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The Relationship Between PSAT/NMSQT® Scores and AP® Examination Grades: A Follow-Up Study

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Introduction

The Advanced Placement Program® (AP®) offers high school students the opportunity to take rigorous college-level courses while still in high school. AP Examinations are linked to each course and administered annually by participating high schools. In 2005, more than 2 million AP Examinations were taken by more than 1 million high school students. Students who elect to take an AP Examination may earn college credit or placement into higher-level college courses if they perform well on the exam. AP Examination grades are reported on a scale that ranges from 1 (no recommendation) to 5 (extremely well qualified). Colleges and universities set their own AP credit and placement policies; however, most institutions award college credit or placement into higher-level courses to those students who earn AP Examination grades of at least 3 or 4.

Several studies have evaluated the validity of AP Examination grades for course placement. These studies have shown that AP Examination grades are indeed valid for their intended purpose (Burnham and Hewitt, 1971; Dodd, Fitzpatrick, De Ayala, and Jennings, 2002; Morgan and Crone, 1993; Morgan and Ramist, 1998). More specifically, these studies found that AP students who were exempted from an introductory college course because of successful AP Examination performance did as well as or better in the subsequent course than those students who were not exempted from the introductory course. At the same time, research has found that the academic intensity and quality of a student's high school curriculum, including AP course work, are predictive of college degree attainment (Adelman, 1999). Bridgeman, Pollack, and Burton (2004) further illustrated that even a coarse index of academic intensity, based partly on the number of AP Examinations taken, can provide a modest increase to the likelihood of college success, holding SAT Reasoning Test™ (SAT®) scores and high school grades constant. It is not surprising, then, that there is interest in developing tools to identify students who are likely to succeed in AP courses.

Camara and Millsap (1998) investigated the validity of using the Preliminary SAT/National Merit Scholarship Qualifying Test (PSAT/NMSQT®) to identify students who have the potential to do well in AP courses, and found that PSAT/NSMQT scores were predictive of AP Examination performance. Haag (1983) found similar results, although he used sample sizes that were smaller than those used by Camara and Millsap and analyzed only 10 AP Examinations. The PSAT/NMSQT is a shorter version of the SAT designed to measure critical reasoning and thinking skills in verbal, math, and writing.[1] It is taken mostly by high school sophomores and juniors (College Board, 2003), and provides an opportunity for students to practice for the SAT and for high school juniors to qualify for the National Merit Scholarship competition. The use of a reasoning test such as the PSAT/NMSQT to predict achievement outcomes is certainly not new. Gussett (1980) showed that the SAT was useful for predicting performance on College-Level Examination Program® (CLEP®) exams, which, similar to AP Exams, provide students with an opportunity to demonstrate mastery of college-level course content and earn college credit or course exemption.

The primary purpose of the research conducted by Camara and Millsap (1998) was to collect validation evidence for using PSAT/NMSQT scores to identify students for AP course work. Their study used PSAT/NMSQT test data from 1993 and 1994 and AP Exam data from 1994 and 1995. Results showed that grades on most AP Examinations were moderately to strongly correlated with PSAT/NMSQT verbal scores, math scores, or the sum of verbal and math scores. Writing scores were not included because the writing test had not yet been added to the PSAT/NMSQT. For three AP Exams (Calculus AB, English Literature, and U.S. History), Camara and Millsap (1998) also evaluated the role of additional variables in explaining variability in AP Examination performance. These additional variables were all self-reported by students and included overall grade point average, grades in related subjects (e.g., English, math, science), and total years of study in related subjects. Results of multiple regression analyses indicated that once PSAT/NMSQT performance was taken into account, these variables accounted for very little additional variance in AP Examination performance. In addition, findings indicated that the relationship between PSAT/NMSQT scores and AP Examination grades for these three AP subjects did not vary for students who completed the PSAT/NMSQT and AP Examinations in the same academic year or completed the PSAT/NMSQT in the academic year prior to the AP Examination.[2]

Using these results as validation evidence, Camara and Millsap (1998) computed expectancy tables showing the percentage of test-takers earning a grade of 3 or better, as well as 4 or better, on AP Examinations across the range of PSAT/NMSQT scores. The PSAT/NMSQT scores or combination of scores that exhibited the strongest correlation with AP Examination performance were usually selected as the basis for computing each expectancy

[1] In 2004, a new PSAT/NMSQT was administered for the first time. Among the changes were the removal of analogies from the verbal test and the removal of the quantitative comparisons from the math test. In addition, the name of the verbal test was changed to critical reading; however, to be consistent with the version of the test analyzed in this study, we continue with the older naming convention.

[2] See Camara and Millsap (1998) pages 10 and 15, which note that the PSAT/NMSQT is administered in early October and the AP Examinations are administered in May. Therefore, the time intervals between examinations are either seven months (for students taking both tests in one academic year) or 19 months (for students taking the PSAT/NMSQT in the academic year prior to the AP Examinations).

table. The expectancy tables serve as the foundation for AP Potential™, an online tool sponsored by the College Board that provides educators with an objective, data-driven method for identifying students who are likely to succeed in a particular AP course (College Board, 2005).

Purpose of Study

The purpose of this study is to reexamine the relationship between PSAT/NMSQT scores and AP Examination grades using more recent test data in order to obtain additional validation evidence for using the PSAT/NMSQT to identify AP students. Toward this end, PSAT/NMSQT data from October 2000 and October 2001 and AP data from May 2002 and May 2003 were analyzed. There have been several important changes to both the AP and PSAT/NMSQT programs since Camara and Millsap (1998) conducted their research that created the need for this study. First, in 1997, a writing test was added to the PSAT/NMSQT. Second, the number of students completing the PSAT/NMSQT increased by 35 percent, and the number of students taking one or more AP Examinations increased by more than 100 percent. Third, the number of sophomores taking the PSAT/NMSQT has been steadily increasing and, in 2001, represented 35 percent of all test-takers, which was up 6 percentage points from 1993. Finally, AP Examinations in Environmental Science, World History, Statistics, and Human Geography have been added, and the volume for several other AP Examinations has increased dramatically. The present study attempts to replicate and extend findings from earlier research given these changes to both programs.

The analyses involved correlating AP Examination grades with several PSAT/NMSQT scores including: (1) verbal, (2) math, (3) writing, (4) sum of verbal + math (V+M), (5) sum of verbal + writing (V+W), (6) sum of math + writing (M+W), and (7) sum of verbal + math + writing (V+M+W). New expectancy tables were then computed for those AP Examinations showing a moderate to high correlation with PSAT/NMSQT performance. Given the possibility that the relationship between PSAT/NMSQT scores and AP Examination grades could vary by grade level and AP subject, we also evaluated whether separate expectancy tables would be needed for sophomore and junior PSAT/NMSQT test-takers.

As in the previous study (Camara and Millsap, 1998), the usefulness of other academic indicators, aside from PSAT/NMSQT scores, to predict success on AP Examinations was also evaluated. These additional academic indicators included students' self-reported cumulative high school grade point average (HSGPA) and self-reported grades in relevant courses. The analyses involved correlating cumulative HSGPA and course grades with AP Examination grades. In addition, a series of multiple linear-regression analyses were also conducted for a subset of 11 high-volume AP Examinations in order to evaluate the incremental validity of PSAT/NMSQT scores in predicting AP Examination grades over and above cumulative HSGPA and relevant course grades. This question of incremental validity concerns how much variability in AP Examination grades can be explained by PSAT/NMSQT scores after the effects of self-reported cumulative HSGPA and relevant course grades are taken into account. The research question was framed in this way in order to evaluate the utility of the PSAT/NMSQT scores in predicting AP Examination grades over and above more traditional indicators of high school academic performance.

Finally, the extent to which the relationship between PSAT/NMSQT scores and AP Examination grades varied as a function of student characteristics including gender, ethnicity, and grade level (sophomore- and junior-class standing) was also evaluated for the same subset of 11 AP Examinations. These analyses involved examining the incremental validity of PSAT/NMSQT scores in predicting AP Examination grades over and above cumulative HSGPA and relevant course grades as a function of student characteristics. Because the original study conducted by Camara and Millsap (1998) found no significant or practical differences in the relationship between students who completed both the PSAT/NMSQT and AP assessments in the same academic year and those who completed the PSAT/NMSQT in the academic year prior to taking the AP Examination, this research question was not reexamined in the present study.

Method

This study examines sophomores and juniors who completed the PSAT/NMSQT in October 2000 or October 2001 and one or more AP Examinations 19 months later in May 2002 or May 2003. Of the more than 4.2 million students who completed the PSAT/NMSQT in 2000 and 2001 as sophomores or juniors, 24 percent (n = 1,035,696) took one or more AP Examinations 19 months later.[3,4]

[3] Students who retook an AP Examination were removed from analyses. In both 2002 and 2003, approximately 6,000 students retook one or more AP Examinations.

[4] Camara and Millsap (1998) examined students who took the PSAT/NMSQT and AP Exams both in the same academic year, as well as 19 months apart and found no differences. They then proceeded to use data from both groups of test-takers in their analysis. Because the number of students completing the PSAT/NMSQT and AP Examinations increased so dramatically in the intervening 8-year period, we were able to eliminate same-year test-takers and conduct all analyses on students who completed testing 19 months apart. This enables us to directly report all results in a manner that demonstrates the validity and efficacy of using PSAT/NMSQT scores in making placement decisions for students in the subsequent year of high school.

Therefore, the students used in this study represent the entire population of tenth- and eleventh-graders who completed the PSAT/NMSQT in either 2000 or 2001 and subsequently took one or more AP Examinations the following academic year.

Of the 1,035,696 students completing both the PSAT/NMSQT and AP Examinations during the specified time periods, 736,228 (71 percent) also completed the SAT Questionnaire prior to November 2003. The SAT Questionnaire, which students are asked to complete when they register for the SAT, collects information about students' academic performance and course-taking patterns while in high school, as well as about their college plans. For the current study, this information was important for supplementing the limited student-level data collected through the PSAT/NMSQT and AP registrations. Thus, additional analyses involving HSGPA, course grades, and PSAT/NMSQT scores were conducted with the subset of students who also completed the SAT Questionnaire.

It is important to note that the students included in this study are of somewhat higher ability than all sophomore and junior PSAT/NMSQT test-takers in 2000 and 2001. The combined average PSAT/NMSQT performance of sophomores and juniors in 2000 and 2001 (n = 4,271,862) was 47.1 for verbal, 47.9 for math, and 47.8 for writing.[5] On the other hand, the combined average performance for students who took the PSAT/NMSQT and also took one or more AP Examinations 19 months later (n = 1,035,696) was several points higher at 54.9 for verbal, 56.2 for math, and 55.0 for writing. In addition, the average PSAT/NMSQT performance of the subsample of sophomores and juniors who completed the SAT Questionnaire (n = 736,228) was also higher than all sophomore and junior test-takers with average scores of 55.2 for verbal, 56.6 for math, and 55.2 for writing. Note, however, that average scores on the PSAT/NMSQT were similar for both the total sample (n = 1,035,696) and the subsample of students who completed the SAT Questionnaire (n = 736,228), suggesting that results from analyses based on the subsample are likely to generalize to the total sample.

