variance of Study Variables by Race/Ethnicity

Variable	*White*	*African American*	*Hispanic*	*Asian American*
SAT-M	18%	28%	30%	42%
SAT-CR	18%	28%	31%	39%
SAT-W	19%	28%	31%	40%
HSGPA	13%	22%	24%	26%
HS Rank	10%	19%	18%	23%
Income	22%	30%	38%	36%
Mother's Education	16%	23%	34%	34%
Father's Education	21%	26%	38%	38%

for a discussion of why these differences may have occurred. In sum, the results revealed that the discrepancy in the magnitude between SES with SAT scores versus high school indicators became less severe when correlations were computed within high schools and then aggregated.

Discussion

The strength of the relationship between cognitive measures and SES is unquestionably affected by the way the correlation is computed. Many researchers interested in the predictive validity of admissions criteria more often than not conduct studies at the college level due to the availability of the data at this level or because it is more in keeping with their interests. However, HSGPA and high school rank are measures that were created with the purpose of differentiating students at the high school level. That is, these measures effectively rank students within a high school, but lose meaning when comparing students across high schools due to differences in school quality and curricula, for example. Conversely, standardized tests provide scores on a common metric across high schools to evaluate students' skills, knowledge bases, and abilities.

As evidenced in the current study, when correlations are computed across high schools, they may be artificially deflated for high school indicators because of differences in school quality across high schools. Therefore, it makes sense to calculate the relationship between HSGPA and rank with other variables at the level of the high school. When this was done in the current study, many of the correlations for high school indicators and SES increased—most notably rank but also HSGPA for some subgroups. Again, this is because the majority of variance in HSGPA (87 percent) and high school rank (91 percent) was within schools. The percentage of within-high-school variance for SAT scores was markedly less, with the percentages ranging from 75 percent to 77 percent for the three sections. This is consistent with what Zwick and Greif Green (2007) found.

These results indicate that the criticism of the SAT as an indicator solely of the "size of the student's house" (Kohn, 2001) is quite misleading. This is particularly true when you consider that HSGPA is often exempt from these criticisms. In fact, the amount of discrepancy in the magnitude of the relationship between SAT scores and SES compared to that of HSGPA and rank with SES was shown to shrink significantly in this study. When computed across high schools, the correlations for the three SAT sections with SES indicators were 2.2 times larger, on average, than the correlations for the high school variables. However, when computed within schools, that value decreased to 1.4.

While the results demonstrate that SAT scores still correlated more strongly, on average, with SES than HSGPA and rank, this does not indicate that this is a problem with the test; more likely it is a societal reflection of disparate resources. That is, higher-SES families have more resources to provide their children with additional or richer educational opportunities along with various other factors that could translate into higher academic performance. In fact, Sackett et al. (in press) showed that when controlling for SES, the SAT score–FYGPA correlation is relatively unaffected, noting that the relationship between SAT scores and freshman grades is not an artifact due to the joint influence of SES on both but rather a true effect. Taken together, this research suggests that the problem doesn't lie with the test but rather is a much larger societal issue of educational access and equality.

Future Research

There are many avenues for future research in this area. The individual and school-level factors that potentially mediate or moderate the relationship between SES and SAT scores, HSGPA, and high school rank should be further explored. For example, Camara, Kobrin, and Sathy (2005) found that the academic rigor of a student's high school curriculum is strongly related to family income. When they analyzed the relationship of family income and SAT scores, after controlling for parental education and academic rigor, there was a very small effect of income on both SAT scores and HSGPA. Future research examining the role of academic rigor, SAT scores, HSGPA, and SES would be useful. It would also be interesting to explore why the SES–academic performance correlations in this study were all slightly but consistently higher for females than for males. Finally, this research could be extended to research examining the relationship between HSGPA and SAT scores with first-year GPA, taking into account SES.

Krista D. Mattern is an assistant research scientist at the College Board.

Emily J. Shaw is an assistant research scientist at the College Board.

Frank E. Williams is a research intern at the College Board.

References

Camara, W.J., Kobrin, J.L., & Sathy, V. (2005, April). *Is there an SES advantage for the SAT and college success?* Paper presented at the 2005 Annual Meeting of the National Council on Measurement in Education, Montreal, Canada.

Camara, W.J., & Schmidt, A.E. (1999). *Group differences in standardized testing and social stratification.* (College Board Report No. 1999-5). New York: The College Board.

Geiser, S., & Studley, R. (2002). UC and the SAT: Predictive validity and differential impact of the SAT I and SAT II at the University of California. *Educational Assessment*, *8*, 1–26.

Kobrin, J.L., Sathy, V., & Shaw, E.J. (2006). *A historical view of subgroup performance differences on the SAT Reasoning Test* (College Board Report No. 2006-5). New York: The College Board.

Kohn, A. (2001). Two cheers for an end to the SAT. *The Chronicle of Higher Education*, *9*, p. B12.

Owings, J., McMillen, M., & Burkett, J. (1995, April). *Making the cut: Who meets highly selective college entrance criteria?* (NCES 95-732). National Center for Education Statistics. Retrieved February 17, 2005, from http://nces.ed.gov/pubs95/95732.pdf.

Sackett, P., Kuncel, N.R., Arneson, J.J., Cooper, S.R., & Waters, S.D. (in press). Socioeconomic status and the relationship between the SAT and freshman GPA: An analysis of data from 41 colleges and universities (College Board Report). New York: The College Board.

Sacks, P. (1997). Standardized testing: Meritocracy's crooked yardstick. *Change*, *29*, 25–31.

Zwick, R. (2002). Is the SAT a 'Wealth Test'? *Phi Delta Kappan*, *84*(4) 307–11.

Zwick, R. (Ed.). (2004). *Rethinking the SAT: The future of standardized testing in university admissions*. New York: RoutledgeFalmer.

Zwick, R., Brown, T., & Sklar, J. (2004, July). *California and the SAT: A reanalysis of University of California admissions data*. Berkeley, CA: Center for Studies in Higher Education, UC Berkeley (Research & Occasional Paper Series, CSHE.8.04). Retrieved November 13, 2007, from http://repositories.cdlib.org/cgi/viewcontent.cgi?article=1032&context=cshe.

Zwick, R., & Greif Green, J. (2007). New perspectives on the correlation of SAT scores, high school grades, and socioeconomic factors. *Journal of Educational Measurement*, *44*(1), 23–45.

Office of Research and Analysis
The College Board
45 Columbus Avenue
New York, NY 10023-6992
212 713-8000

The College Board: Connecting Students to College Success
The College Board is a not-for-profit membership association whose mission is to connect students to college success and opportunity. Founded in 1900, the association is composed of more than 5,400 schools, colleges, universities, and other educational organizations. Each year, the College Board serves seven million students and their parents, 23,000 high schools, and 3,500 colleges through major programs and services in college admissions, guidance, assessment, financial aid, enrollment, and teaching and learning. Among its best-known programs are the SAT®, the PSAT/NMSQT®, and the Advanced Placement Program® (AP®). The College Board is committed to the principles of excellence and equity, and that commitment is embodied in all of its programs, services, activities, and concerns. For further information, visit www.collegeboard.com.

CollegeBoard
connect to college success™