To summarize, two overlapping samples were used for all analyses reported in this paper. The first sample was composed of two cohorts of students who took the PSAT/NMSQT in 2000 or 2001 and then took one or more AP Examinations 19 months later. This sample was used to examine the relationship between PSAT/NMSQT scores and AP Examination grades, as well as to compute the expectancy tables. The second sample was composed of students who also completed the SAT Questionnaire in addition to taking the PSAT/NMSQT and AP Exams during the specified periods. Data from the SAT Questionnaire enabled additional analyses to be conducted to evaluate the role of other academic indicators (i.e., cumulative HSGPA and grades in relevant courses) in predicting performance on AP Examinations.

Analyses and Results

Strength of the Relationship Between AP® Examination Grades and PSAT/NMSQT® Scores

Pearson-product moment correlations were computed between grades on 33 AP Examinations[6] and seven PSAT/NMSQT scores: (1) verbal (V), (2) math (M), (3) writing (W), (4) V+M, (5) V+W, (6) M+W, and (7) V+M+W. Table 1 shows the means and standard deviations for AP Examination grades and PSAT/NMSQT scores by AP subject, and the sample sizes that were involved. The number of students per AP Examination ranged from 2,500 students for AP French Literature to 324,151 for AP English Literature. The median number of students across all AP Examinations was 30,421. For six AP Examinations, the analyses involved more than 100,000 students.

Table 2 presents the correlations between PSAT/NMSQT scores and AP Examination grades. Results show that one or more PSAT/NMSQT scores were moderately to strongly correlated to grades on all AP Examinations with the exception of four exams. The exceptions were: (1) German Language, (2) Spanish Language, (3) Studio Art: Drawing, and (4) Studio Art: 2-D Design. Camara and Millsap (1998) found similar results, and speculated that one reason for the low correlations among PSAT/NMSQT scores and the language exams was that a large proportion of students taking these exams may have been exposed to the language in their household or have acquired language skills outside of the classroom. In the case of AP Studio Art, the low correlations may be because the AP Studio Art Examinations consist entirely of portfolio assessments, with traditional assessments not being used.

Of the remaining 29 AP Examinations, Table 2 shows that all exams exhibited a correlation of .40 or higher with one or more PSAT/NMSQT scores.

[5] PSAT/NMSQT scores are reported on a 20–80 scale with a mean of approximately 50 and a standard deviation of approximately 10.

[6] At the time of this study, 34 AP Examinations were available for analysis; however, AP Studio Art: 3-D Design was not included due to small sample sizes.

Table 1

Means and Standard Deviations of AP Examination Grades and PSAT/NMSQT Scores

	Mean	*SD*
AP Art History		
AP Grade	3.20	1.19
Verbal Score	56.71	10.02
Math Score	56.48	9.70
Writing Score	56.80	10.32
V + M	113.19	17.76
V + W	113.51	19.20
M + W	113.28	17.95
V + M + W	169.99	26.56
N = 16,055		
AP Biology		
AP Grade	3.15	1.30
Verbal Score	56.28	9.47
Math Score	57.68	9.36
Writing Score	56.17	9.84
V + M	113.96	16.88
V + W	112.45	18.10
M + W	113.85	17.14
V + M + W	170.13	25.14
N = 120,388		
AP Calculus AB		
AP Grade	3.13	1.33
Verbal Score	56.51	9.22
Math Score	60.64	7.69
Writing Score	56.69	9.60
V + M	117.15	14.85
V + W	113.19	17.57
M + W	117.33	15.10
V + M + W	173.84	22.82
N = 228,922		
AP Calculus BC		
AP Grade	3.74	1.34
Verbal Score	61.08	9.50
Math Score	66.70	7.08
Writing Score	61.41	9.83
V + M	127.78	14.35
V + W	122.49	18.06
M + W	128.11	14.64
V + M + W	189.19	22.57
N = 66,370		
AP Chemistry		
AP Grade	2.89	1.37
Verbal Score	56.94	9.71
Math Score	60.84	8.99
Writing Score	56.94	9.96
V + M	117.78	16.64
V + W	113.88	18.46
M + W	117.78	16.80
V + M + W	174.72	25.01
N = 76,704		

	Mean	*SD*
AP Computer Science A		
AP Grade	2.93	1.49
Verbal Score	55.87	9.66
Math Score	60.71	8.90
Writing Score	55.04	9.92
V + M	116.58	16.37
V + W	110.90	18.34
M + W	115.75	16.65
V + M + W	171.61	24.72
N = 16,020		
AP Computer Science AB		
AP Grade	3.44	1.42
Verbal Score	60.48	9.57
Math Score	65.74	8.00
Writing Score	59.31	10.09
V + M	126.22	15.28
V + W	119.79	18.37
M + W	125.04	15.87
V + M + W	185.53	23.78
N = 8,866		
AP English Language		
AP Grade	3.02	1.07
Verbal Score	54.74	9.30
Math Score	54.90	9.63
Writing Score	55.05	9.58
V + M	109.64	17.05
V + W	109.79	17.67
M + W	109.95	17.19
V + M + W	164.69	25.05
N = 188,200		
AP English Literature		
AP Grade	3.07	1.05
Verbal Score	58.00	9.27
Math Score	57.51	9.54
Writing Score	58.12	9.70
V + M	115.50	16.93
V + W	116.12	17.74
M + W	115.63	17.22
V + M + W	173.62	25.03
N = 324,151		
AP Environmental Science		
AP Grade	2.73	1.35
Verbal Score	54.27	9.39
Math Score	55.36	9.32
Writing Score	54.09	9.67
V + M	109.64	16.77
V + W	108.36	17.85
M + W	109.45	16.88
V + M + W	163.73	24.83
N = 35,679		

Table 1 (continued)

Means and Standard Deviations of AP Examination Grades and PSAT/NMSQT Scores

	Mean	*SD*
AP European History		
AP Grade	3.26	1.15
Verbal Score	59.12	9.16
Math Score	58.17	9.26
Writing Score	58.48	9.72
V + M	117.29	16.40
V + W	117.60	17.62
M + W	116.65	16.87
V + M + W	175.77	24.50
N = 47,027		
AP French Language		
AP Grade	2.72	1.24
Verbal Score	60.09	9.76
Math Score	60.04	9.34
Writing Score	61.21	9.99
V + M	120.13	17.19
V + W	121.30	18.60
M + W	121.25	17.35
V + M + W	181.34	25.69
N = 22,712		
AP French Literature		
AP Grade	3.31	1.33
Verbal Score	63.59	10.09
Math Score	62.68	9.31
Writing Score	65.16	10.12
V + M	126.27	17.61
V + W	128.74	19.12
M + W	127.84	17.71
V + M + W	191.42	26.42
N = 2,500		
AP German Language		
AP Grade	3.02	1.30
Verbal Score	59.59	9.71
Math Score	60.24	9.36
Writing Score	59.96	9.93
V + M	119.83	17.20
V + W	119.55	18.42
M + W	120.21	17.27
V + M + W	179.79	25.55
N = 4,749		
AP Government and Politics: Comparative		
AP Grade	3.02	1.25
Verbal Score	59.92	9.28
Math Score	59.73	9.29
Writing Score	59.13	9.83
V + M	119.65	16.55
V + W	119.05	17.87
M + W	118.87	17.00
V + M + W	178.79	24.76
N = 14,759		

	Mean	*SD*
AP Government and Politics: United States		
AP Grade	2.80	1.11
Verbal Score	57.46	9.43
Math Score	57.92	9.53
Writing Score	57.15	9.85
V + M	115.38	17.02
V + W	114.61	18.07
M + W	115.07	17.30
V + M + W	172.53	25.27
N = 134,996		
AP Human Geography		
AP Grade	3.27	1.34
Verbal Score	55.65	9.54
Math Score	56.40	9.68
Writing Score	55.45	9.91
V + M	112.05	17.23
V + W	111.09	18.26
M + W	111.85	17.55
V + M + W	167.50	25.60
N = 4,600		
AP Latin Literature		
AP Grade	2.85	1.41
Verbal Score	62.28	9.06
Math Score	62.06	8.75
Writing Score	62.45	9.52
V + M	124.34	15.73
V + W	124.74	17.29
M + W	124.51	16.13
V + M + W	186.79	23.61
N = 4,161		
AP Latin: Vergil		
AP Grade	3.01	1.34
Verbal Score	62.06	9.06
Math Score	62.06	8.78
Writing Score	62.40	9.57
V + M	124.12	15.82
V + W	124.46	17.37
M + W	124.46	16.23
V + M + W	186.52	23.77
N = 5,437		
AP Macroeconomics		
AP Grade	3.02	1.31
Verbal Score	58.14	9.64
Math Score	60.53	9.46
Writing Score	57.82	10.03
V + M	118.67	17.10
V + W	115.96	18.46
M + W	118.35	17.40
V + M + W	176.49	25.55
N = 50,791		

Table 1 (continued)

Means and Standard Deviations of AP Examination Grades and PSAT/NMSQT Scores

	Mean	*SD*
AP Microeconomics		
AP Grade	3.07	1.30
Verbal Score	58.48	9.57
Math Score	61.19	9.29
Writing Score	58.15	9.97
V + M	119.68	16.79
V + W	116.63	18.31
M + W	119.34	17.12
V + M + W	177.82	25.16
N = 34,769		
AP Music Theory		
AP Grade	3.29	1.23
Verbal Score	57.05	9.74
Math Score	58.43	9.79
Writing Score	57.76	10.24
V + M	115.48	17.61
V + W	114.81	18.80
M + W	116.19	18.05
V + M + W	173.24	26.35
N = 8,382		
AP Physics B		
AP Grade	2.83	1.33
Verbal Score	57.75	9.49
Math Score	62.13	8.24
Writing Score	57.45	9.91
V + M	119.88	15.58
V + W	115.20	18.15
M + W	119.57	15.95
V + M + W	177.33	23.89
N = 51,915		
AP Physics C: Electricity and Magnetism		
AP Grade	3.36	1.44
Verbal Score	62.92	9.41
Math Score	68.55	7.05
Writing Score	62.63	9.86
V + M	131.47	14.21
V + W	125.55	17.99
M + W	131.17	14.72
V + M + W	194.10	22.51
N = 15,366		
AP Physics C: Mechanics		
AP Grade	3.36	1.36
Verbal Score	61.37	9.66
Math Score	66.64	7.78
Writing Score	61.16	10.08
V + M	128.01	15.30
V + W	122.53	18.51
M + W	127.80	15.72
V + M + W	189.17	23.83
N = 30,421		

	Mean	*SD*
AP Psychology		
AP Grade	3.38	1.27
Verbal Score	55.30	9.25
Math Score	55.88	9.62
Writing Score	55.24	9.64
V + M	111.18	16.97
V + W	110.54	17.67
M + W	111.12	17.22
V + M + W	166.42	25.01
N = 73,720		
AP Spanish Language		
AP Grade	3.23	1.30
Verbal Score	54.37	11.39
Math Score	55.72	11.41
Writing Score	55.76	11.26
V + M	110.09	21.29
V + W	110.13	21.62
M + W	111.47	21.06
V + M + W	165.84	31.27
N = 74,433		
AP Spanish Literature		
AP Grade	3.15	1.22
Verbal Score	51.28	13.65
Math Score	52.24	13.04
Writing Score	53.08	13.06
V + M	103.52	25.44
V + W	104.36	25.85
M + W	105.32	24.82
V + M + W	156.60	37.47
N = 9,250		
AP Statistics		
AP Grade	2.91	1.31
Verbal Score	56.30	9.40
Math Score	59.94	8.75
Writing Score	56.35	9.77
V + M	116.25	16.04
V + W	112.66	17.95
M + W	116.30	16.28
V + M + W	172.60	24.17
N = 73,292		
AP Studio Art: Drawing		
AP Grade	3.20	1.02
Verbal Score	53.31	10.07
Math Score	53.21	9.98
Writing Score	53.34	10.29
V + M	106.52	18.06
V + W	106.64	19.22
M + W	106.55	18.27
V + M + W	159.85	26.88
N = 10,970		

Table 1 (continued)

Means and Standard Deviations of AP Examination Grades and PSAT/NMSQT Scores

	Mean	*SD*
AP Studio Art: 2-D Design		
AP Grade	2.97	1.07
Verbal Score	53.04	9.76
Math Score	52.90	9.58
Writing Score	53.01	9.91
V + M	105.94	17.31
V + W	106.05	18.50
M + W	105.91	17.43
V + M + W	158.95	25.70
N = 8,165		
AP U.S. History		
AP Grade	2.89	1.23
Verbal Score	54.47	9.04
Math Score	54.88	9.38
Writing Score	54.44	9.41
V + M	109.35	16.42
V + W	108.91	17.20
M + W	109.31	16.64
V + M + W	163.79	24.17
N = 231,889		
AP World History		
AP Grade	3.31	1.24
Verbal Score	56.61	9.77
Math Score	56.64	9.79
Writing Score	56.05	9.94
V + M	113.25	17.55
V + W	112.66	18.50
M + W	112.68	17.66
V + M + W	169.29	25.92
N = 7,990		

In general, the strength of the correlation between PSAT/NMSQT scores and AP Examination grades varied by AP subject. For example, AP English Language and AP English Literature Examinations exhibited the highest correlations with PSAT/NMSQT scores, whereas AP Spanish Literature exhibited the lowest correlation. Table 1 also shows that AP Examination grades tended to be more highly correlated (if only slightly) with the combined PSAT/NMSQT scores than with the separate verbal, math, and writing scores. Ten AP Examinations correlated the highest with V+M scores, eight AP Examinations correlated the highest with V+M+W scores, and six AP Examinations correlated the highest with V+W scores. Just one exam, AP Music Theory, correlated the highest with M+W scores. No AP Examinations correlated the highest with the verbal-only scale.

As noted earlier, the average scores on the PSAT/NMSQT for students in this study are higher than the average scores for all sophomore and junior test-takers in 2000 and 2001, which is not surprising because only those students taking one or more AP Examinations were included in this study. Given this, correlations between PSAT/NMSQT scores and AP Examination grades are likely to be underestimates of the true correlation because of the restriction of range for the data analyzed in this study.

Finally, Table 2 shows the PSAT/NMSQT scale that was selected as the basis for computing each expectancy table. This is indicated by the "boxed" correlations. The median correlation between the selected PSAT/NMSQT scale and AP Examination grades was .57, and the average correlation was .56. For 20 of the 29 AP Examinations, correlations were above .50. In 18 of 29 instances, the PSAT/NMSQT scale that was selected was the one that had the highest correlation with each AP Examination. In 11 instances, a PSAT/NMSQT scale other than the one with the highest correlation was selected. The reasons for doing so were to ensure consistency across exams of similar AP subject areas and/or to improve the stability of the resulting expectancy data. The difference between the highest correlation and the selected correlation for these 11 AP Examinations was very small (ranging from .001 to .039). As a result, the accuracy of predictions for these AP Examinations was not affected in any meaningful way. Further information about the development of the expectancy tables, as well as their recommended use, will be provided in a subsequent section of this report.

Separate Versus Combined Correlations for Sophomores and Juniors Taking the PSAT/NMSQT

In the past decade, the number of sophomores taking the PSAT/NMSQT has grown steadily, and the number of juniors taking AP Examinations has also grown. It is possible that the relationship between PSAT/NMSQT scores and AP Examination grades varies by grade level and AP subject. Therefore, one of the research questions we considered was whether separate expectancy tables would be needed for sophomore and junior PSAT/NMSQT test-takers. To investigate this possibility, correlations were computed separately for two groups of students: (1) sophomores taking the PSAT/NMSQT and then completing AP Examinations in their junior year, and (2) juniors taking the PSAT/NMSQT and then completing the AP Examinations in their senior year. Although there are seven indices of PSAT/NMSQT performance, these analyses focused on the PSAT/NMSQT index that was selected to compute the expectancy tables based on the combined analyses (see Table 2). Grade-level correlations were not compared for those exams that did not show a strong relationship with performance on the

Table 2

Correlations of PSAT/NMSQT Scores with AP Examination Grades

AP Examination	*V*	*M*	*W*	*V+M*	*V+W*	*M+W*	*V+M+W*	*Sample*
Art History	.566	.424	.521	.551	**.575**	.529	.571	16,055
Biology	.585	.591	.527	**.656**	.592	.625	.646	120,388
Calculus AB	.374	**.530**	.359	.507	.392	.498	.481	228,922
Calculus BC	.324	**.484**	.324	.454	.347	.452	.430	66,370
Chemistry	.472	**.599**	.453	**.599**	.492	.589	.579	76,704
Computer Science A	.423	.511	.401	**.527**	.440	.512	.510	16,020
Computer Science AB	.408	.454	.381	**.493**	.422	.471	.479	8,866
English Language	.712	.543	.659	.695	**.732**	.671	.725	188,200
English Literature	.704	.511	.657	.674	**.727**	.653	.710	324,151
Environmental Science	.591	.542	.515	**.632**	.590	.594	.628	35,679
European History	.577	.451	.503	.577	.577	.537	**.586**	47,027
French Language	.423	.342	.452	.426	**.465**	.445	.461	22,712
French Literature	.464	.382	.499	.468	**.509**	.486	.503	2,500
German Language*	.257	.195	.348	.251	.323	.306	.304	4,749
Government and Politics: Comparative	.520	.413	.458	.523	.522	.490	**.532**	14,759
Government and Politics: United States	.599	.515	.525	.620	.599	.582	**.622**	134,996
Human Geography	.597	.491	.540	.606	.605	.575	**.617**	4,600
Latin Literature	.443	.380	.479	.466	.496	.489	**.504**	4,161
Latin: Vergil	.432	.380	.471	.458	.485	.483	**.495**	5,437
Macroeconomics	.481	.533	.440	**.566**	.490	.543	.551	50,791
Microeconomics	.454	.525	.431	**.549**	.472	.535	.537	34,769
Music Theory	.375	.477	.422	.473	.424	**.498**	.480	8,382
Physics B	.419	.540	.396	**.541**	.435	.525	.517	51,915
Physics C: Electricity and Magnetism	.354	.455	.355	**.460**	.380	.455	.446	15,366
Physics C: Mechanics	.436	**.572**	.426	.567	.460	.556	.544	30,421
Psychology	.582	.523	.538	.614	.598	.593	**.624**	73,720
Spanish Language*	.005	.056	.030	.033	.013	.014	.012	74,433
Spanish Literature	.427	.379	.411	.424	**.433**	.415	.431	9,250
Statistics	.490	.604	.478	**.617**	.516	.612	.602	73,292
Studio Art: Drawing*	.157	.202	.160	.199	.168	.200	.195	10,970
Studio Art: 2-D Design*	.138	.160	.122	.167	.138	.157	.159	8,165
U.S. History	.584	.478	.513	.595	.587	.559	**.603**	231,889
World History	.573	.476	.488	**.584**	.565	.539	.583	7,990

*Correlations too low for reporting.
Bold indicates highest correlation among PSAT/NMSQT scores.
Shaded boxed number indicates the model used for estimating expected grades on AP Examinations from PSAT/NMSQT scores.

PSAT/NMSQT (i.e., German Language, Spanish Language, Studio Art: Drawing, and Studio Art: 2-D Design).

Results are displayed in Table 3, and show that correlations for both groups were nearly identical for most AP Examinations and only differed by more than .05 in four instances. The variance contributed by PSAT/NMSQT over and above HSGPA and relevant course grades was similarly compared for these two groups of students using a subset of AP Examinations. These results are described in a subsequent section and displayed in Table 7. Based on all of these analyses, there was no justification to provide separate expectancy tables by grade level.

Table 3

Correlations of PSAT/NMSQT Scores with AP Examination Grades by Grade Level

AP Examination	*PSAT/NMSQT Scale*	*Sophomore*	*Junior*	*Difference (Sophomore–Junior)*
Art History	V + W	.579 (4,177)	.587 (11,878)	-0.01
Biology	V + M	.660 (40,721)	.674 (79,667)	-0.01
Calculus AB	Math	.564 (27,223)	.525 (201,699)	0.04
Calculus BC	Math	.493 (10,359)	.483 (56,011)	0.01
Chemistry	Math	.610 (36,969)	.612 (39,735)	0.00
Computer Science A	Math	.536 (6,273)	.515 (9,747)	0.02
Computer Science AB	Math	.466 (3,284)	.467 (5,582)	0.00
English Language	V + W	.738 (140,946)	.720 (47,254)	0.02
English Literature	CR + W	.738 (15,897)	.727 (308,254)	0.01
Environmental Science	V + M	.655 (10,042)	.636 (25,637)	0.02
European History	V + M + W	.587 (10,132)	.593 (36,895)	-0.01
French Language	V+W	.432 (5,088)	.497 (17,624)	-0.07
French Literature	Writing	.507 (398)	.521 (2,102)	-0.01
Government and Politics: Comparative	V + M	.546 (1,485)	.525 (13,274)	0.02
Government and Politics: United States	V + M + W	.629 (9,314)	.625 (125,682)	0.00
Human Geography	V + M	.643 (1,506)	.597 (3,094)	0.05
Latin Literature	Writing	.492 (1,608)	.497 (2,553)	-0.01
Latin: Vergil	Writing	.502 (2,289)	.493 (3,148)	0.01
Macroeconomics	V + M	.594 (4,060)	.569 (46,731)	0.03
Microeconomics	V + M	.577 (3,121)	.554 (31,648)	0.02
Music Theory	Math	.510 (2,294)	.466 (6,088)	0.04
Physics B	Math	.572 (14,965)	.541 (36,950)	0.03
Physics C: Electricity and Magnetism	Math	.509 (1,038)	.449 (14,238)	0.06
Physics C: Mechanics	Math	.655 (2,681)	.564 (27,740)	0.09
Psychology	V + M + W	.631 (17,821)	.627 (55,899)	0.00
Spanish Literature	Writing	.488 (2,178)	.405 (7,072)	0.08
Statistics	V + M	.633 (11,822)	.627 (61,470)	0.01
U.S. History	V + M + W	.609 (208,949)	.584 (22,940)	0.03
World History	V + M	.605 (4,631)	.554 (3,359)	0.05

Sample sizes in parentheses.

Strength of Relationship Between AP Examination Grades and High School Grades

SAT Questionnaire data were analyzed to evaluate the relationship between high school grades and AP Examination performance.[7] High school grade data included students' self-reported cumulative HSGPA and their self-reported average grades in six subject areas: (1) arts and music, (2) English, (3) foreign and classical language, (4) math, (5) natural sciences (e.g., biology, chemistry, physics), and (6) social sciences and history (e.g., psychology, European history, government, economics). The SAT Questionnaire asks students to provide their average grade for all courses taken in each subject area using a scale ranging from A ("excellent, usually 90–100") to E or F ("failing, usually 59 or below"). Cumulative HSGPA is reported on a 12-point scale ranging from A (coded as 1) to E/F (coded as 12). Because HSGPA is negatively coded, negative correlations with AP Examination grades were expected.[8] Table 4 reports the Pearson-product moment correlations between these indicators of high school academic performance and AP Examination grades. Only correlations with relevant subject areas are reported.

The AP Examinations that had the highest correlations with cumulative HSGPA were Biology, Psychology, Statistics, and Environmental Science. Correlations between AP Examination grades and HSGPA, however, were still much lower than the correlations between PSAT/NMSQT scores and the same AP Examinations. When considering all of the 29 AP Examinations that exhibited a moderate to strong correlation with PSAT/NMSQT scores, the average correlation between AP Examination grades and HSGPA had a magnitude of .28. By contrast, the average correlation between the same AP Examinations and the PSAT/NMSQT scores used for computing the expectancy tables was much higher at .56.

Table 4 also reports the correlations between AP Examination grades and relevant course grades, but as was the case with cumulative HSGPA, these correlations were all lower than those involving the PSAT/NMSQT. The correlations between AP Examination grades and relevant course grades ranged from .08 (i.e., Studio Art: 2-D Design and Studio Art: Drawing) to .36 (i.e., Statistics). When considering all of the 29 AP Examinations that exhibited a moderate to strong correlation with PSAT/NMSQT scores, the average correlation between AP Examination grades and relevant course grades was .25. This average was again well below the average correlation between AP Examination grades and the PSAT/NMSQT scores used to compute the expectancy tables.[9]

Multiple Regression Analyses

For 11 moderate- to high-volume AP Examinations, a series of multiple regression analyses was also conducted to evaluate the incremental validity of PSAT/NMSQT scores in predicting AP Examination grades over and above other indicators of high school academic performance. As in the correlational analyses, the additional indicators included cumulative HSGPA and relevant course grades. For each AP Examination, the PSAT/NMSQT scale used in the model was the one that was selected to compute the corresponding expectancy table as shown in Table 5. The research question concerned how much variability in AP Examination grades could be explained by PSAT/NMSQT scores after the effects of self-reported cumulative HSGPA and relevant course grades were taken into account. The research question was framed this way in order to evaluate the utility of the PSAT/NMSQT scores in predicting AP Examination grades over and above more traditional indicators of high school academic performance.

The analyses involved a series of hierarchical multiple-linear regressions in which the independent variables were always cumulative HSGPA, relevant course grade, and the PSAT/NMSQT scale used to compute the expectancy table. The dependent variable in all analyses was AP Examination grade. To test the incremental validity of the PSAT/NMSQT, cumulative HSGPA and relevant course grades were entered into the model first, and then the amount of variability accounted for by these two variables, as measured by R-squared, was computed. In the second model, all three predictors were entered, and the additional variance accounted for by considering PSAT/NMSQT, referred to as the R-squared increment, was computed

[7] After analyses were completed, it was determined that a very small percentage of students not of sophomore- or junior-class standing were included in analyses involving the SAT Questionnaire. Because this percentage was very small (less than 1 percent), we do not believe the results were impacted in any meaningful way.

[8] Correlations range from -1.0 to 1.0 with a value closer to 1.0 indicating a stronger relationship between two variables. The sign of the correlation indicates the direction of relationship, whereas the value of the correlation indicates the magnitude of the relationship.

[9] It is important to emphasize that the correlations between AP grades and PSAT/NMSQT scores and the correlations between AP grades and high school grades (i.e., HSGPA and relevant course grades) are based on different samples (SAT Questionnaire versus no questionnaire). As mentioned, however, both samples were similar with respect to average PSAT/NMSQT scores and therefore we would not expect the correlations between AP grades and PSAT/NMSQT scores in the SAT Questionnaire sample to be substantially different from those based on the total sample. Nonetheless, when making comparisons, this caveat should be kept in mind.

Table 4

Means and Correlations of AP Examination Grades with High School Courses and Grades

	Mean	*sd*	*n*	*Correlation with AP Grade*
Art History				
AP Grade	3.20	1.18	12,479	-
HSGPA*	3.06	1.43	9,949	-.299
Art and Music Grades**	3.89	0.35	8,386	.156
Biology				
AP Grade	3.19	1.29	90,170	-
HSGPA*	2.59	1.28	76,291	-.399
Natural Science Grades**	3.72	0.48	69,733	.328
Calculus AB				
AP Grade	3.15	1.33	159,871	-
HSGPA*	2.45	1.19	136,882	-.199
Math Grades**	3.75	0.46	126,779	.228
Calculus BC				
AP Grade	3.74	1.34	49,250	-
HSGPA*	2.16	1.04	41,366	-.175
Math Grades**	3.86	0.36	37,962	.210
Chemistry				
AP Grade	2.94	1.37	59,090	-
HSGPA*	2.30	1.16	49,914	-.272
Natural Science Grades**	3.82	0.40	45,585	.267
Computer Science A				
AP Grade	2.96	1.49	12,485	-
HSGPA*	2.88	1.48	10,141	-.259
Math Grades**	3.64	0.55	9,367	.276
Computer Science AB				
AP Grade	3.45	1.42	6,963	-
HSGPA*	2.68	1.38	5,479	-.257
Math Grades**	3.75	0.46	4,991	.225
English Language				
AP Grade	3.10	1.06	142,137	-
HSGPA*	2.59	1.30	118,619	-.304
English Grades**	3.72	0.48	108,813	.295
English Literature				
AP Grade	3.10	1.06	221,838	-
HSGPA*	2.59	1.29	190,151	-.296
English Grades**	3.74	0.46	177,865	.275
Environmental Science				
AP Grade	2.76	1.34	27,944	-
HSGPA*	3.18	1.47	22,708	-.351
English Grades**	3.55	0.56	20,711	.269
European History				
AP Grade	3.29	1.15	34,772	-
HSGPA*	2.71	1.32	29,097	-.294
Social Science Grades**	3.79	0.43	26,700	.277
French Language				
AP Grade	2.73	1.23	17,598	-
HSGPA*	2.58	1.22	14,442	-.167
Language Grades**	3.82	0.40	13,261	.158
French Literature				
AP Grade	3.28	1.32	1,931	-
HSGPA*	2.76	1.20	1,487	-.257
Language Grades**	3.79	0.43	1,327	.249
German Language				
AP Grade	3.04	1.31	3,239	-
HSGPA*	2.59	1.32	2,688	-.153
Language Grades**	3.83	0.41	2,487	.162
Government and Politics: Comparative				
AP Grade	3.21	1.09	8,806	-
HSGPA*	2.70	1.35	8,961	-.313
Social Science Grades**	3.77	0.45	8,259	.287
Government and Politics: United States				
AP Grade	2.80	1.11	98,233	-
HSGPA*	2.67	1.35	83,558	-.309
Social Science Grades**	3.76	0.45	77,007	.271
Human Geography				
AP Grade	3.29	1.34	3,509	-
HSGPA*	2.98	1.42	2,813	-.335
Social Science Grades**	3.68	0.51	2,521	.314
Latin Literature				
AP Grade	2.81	1.41	2,523	-
HSGPA*	2.52	1.23	2,070	-.321
Language Grades**	3.82	0.39	1,921	.288
Latin: Vergil				
AP Grade	3.04	1.33	4,502	-
HSGPA*	2.40	1.15	3,599	-.274
Language Grades**	3.86	0.36	3,265	.240
Macroeconomics				
AP Grade	3.24	1.28	16,313	-
HSGPA*	2.62	1.32	31,541	-.258
Math Grades**	3.61	0.57	28,848	.293
Social Science Grades**	3.76	0.45	28,709	.182
Microeconomics				
AP Grade	3.07	1.30	25,755	-
HSGPA*	2.64	1.30	21,628	-.261
Math Grades**	3.63	0.56	19,774	.296
Social Science Grades**	3.76	0.45	19,708	.188
Music Theory				
AP Grade	3.29	1.24	5,924	-
HSGPA*	3.02	1.51	4,788	-.303
Art and Music Grades**	3.96	0.20	4,458	.114
Physics B				
AP Grade	2.84	1.33	39,836	-
HSGPA*	2.43	1.22	33,501	-.220
Natural Science Grades**	3.78	0.44	30,679	.233
Physics C: Electricity and Magnetism				
AP Grade	3.32	1.44	11,061	-
HSGPA*	2.31	1.15	9,194	-.205
Natural Science Grades**	3.85	0.38	8,392	.215
Physics C: Mechanics				
AP Grade	3.31	1.36	22,127	-
HSGPA*	2.35	1.18	18,513	-.228
Natural Science Grades**	3.83	0.39	16,860	.240
Psychology				
AP Grade	3.38	1.28	51,889	-
HSGPA*	2.99	1.42	43,021	-.391
Social Science Grades**	3.68	0.51	39,316	.303
Spanish Language				
AP Grade	3.22	1.29	54,887	-
HSGPA*	2.78	1.41	46,104	.021
Language Grades**	3.80	0.43	42,560	.101
Spanish Literature				
AP Grade	3.22	1.19	6,890	-
HSGPA*	3.15	1.58	5,768	-.279
Language Grades**	3.77	0.47	5,390	.194
Statistics				
AP Grade	2.90	1.31	54,635	-
HSGPA*	2.79	1.35	45,338	-.367
Math Grades**	3.59	0.56	41,585	.359

Table 4 (continued)

Means and Correlations of AP Examination Grades with High School Courses and Grades

	Mean	*sd*	*n*	*Correlation with AP Grade*
Studio Art: Drawing				
AP Grade	3.21	1.01	7,406	-
HSGPA*	3.29	1.55	5,999	-.160
Art & Music Grades**	3.94	0.26	5,696	.076
Studio Art: 2-D Design				
AP Grade	2.97	1.08	5,532	-
HSGPA*	3.40	1.55	4,482	-.146
Art and Music Grades**	3.93	0.26	4,311	.076
U.S. History				
AP Grade	2.98	1.22	186,729	-
HSGPA*	2.61	1.29	155,224	-.305
Social Science Grades**	3.74	0.47	140,754	.303
World History				
AP Grade	3.37	1.21	6,644	-
HSGPA*	2.71	1.37	5,427	-.243
Social Science Grades**	3.77	0.44	4,906	.290

*HSGPA is negatively coded (A+ = 1, A = 2, A- = 3, ...D = 11, E/F = 12)
**A = 4, B = 3, C = 2, D = 1, E/F = 0.

and tested for statistical significance. Appendix A presents the results of the full regression analyses. Table 5 summarizes the amount of variability in AP Examination grades accounted for in each model, as well as the increment to R-squared that occurred when PSAT/NMSQT was added. Notice that the best-fitting model for each AP Examination, as indicated by higher R-squared values, was always Model 2—the one that includes PSAT/NMSQT scores. In other words, for each AP Examination, the amount of variability explained by Model 2 was always substantially greater than the amount of variability explained by Model 1. Specifically, the R-squared increments ranged from .19 to .43.

Multiple Regression Analyses: Gender, Ethnic, and Grade-Level Differences

Additional analyses were also conducted to evaluate the extent to which the relationship between PSAT/NMSQT scores and AP Examination grades varied as a function of student characteristics including gender, grade level, and ethnicity for the same subset of 11 AP Examinations. Table 6 shows the correlations between AP Examination grades and the PSAT/NMSQT scores used to compute the expectancy tables by racial/ethnic groups and gender. Refer back to Table 3 for correlations by grade level. All correlations were based on the total sample. In all cases, the strength of the correlations between AP Examination grades and PSAT/NMSQT scores were consistently high across all groups; however, some differences did emerge. With respect to gender, all correlations were slightly higher for female students than for male students. The correlations for racial/ethnic groups were all higher than for white students, with the exception of AP Chemistry, where the correlation for African American students was slightly lower than that of the correlation for white students. In general, however, none of the differences were large in absolute terms across any of the subgroups.

To evaluate whether the incremental validity of PSAT/NMSQT scores in predicting AP Examination grades varied as a function of student characteristics, we again conducted hierarchical multiple linear regression analyses, using the same procedure as described previously. These analyses were conducted using the subsample of students who completed the SAT Questionnaire, and were conducted separately for gender, grade level, and racial/ethnic subgroups. The goal was to evaluate whether the

Table 5

R-Squared and R-Squared Change for Models with and without PSAT/NMSQT Scores

AP Examination	*R-Squared Model 1*	*R-Squared Model 2*	*R-Squared Increment*	*Sample Size*
Biology	.142	.449	.307	68,358
Calculus AB	.062	.303	.241	124,493
Calculus BC	.052	.244	.192	37,153
Chemistry	.095	.370	.275	44,752
English Language	.116	.540	.424	106,710
English Literature	.108	.542	.434	174,182
Government and Politics: United States	.115	.408	.293	75,506
Macroeconomics	.090	.338	.248	28,105
Psychology	.166	.427	.261	38,396
Statistics	.170	.429	.259	40,593
U.S. History	.122	.378	.256	138,237

Note: All results are significant at the .000 alpha level.
Model 1 predictors include cumulative HSGPA and relevant course grades.
Model 2 predictors include cumulative HSGPA, relevant course grades, and PSAT/NMSQT scores.

Table 6

Correlations of PSAT/NMSQT Scores with AP Examination Grades by Racial/Ethnic Groups and Gender

PSAT/NMSQT Index	*AP Examination*	*African American*	*Asian American*	*Hispanic*	*White*	*Female*	*Male*
Math	Calculus AB	.555 (9,045)	.522 (33,096)	.552 (13,375)	.492 (162,029)	.536 (114,196)	.509 (114,644)
	Calculus BC	.556 (1,352)	.482 (16,163)	.538 (2,314)	.459 (42,802)	.492 (27,382)	.463 (38,955)
	Chemistry	.561 (2,905)	.597 (15,607)	.577 (3,751)	.570 (50,359)	.601 (36,458)	.572 (40,207)
V+M	Biology	.664 (5,845)	.651 (20,607)	.667 (6,764)	.623 (80,101)	.665 (73,376)	.624 (46,955)
	Macroeconomics	.585 (1,639)	.528 (9,669)	.596 (4,422)	.524 (31,956)	.575 (23,274)	.538 (27,497)
	Statistics	.601 (2,929)	.625 (12,231)	.632 (3,747)	.592 (50,493)	.610 (38,175)	.608 (35,088)
V+W	English Language	.726 (10,317)	.742 (21,539)	.755 (16,300)	.691 (129,380)	.741 (118,966)	.716 (69,103)
	English Literature	.726 (16,929)	.742 (34,758)	.753 (22,002)	.692 (232,670)	.739 (207,552)	.710 (116,425)
V+M+W	Government and Politics: United States	.629 (6,035)	.633 (17,832)	.657 (11,062)	.573 (92,309)	.640 (71,807)	.591 (63,128)
	Psychology	.641 (4,219)	.621 (9,472)	.651 (4,177)	.590 (51,817)	.633 (48,780)	.610 (24,907)
	U.S. History	.603 (12,356)	.627 (29,556)	.623 (15,350)	.557 (161,274)	.618 (130,098)	.579 (101,640)

Note: Sample sizes in parentheses.

incremental validity of PSAT/NMSQT scores to predict AP Examination grades over and above cumulative HSGPA and relevant course grades varied by gender, grade level, and racial/ethnic groups. Tables 7 and 8 display the R-squared increments of the PSAT/NMSQT by student characteristics. Differences in these R-squared increments were tested for statistical significance using a procedure that is explained in detail in Appendix B. For the group differences with regard to gender, the results showed that all differences were statistically significant except for AP Statistics and, in all cases, female students had the higher R-squared increments than male students. These results are consistent with findings that correlations between high school grades or admissions test scores with

Table 7

R-Squared Increments for PSAT/NMSQT by Gender and Grade Level

PSAT/NMSQT Index	*AP Examination*	*Gender*		*Class Status*	
		Female	*Male*	*Sophomore*	*Junior*
Math	Calculus AB	.237*	.220	.238	.241
	Calculus BC	.194*	.169	.187	.194
	Chemistry	.274*	.234	.290	.294
V+M	Biology	.307*	.276	.313	.332*
	Macroeconomics	.241*	.218	.262	.253
	Statistics	.249	.245	.284	.273
V+W	English Language	.429*	.409	.428	.421
	English Literature	.444*	.419	.467*	.433
V+M+W	Government and Politics: United States	.292*	.270	.297	.298
	Psychology	.268*	.246	.242	.281*
	U.S. History	.260*	.236	.261	.250

*Gender difference or class-status difference was significant at $p \leq .05$.

Table 8

R-Squared Increments for PSAT/NMSQT by Ethnicity

PSAT/NMSQT Index	*AP Examination*	*African American*	*Asian American*	*Hispanic*	*White*
Math	Calculus AB*	.241	.229	.244	.212
	Calculus BC*	.249	.186	.229	.171
	Chemistry	.252	.271	.250	.256
V+M	Biology*	.312	.300	.330	.284
	Macroeconomics*	.290	.213	.263	.209
	Statistics	.273	.248	.285	.243
V+W	English Language*	.428	.434	.454	.399
	English Literature*	.439	.446	.450	.407
V+M+W	Government and Politics: United States*	.283	.280	.335	.252
	Psychology*	.288	.253	.308	.239
	U.S. History*	.270	.274	.275	.229

*Omnibus difference was significant at $p \leq .05$.

college grades are consistently higher for female students than for male students (Willingham and Cole, 1997). With regard to grade level, the only significant differences that were found were for AP English Literature, Biology, and Psychology. In the case of Biology and Psychology, juniors had the higher increments, whereas sophomores had the higher increment for English Literature.

For the group differences with regard to ethnicity, which compared R-squared increments for African American, Asian American, Hispanic, and white students, significant differences between at least one of the four groups were found on all tests except for AP Statistics and AP Chemistry. Because four student groups were being compared, additional analyses were conducted to determine which groups differed. For five AP Examinations (i.e., Biology, Calculus AB, English Language, English Literature, and U.S. History), the same pattern emerged. That is, white students had significantly lower R-squared increments than Asian American, African American, and Hispanic students, and the R-squared increments for these three groups did not differ significantly from each other. For AP U.S. Government, the R-squared increments for Asian American students and African American students did not differ, but the R-squared increments for all other groups did differ. For AP Calculus BC, the R-squared increments for Hispanic students and Asian American students did not differ, although the R-squared increments for all other groups did. For AP Psychology, the R-squared increments for Hispanic students differed from the R-squared increments for the other three groups, but the R-squared increments for African American, Asian American, and white students did not differ from each other. Finally, for AP Macroeconomics, the R-squared increments for Asian American and white students did not differ, nor did the R-squared increments for African American and Hispanic students, but the R-squared increments for Asian American and white students did differ from the R-squared increments for African American and Hispanic students.

In summary, while statistically significant differences were found among the R-squared increments, the differences were generally not large. Coupled with the results from the correlations, these findings suggest that the relationship between PSAT/NMSQT scores and AP Examination grades, as well as the incremental validity of the PSAT/NMSQT in predicting AP Examination grades, is fairly consistent across various student characteristics. When statistically significant differences were found between R-squared increments, the R-squared increments for the white students were the lowest among the four ethnic groups in each instance. These results differ from studies comparing the relationship of high school grades and admissions tests with college performance, which generally show stronger relationships for white students than Hispanic or African American students (Camara and Echternacht, 2000). This study demonstrates that PSAT/NMSQT scores are as strong or even stronger predictors of AP Examination performance for minority students than they are for white students. Differences in the population of students taking AP Examinations may be partially responsible for these inconsistent findings.

Computing Expectancy Tables

For the 29 AP Examinations that exhibited a moderate to high correlation with AP Examination grades, expectancy tables were computed showing the percentage of test-takers earning a 3 or better, and a 4 or better, on AP Examinations across the range of PSAT/NMSQT scores. The data used for these analyses included all sophomores and juniors who took the PSAT/NMSQT in October

of 2000 or 2001 and completed an AP Examination 19 months later. The expectancy tables are presented in Tables 9 through 13, and are organized according to the PSAT/NMSQT scale that was selected to compute the table. As noted earlier, in 18 of 29 instances, the PSAT/NMSQT scale with the highest correlation with AP Examination grades was selected. In 11 instances, however, a scale other than the one with the highest correlation was selected. This slight loss in prediction was offset by the desire to maintain consistency among PSAT/NMSQT scales employed for similar AP subjects (e.g., math, sciences, and social sciences) and/or to improve the stability of the expectancy data.

To develop each expectancy table, the selected PSAT/NMSQT scale was divided into 5-point or 10-point score ranges. Five-point score ranges were used when one or two PSAT/NMSQT scales were used, and resulted in 12 or 24 score intervals, respectively. When all three PSAT/NMSQT scales were used, 10-point score ranges were used in order to provide sufficient power at each range and to avoid overinterpretation of minor differences. Eighteen score intervals resulted when three PSAT/NMSQT scales were used, which provides sufficient discrimination for the purposes of this study. For each score range, the percentages of test-takers earning a 3 or better, and a 4 or better, were then calculated. For example, consider AP Chemistry (see Table 9). The table shows that 50 percent of students who earned a PSAT/NMSQT math score between the range of 56 and 60 also earned a 3 or better on the AP Chemistry Examination. This percentage, as well as the other resulting percentages, may be interpreted as probabilities, or success rates, for how future students are likely to perform on AP Examinations given the same PSAT/NMSQT score range.

There are two important points to make about the computation of these expectancy tables. First, if the number of AP students falling within the PSAT/NMSQT score interval was less than 20, or if only two students or fewer within a given interval earned a 3 or better, or a 4 or better, percentages were not reported. Second, in a few cases, the computations yielded percentages that were unstable, particularly at the very low end of the PSAT/NMSQT scale, in that the percentages did not always increase as PSAT/NMSQT scores increased. This result is relatively common with the empirical approach used in this study, especially when the number of students per interval is small. To help address this issue, 10-point PSAT/NMSQT score intervals were used when all three PSAT/NMSQT scales were used to compute the expectancy table in order to increase the number of students per interval. In addition, AP Potential (College Board, 2005), the online tool that uses these expectancy tables as the basis for helping educators identify students for AP course work, reports percentages only once an increasing trend has stabilized.

Using Expectancy Tables

The expectancy tables are designed to assist educators in identifying potential students who may be successful in AP courses. Educators may also use AP Potential, which is based on this research and provided free to schools that administer the PSAT/NMSQT (see College Board, 2005, for demonstration). In using these tables or AP Potential, educators would first select the appropriate AP Examination and then determine the probability of success (or success rate) that they feel is appropriate for their school.[10] As discussed in previous research (Camara and Millsap, 1998), there should be no absolute rules for selecting the appropriate success rate. Although a reasonable starting point may be to select the probability level that is closest to 50 percent for earning an AP Examination grade of 3 or better, schools may wish to adjust that level up or down depending on their school's AP program.

To better understand how to use the expectancy tables, consider the following example based on the expectancy table for AP English Literature (see Table 12). The first step is to identify the score range that comes closest to a 50 percent success rate. A score range on V+W of 101–105 indicates that 45.4 percent of students have attained an AP Examination grade of 3 or higher on the AP English Literature Examination. A counselor might begin by identifying all students who have combined V+W scores of 101 or above as a starting point when considering placement decisions in this course. Similarly, if a student or parent expresses interest in AP English Literature, the table can also be used to look up the student's expected success rate to help make a more informed decision. In this example, it is important to understand that not every student with a combined V+W score of 101 or higher will achieve a grade of 3 or higher on the AP English Literature Examination. Similarly, the table does not mean that all students with a V+W score below 101 will earn an AP Examination grade of 1 or 2. The expectancy tables provide probabilistic statements that describe the likely outcome on each AP Examination given performance on the relevant PSAT/NMSQT scales.

While counselors and teachers may use the expectancy tables in many ways to have an additional indicator of the likelihood of success in AP, the tables cannot be used as the only source of information or as an absolute standard or minimum requirement. Student interest and motivation are important aspects for success in any course, and these are likely to be more important for rigorous college-level courses, such as AP, where a highly motivated student with average ability in a subject may be more successful than a disinterested student

[10] In AP Potential, the success rates that users may select from correspond to earning an AP Examination grade of 3 or better.

Table 9

AP Examinations Using PSAT/NMSQT Math Scores

PSAT/NMSQT M Score	AP Grade ≥3	AP Grade ≥4	n
Calculus AB			
80–76	96.4	86.4	4,401
75–71	94.0	78.6	14,339
70–66	87.8	65.1	42,992
65–61	77.1	48.2	64,237
60–56	61.9	31.2	49,616
55–51	45.8	18.1	30,170
50–46	29.1	9.0	15,791
45–41	17.7	3.9	5,113
40–36	8.1	1.5	1,626
35–31	3.6	0.8	521
30–26	3.4	-	87
25–20	-	-	29
Total	-	-	228,922
Calculus BC			
80–76	97.1	87.7	6,847
75–71	94.0	79.3	12,552
70–66	87.6	65.5	19,864
65–61	77.9	48.2	15,933
60–56	62.8	32.0	6,989
55–51	46.0	18.0	2,787
50–46	30.9	9.1	1,061
45–41	15.7	3.5	255
40–36	12.7	4.8	63
35–31	-	-	14
30–26	-	-	3
25–20	-	-	2
Total	-	-	66,370
Chemistry			
80–76	96.6	84.3	3,570
75–71	91.7	72.2	6,565
70–66	82.8	56.3	13,685
65–61	69.0	37.4	18,391
60–56	50.0	20.9	14,468
55–51	34.6	11.1	9,922
50–46	19.6	4.8	6,262
45–41	11.1	2.0	2,506
40–36	4.2	0.6	924
35–31	1.9	-	313
30–26	-	-	70
25–20	-	-	28
Total	-	-	76,704
Computer Science A			
80–76	92.5	81.3	678
75–71	87.1	73.9	1,309
70–66	81.6	62.5	2,919
65–61	70.5	49.4	3,849
60–56	56.0	33.4	2,978
55–51	42.1	20.7	2,150
50–46	26.6	11.6	1,322
45–41	16.6	6.2	531
40–36	5.8	1.9	208
35–31	-	-	63
30–26	-	-	11
25–20	-	-	2
Total	-	-	16,020

PSAT/NMSQT M Score	AP Grade ≥3	AP Grade ≥4	n
Computer Science AB			
80–76	92.4	78.0	1,018
75–71	89.1	67.5	1,419
70–66	82.9	56.3	2,290
65–61	72.9	40.1	2,034
60–56	58.9	27.4	1,176
55–51	43.8	15.4	609
50–46	34.9	10.2	235
45–41	21.3	-	61
40–36	-	-	19
35–31	-	-	4
30–26	-	-	0
25–20	-	-	1
Total	-	-	8,866
Music Theory			
80–76	96.6	84.8	322
75–71	91.4	72.8	537
70–66	88.0	65.3	1,157
65–61	80.9	51.9	1,723
60–56	74.9	42.8	1,580
55–51	63.3	31.9	1,246
50–46	50.0	19.8	1,006
45–41	41.5	14.0	501
40–36	29.2	9.7	195
35–31	15.1	2.2	93
30–26	-	-	16
25–20	-	-	6
Total	-	-	8,382
Physics B			
80–76	93.0	74.7	2,351
75–71	88.6	63.5	5,108
70–66	80.0	47.3	10,850
65–61	66.1	30.1	13,611
60–56	49.5	16.6	9,687
55–51	33.4	7.6	5,786
50–46	18.6	3.3	3,109
45–41	9.2	0.9	927
40–36	2.0	-	342
35–31	-	-	111
30–26	-	-	27
25–20	-	-	6
Total	-	-	51,915
Physics C: Electricity and Magnetism			
80–76	88.0	79.4	2,667
75–71	79.8	67.0	3,402
70–66	68.1	53.1	4,438
65–61	53.7	37.3	3,047
60–56	38.8	23.5	1,174
55–51	21.7	11.6	456
50–46	11.6	5.4	129
45–41	5.4	-	37
40–36	-	-	11
35–31	-	-	4
30–26	-	-	1
25–20	-	-	0
Total	-	-	15,366

Table 9 (continued)

AP Examinations Using PSAT/NMSQT Math Scores

PSAT/NMSQT M Score	*AP Grade*		
	≥3	*≥4*	*n*
Physics C: Mechanics			
80–76	95.3	85.6	3,843
75–71	90.1	73.4	5,637
70–66	81.2	56.1	8,318
65–61	66.2	36.9	6,907
60–56	45.1	19.3	3,267
55–51	26.2	9.0	1,526
50–46	11.0	3.7	619
45–41	4.4	1.7	181
40–36	-	-	77
35–31	-	-	37
30–26	-	-	6
25–20	-	-	3
Total	-	-	30,421

who has higher test scores. In addition, counselors still must determine if prospective students have completed prerequisite courses and demonstrated success in a subject area before concluding that a student with high test scores will be successful in a particular AP course.

Many factors will ultimately determine a student's success in a rigorous course. Counselors and teachers often rely on many different indicators in making placement decisions for AP courses, such as previous courses completed, grades in those courses, teacher recommendations, student and parent requests, student motivation and interest, and additional course load. Each of these factors may be important in determining the ultimate success of students in any rigorous course. PSAT/NMSQT scores can supplement existing procedures and provide standardized and objective information. This study and previous research (Camara and Millsap, 1998) demonstrate that PSAT/NMSQT scores are significantly more informative for such placement decisions than a

Table 10

AP Examinations Using PSAT/NMSQT Writing Scores

PSAT/NMSQT W Score	*AP Grade*		
	≥3	*≥4*	*n*
French Literature			
80–76	95.9	81.1	418
75–71	86.1	66.4	452
70–66	78.8	50.0	504
65–61	65.6	37.2	366
60–56	57.0	27.8	291
55–51	46.5	22.4	241
50–46	32.8	20.3	128
45–41	29.3	13.8	58
40–36	30.6	22.2	36
35–31	-	-	5
30–26	-	-	1
25–20	-	-	0
Total	-	-	2,500
Latin Literature			
80–76	89.1	67.9	358
75–71	81.1	55.3	533
70–66	73.8	44.1	848
65–61	62.0	32.7	707
60–56	52.1	25.5	652
55–51	35.1	14.7	619
50–46	27.9	8.6	280
45–41	12.8	5.5	109
40–36	8.0	-	50
35–31	-	-	3
30–26	-	-	2
25–20	-	-	0
Total	-	-	4,161

PSAT/NMSQT W Score	*AP Grade*		
	≥3	*≥4*	*n*
Latin: Vergil			
80–76	90.7	72.1	484
75–71	86.9	60.5	701
70–66	75.2	45.6	1,109
65–61	69.4	34.7	919
60–56	57.9	25.9	791
55–51	45.6	18.5	790
50–46	35.4	14.7	429
45–41	19.2	7.1	156
40–36	10.9	-	46
35–31	-	-	12
30–26	-	-	0
25–20	-	-	0
Total	-	-	5,437
Spanish Literature			
80–76	95.3	79.5	464
75–71	91.7	69.0	617
70–66	87.2	57.7	999
65–61	82.3	50.5	820
60–56	80.5	47.0	875
55–51	77.9	44.9	1,125
50–46	70.6	34.1	1,216
45–41	64.7	24.3	1,265
40–36	54.8	19.1	1,280
35–31	49.6	14.0	470
30–26	42.4	8.5	118
25–20	-	-	1
Total	-	-	9,250

Table 11

AP Examinations Using PSAT/NMSQT Verbal and Math Scores

PSAT/NMSQT V+M Score	*AP Grade* ≥3	≥4	*n*
Biology			
160–156	99.6	96.9	482
155–151	99.4	95.8	1,191
150–146	98.3	92.1	1,951
145–141	98.4	89.1	3,400
140–136	96.4	83.9	5,091
135–131	94.5	78.2	7,562
130–126	90.6	68.3	10,205
125–121	85.3	57.9	12,536
120–116	77.4	46.9	13,941
115–111	69.0	37.0	14,059
110–106	58.9	26.6	13,457
105–101	46.3	18.1	11,506
100–96	34.8	11.2	8,676
95–91	24.4	6.8	6,266
90–86	16.1	3.8	4,228
85–81	9.1	2.5	2,607
80–76	5.6	1.4	1,578
75–71	3.1	0.5	836
70–66	3.4	0.5	435
65–61	-	-	206
60–56	-	-	102
55–51	-	-	53
50–46	-	-	18
45–40	-	-	2
Total	-	-	120,388
Environmental Science			
160–156	100.0	100.0	49
155–151	98.0	95.4	151
150–146	97.0	93.3	269
145–141	97.0	89.1	598
140–136	95.2	84.4	976
135–131	91.1	78.2	1,619
130–126	86.5	66.7	2,445
125–121	80.8	58.2	3,247
120–116	74.8	48.1	3,808
115–111	64.1	38.0	4,205
110–106	53.9	28.4	4,274
105–101	40.7	17.8	3,917
100–96	30.6	10.9	3,193
95–91	22.9	8.3	2,408
90–86	15.7	4.6	1,770
85–81	8.1	1.7	1,116
80–76	6.0	0.8	732
75–71	3.1	-	445
70–66	1.8	-	223
65–61	-	-	121
60–56	-	-	53
55–51	-	-	36
50–46	-	-	16
45–40	-	-	8
Total	-	-	35,679

PSAT/NMSQT V+M Score	*AP Grade* ≥3	≥4	*n*
Government and Politics: Comparative			
160–156	100.0	80.0	130
155–151	97.0	74.1	232
150–146	92.4	67.8	450
145–141	92.9	62.7	678
140–136	89.8	58.0	1,051
135–131	85.6	50.2	1,322
130–126	79.7	40.0	1,626
125–121	74.4	33.9	1,808
120–116	66.2	26.5	1,722
115–111	58.6	20.5	1,610
110–106	51.8	14.4	1,302
105–101	42.4	10.4	967
100–96	34.1	6.5	750
95–91	26.4	4.3	440
90–86	23.5	3.2	281
85–81	17.1	1.2	170
80–76	9.1	1.8	110
75–71	12.9	-	62
70–66	6.5	-	31
65–61	-	-	9
60–56	-	-	7
55–51	-	-	1
50–46	-	-	0
45–40	-	-	0
Total	-	-	14,759
Human Geography			
160–156	-	-	11
155–151	98.0	98.0	49
150–146	98.3	93.2	59
145–141	98.1	83.2	107
140–136	96.6	83.9	174
135–131	93.1	81.5	259
130–126	94.3	76.1	348
125–121	90.6	66.9	405
120–116	85.1	59.0	556
115–111	79.4	50.0	528
110–106	69.8	34.7	487
105–101	63.3	28.6	469
100–96	52.5	19.1	362
95–91	47.2	18.3	284
90–86	32.3	8.6	220
85–81	19.5	6.3	128
80–76	18.5	4.6	65
75–71	12.2	-	49
70–66	-	-	18
65–61	-	-	13
60–56	-	-	6
55–51	-	-	1
50–46	-	-	2
45–40	-	-	0
Total	-	-	4,600

Table 11 (continued)

AP Examinations Using PSAT/NMSQT Verbal and Math Scores

PSAT/NMSQT V+M Score	AP Grade ≥3	AP Grade ≥4	n
Macroeconomics			
160–156	98.0	91.9	396
155–151	95.4	87.5	920
150–146	92.6	81.0	1,395
145–141	89.5	76.8	2,267
140–136	87.1	71.2	3,328
135–131	83.2	64.4	4,334
130–126	75.7	55.2	5,407
125–121	69.6	46.6	5,918
120–116	62.4	38.9	5,954
115–111	54.6	30.8	5,429
110–106	45.5	23.7	4,554
105–101	37.1	16.7	3,598
100–96	28.2	12.7	2,592
95–91	21.8	8.7	1,836
90–86	14.3	4.8	1,197
85–81	7.0	1.9	689
80–76	7.0	2.6	469
75–71	3.5	1.9	260
70–66	3.3	-	120
65–61	-	-	70
60–56	-	-	35
55–51	-	-	10
50–46	-	-	10
45–40	-	-	3
Total	-	-	50,791
Microeconomics			
160–156	97.7	87.3	306
155–151	95.7	85.4	697
150–146	92.1	80.1	1,040
145–141	90.4	74.1	1,656
140–136	88.2	70.0	2,366
135–131	83.6	63.3	3,169
130–126	78.5	55.4	3,852
125–121	72.4	46.8	4,089
120–116	65.3	37.9	4,044
115–111	57.6	30.6	3,632
110–106	51.4	24.7	3,073
105–101	41.8	17.6	2,424
100–96	31.3	12.2	1,641
95–91	24.1	8.4	1,171
90–86	17.9	5.6	711
85–81	10.0	2.5	402
80–76	10.7	1.7	234
75–71	5.3	-	132
70–66	3.1	-	64
65–61	-	-	37
60–56	-	-	15
55–51	-	-	10
50–46	-	-	3
45–40	-	-	1
Total	-	-	34,769

PSAT/NMSQT V+M Score	AP Grade ≥3	AP Grade ≥4	n
Statistics			
160–156	99.7	95.1	346
155–151	98.7	92.7	855
150–146	97.0	88.9	1,409
145–141	95.9	82.5	2,386
140–136	93.2	74.2	3,661
135–131	89.2	66.4	5,105
130–126	82.9	55.9	6,967
125–121	77.1	45.7	8,098
120–116	68.5	35.1	8,967
115–111	58.2	26.1	9,014
110–106	48.2	17.9	8,215
105–101	38.0	11.5	6,637
100–96	27.0	6.8	4,662
95–91	19.4	4.3	3,073
90–86	12.1	2.0	1,836
85–81	7.6	1.4	997
80–76	5.5	0.9	560
75–71	3.8	-	263
70–66	1.5	-	132
65–61	-	-	66
60–56	-	-	25
55–51	-	-	9
50–46	-	-	4
45–40	-	-	5
Total	-	-	73,292
World History			
160–156	100.0	95.1	41
155–151	100.0	92.6	68
150–146	98.4	93.0	128
145–141	97.3	84.4	225
140–136	97.4	86.2	341
135–131	94.0	77.6	504
130–126	93.8	71.5	662
125–121	89.3	61.3	783
120–116	82.3	53.1	892
115–111	78.3	42.5	915
110–106	71.2	34.4	875
105–101	64.5	29.5	733
100–96	57.9	22.1	598
95–91	46.6	14.2	429
90–86	40.4	10.1	287
85–81	31.9	9.8	235
80–76	21.8	3.2	124
75–71	11.3	-	71
70–66	7.5	-	40
65–61	-	-	17
60–56	-	-	12
55–51	-	-	7
50–46	-	-	2
45–40	-	-	1
Total	-	-	7,990

Table 12

AP Examinations Using PSAT/NMSQT Verbal and Writing Scores

PSAT/NMSQT V+W Score	*AP Grade* ≥3	≥4	*n*
Art History			
160–156	99.4	94.3	174
155–151	98.9	87.2	274
150–146	97.6	84.7	380
145–141	97.1	80.8	548
140–136	95.2	73.3	778
135–131	93.1	67.5	1,044
130–126	91.3	59.6	1,239
125–121	88.3	57.8	1,388
120–116	83.9	48.0	1,464
115–111	81.2	41.2	1,592
110–106	73.9	33.7	1,607
105–101	65.9	26.5	1,436
100–96	57.7	20.7	1,215
95–91	50.6	14.9	1,003
90–86	38.3	9.8	728
85–81	33.2	6.7	521
80–76	27.7	3.2	314
75–71	13.6	3.1	191
70–66	9.8	2.9	102
65–61	16.2	-	37
60–56	-	-	15
55–51	-	-	4
50–46	-	-	1
45–40	-	-	0
Total	-	-	16,055
English Language			
160–156	99.7	96.8	692
155–151	99.8	95.6	1,316
150–146	99.6	92.5	2,495
145–141	99.5	90.7	3,996
140–136	98.9	84.5	6,147
135–131	98.3	77.6	9,274
130–126	96.6	68.0	12,203
125–121	94.5	57.2	15,280
120–116	90.1	45.0	17,930
115–111	82.9	32.2	20,126
110–106	72.7	21.2	20,879
105–101	60.1	12.2	20,372
100–96	45.5	6.5	17,386
95–91	30.1	2.8	14,141
90–86	19.3	1.3	10,303
85–81	9.7	0.3	6,996
80–76	5.0	0.1	4,307
75–71	2.8	0.2	2,343
70–66	0.7	-	1,189
65–61	0.8	-	530
60–56	1.4	-	207
55–51	-	-	78
50–46	-	-	10
45–40	-	-	0
Total	-	-	188,200

PSAT/NMSQT V+W Score	*AP Grade* ≥3	≥4	*n*
English Literature			
160–156	99.9	97.1	2,906
155–151	99.5	94.8	4,957
150–146	99.4	91.6	8,364
145–141	99.0	85.3	12,702
140–136	97.9	77.3	17,329
135–131	96.2	66.9	23,674
130–126	93.3	54.7	28,556
125–121	88.7	42.2	33,126
120–116	81.8	30.1	35,214
115–111	71.8	19.7	35,025
110–106	60.0	11.7	32,604
105–101	45.4	6.1	27,940
100–96	31.7	2.8	21,418
95–91	19.6	1.3	15,565
90–86	10.6	0.4	10,454
85–81	5.9	0.3	6,666
80–76	2.4	0.1	3,853
75–71	1.1	-	2,086
70–66	0.8	-	1,035
65–61	0.5	-	428
60–56	-	-	175
55–51	-	-	63
50–46	-	-	11
45–40	-	-	0
Total	-	-	324,151

student's HSGPA, grades in prior courses, and even the number of additional courses in a subject area a student has completed. PSAT/NMSQT scores account for between two and three times as much variation in AP Examination grades as HSGPA and relevant course grades. However, these factors remain important and should be used in combination with PSAT/NMSQT scores, student interest, and other factors in making final placement decisions. Certainly, a student who is not interested in AP Music Theory is not likely to be successful in such a course irrespective of PSAT/NMSQT scores. Similarly, a student who has not completed prerequisite courses in a foreign language or other discipline will likely be unprepared to succeed in advanced courses despite high test scores. In 1998, Camara and Millsap explained how this research could be appropriately used to inform sound educational decisions, and these recommendations are just as relevant today:

> "PSAT/NMSQT scores should never be used as the sole or even the primary indicator. Schools should not establish minimum 'cut scores' on the PSAT/NMSQT or any other assessment for placing students into AP courses—such practices are a clear misuse of assessment scores. Faculty and counselors should be cautious in using these tables." (p. 17)

Table 13

AP Examinations Using PSAT/NMSQT Verbal and Math and Writing Scores

PSAT/NMSQT V+M+W Score	*AP Grade* ≥3	≥4	*n*
European History			
240–231	99.2	94.5	365
230–221	99.4	90.0	1,132
220–211	98.4	83.1	2,358
210–201	96.9	73.1	3,836
200–191	94.2	63.4	5,522
190–181	89.1	49.2	6,915
180–171	83.1	37.5	7,377
170–161	73.7	26.7	6,819
160–151	63.3	17.7	5,414
150–141	51.6	11.5	3,720
140–131	37.7	6.1	2,028
130–121	24.5	2.8	967
120–111	15.7	1.6	369
110–101	7.6	-	144
100–91	6.4	-	47
90–81	-	-	10
80–71	-	-	4
70–60	-	-	0
Total	-	-	47,027
Government and Politics: United States			
240–231	99.0	87.4	792
230–221	97.5	80.4	2,628
220–211	93.8	71.1	5,714
210–201	90.3	61.0	9,623
200–191	83.7	48.2	14,276
190–181	75.9	36.5	18,636
180–171	64.4	25.8	20,779
170–161	51.5	16.3	20,059
160–151	37.3	9.2	16,582
150–141	24.5	4.6	11,655
140–131	12.9	1.7	7,215
130–121	6.6	0.6	4,007
120–111	2.7	0.1	1,903
110–101	1.6	-	773
100–91	0.7	-	278
90–81	3.2	-	62
80–71	-	-	13
70–60	-	-	1
Total	-	-	134,996

PSAT/NMSQT V+M+W Score	*AP Grade* ≥3	≥4	*n*
Psychology			
240–231	100.0	98.3	242
230–221	99.8	97.5	837
220–211	99.0	93.7	1,939
210–201	98.5	90.2	3,762
200–191	96.3	84.0	5,880
190–181	93.8	75.1	8,630
180–171	88.4	63.4	10,541
170–161	80.5	50.8	11,642
160–151	69.7	37.8	10,561
150–141	55.8	25.2	8,455
140–131	39.8	14.7	5,745
130–121	25.9	7.3	3,120
120–111	14.0	3.6	1,513
110–101	7.9	1.2	604
100–91	2.2	0.0	186
90–81	3.7	3.7	54
80–71	-	-	9
70–60	-	-	0
Total	-	-	73,720
U.S. History			
240–231	99.3	94.0	417
230–221	97.7	91.5	1,687
220–211	96.5	84.4	4,352
210–201	93.8	77.7	8,944
200–191	89.1	67.7	16,320
190–181	82.9	56.5	25,242
180–171	73.7	43.6	33,039
170–161	61.0	31.5	38,104
160–151	47.7	20.5	36,216
150–141	34.2	12.2	28,803
140–131	23.3	7.2	19,169
130–121	12.9	3.2	10,967
120–111	7.0	1.4	5,399
110–101	3.1	0.8	2,242
100–91	1.6	-	770
90–81	2.1	-	188
80–71	-	-	30
70–60	-	-	0
Total	-	-	231,889

This study was based on the entire population of students who completed the PSAT/NMSQT and subsequently completed one or more AP Examinations across two cohorts—more than 1 million students. However, there are more students who completed the PSAT/NMSQT who did not enroll in AP courses or chose not to complete an AP Examination if they did enroll in an AP course. It is not possible to know exactly how these groups of students differ from study participants in ways that could impact predicted performance on AP Examinations. We do know, however, that students in this study earned higher PSAT/NMSQT scores than all sophomores and juniors who took the PSAT/NMSQT in 2000 and 2001. It is fair to say then that the expectancy tables presented in this report are based on rather motivated students who performed, on average, better than all sophomore and junior PSAT/NMSQT test-takers. Because the expectancy tables are based on students completing AP Examinations, the tables do not necessarily represent the general high school population; however, it is apparent that the population of students completing the PSAT/NMSQT and AP assessments in this study is nearly 50 percent larger than the group of students examined by Camara and Millsap (1998) and comprise a much greater and more representative group of college-bound tenth- and eleventh-graders.

Determining Whether AP Courses Can Be Offered in a School

The expectancy tables can also be useful for schools considering introducing AP courses or expanding the number of sections offered for an existing AP course. Schools can quickly identify the number of students who may be successful in various AP courses if those courses were offered or enrollment was expanded. To do so, schools would first determine the appropriate success rate for their school and for the particular AP Examination. As mentioned, some schools may employ a 50 percent success rate, while other schools may prefer a lower or higher success rate. Using the expectancy tables or AP Potential, schools would then be able to generate potential class rosters and see the number of students who have a certain probability level of being successful on the corresponding AP Examination. Of course, schools would still need to verify that the identified students meet other requirements for enrollment.

Conclusion

This study is a replication and extension of two earlier studies (Camara and Millsap, 1998; Haag, 1983) that examined the relationship between PSAT/NMSQT test scores and AP Examination grades. Results of this study showed that PSAT/NMSQT scores of sophomores and juniors were moderately to highly correlated with subsequent grades on 29 AP Examinations. The median correlation between the PSAT/NMSQT scale selected to build the expectancy table and AP Examination grades was .57 and the average correlation was .56, with correlations for 20 of the 29 AP Examinations above .50. Sample sizes ranged from 2,500 students in AP French Literature to 324,151 students in AP English Literature. Of the 25 AP Examinations included in Camara and Millsap (1998), 18 had more than twice as many students in the sample for this study, using more restrictive conditions, and 11 of those had more than three times as many students. In comparison to the 1998 study, the total sample in this study increased by nearly 50 percent and the correlations with test scores increased for 19 of the 25 AP Examinations. The current study also confirms findings from the earlier study that PSAT/NMSQT scores were not useful in predicting AP Examination grades on four examinations (German Language, Spanish Language, Studio Art: Drawing, and Studio Art: 2-D Design) and have a weaker predictive relationship with foreign language exams. This latter finding may be partially attributed to the large proportion of students who acquire language skills at home or outside the classroom. However, test scores from the PSAT/NMSQT were strong predictors for four AP Examinations added since the 1998 study (Environmental Science, Human Geography, Statistics, and World History).

The larger number of students completing 11 AP Examinations also permitted the comparison of variance-explained statistics for PSAT/NMSQT scores in predicting AP Examination grades over and above HSGPA and high school grades in the relevant subject areas. In each instance, the increment added by PSAT/NMSQT test scores far exceeded the variance accounted for by HSGPA and relevant course grades. In 9 of 11 comparisons, test scores from the PSAT/NMSQT accounted for more than twice the variance contributed by grades. This may not be unusual given that students who are successfully completing AP Examinations generally have extremely high grades. Increased grade inflation and the lack of variance in HSGPA, particularly among students in the top 25 percent of their class, severely limit the predictive power of grades among top performers (Camara and Kimmel, 2003). Similarly, other research studies involving college admissions tests have demonstrated that SAT and ACT scores may have slightly greater validity than high school grades in predicting college performance among students with the highest grades in college (Kobrin and Robert, 2005; Noble and Sawyer, 2002).

The relationship between PSAT/NMSQT scores and AP Examination grades remains strong and consistent

across sophomore and junior PSAT/NMSQT test-takers, gender, and ethnic groups. Generally, correlations between PSAT/NMSQT test scores and AP Examination grades were slightly higher and account for more variance among female students and minority students. The finding that test scores were slightly better predictors of AP Examination grades for minority students runs counter to research on admissions testing that consistently demonstrates that both grades and test scores are better predictors for white students than underrepresented minority students. One possible explanation for this difference could lie in the criteria. In this study, the criteria are AP Examination grades, which are a standardized measure, whereas the criteria in admissions studies are freshman grades, which differ markedly by institution and courses taken.

This study provides additional validation evidence for the use of PSAT/NMSQT scores in predicting success on AP Examinations. Despite the stronger relationships between PSAT/NMSQT test scores and AP Examination grades, a larger and more representative population of students in this study, and the consistent finding that the PSAT/NMSQT is the most powerful predictor examined to date of success on AP Examinations, the expectancy tables or related AP Potential tool should not be used alone to determine placement in AP courses. Many factors, including student motivation and interest, student persistence and willingness to put in extra effort, performance in prerequisite courses, and teacher recommendations, should always be considered in making such placement decisions.

The results from this study and AP Potential can be useful in identifying students who are likely to be successful in AP and other rigorous courses. For example, for many AP Examinations, students with scores in the middle of the distribution on the PSAT/NMSQT have an excellent chance of succeeding in many AP courses, and their probability of success could increase given motivation and interest in the subject area. This study provides further evidence that the placement of only the highest ability students into rigorous courses, such as AP, is without merit. A much larger proportion of students are likely to be successful in many AP courses if identified early and given the opportunity and support needed to succeed.

The results also show that a significant group of students have a less-than-break-even chance of succeeding on many AP Examinations today, but many of these students can and will succeed in AP courses because of factors that cannot be measured by tests, grades, or past performance. The high school years are a period of transition and growth for students. Given the opportunity, many students will develop a passion for an activity or subject and, thus, entry into AP courses for highly motivated students should not be denied based on past test scores or grades. On the contrary, more effort should be placed on preparing students for rigorous advanced courses to ensure greater success and access for students in all schools.

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Appendix A:
Linear Regressions of PSAT/NMSQT Score, Cumulative HSGPA, and Course Grades in Predicting AP Examination Grades

Predictor	*B*	*SE B*	*BETA*	*T*	*Sig. T*
AP Biology					
Model 1					
HSGPA*	-.230	.004	-.226	-52.028	.000
Grades in Natural Science**	.532	.012	.197	45.258	.000
Constant	1.784	.051		34.678	.000
Model 2					
HSGPA*	-.059	.004	-.058	-16.233	.000
Grades in Natural Science**	.302	.009	.112	31.814	.000
PSAT/NMSQT VM	.046	.000	.599	194.979	.000
Constant	-3.090	.048		-64.065	.000
R-Squared Change	.307				
F Change	38016.973				
Sign. F. Change	.000				
AP Calculus AB					
Model 1					
HSGPA*	-.130	.004	-.116	-36.339	.000
Grades in Math**	.497	.009	.171	53.638	.000
Constant	1.578	.040		39.420	.000
Model 2					
HSGPA*	-.066	.003	-.059	-21.234	.000
Grades in Math**	.213	.008	.073	26.259	.000
PSAT/NMSQT M	.087	.000	.509	207.333	.000
Constant	-2.778	.040		-68.763	.000
R-Squared Change	.241				
F Change	42986.786				
Sign. F. Change	.000				
AP Calculus BC					
Model 1					
HSGPA*	-.130	.007	-.100	-17.868	.000
Grades in Math**	.633	.021	.166	29.506	.000
Constant	1.559	.091		17.125	.000
Model 2					
HSGPA*	-.072	.007	-.055	-10.964	.000
Grades in Math**	.343	.019	.090	17.709	.000
PSAT/NMSQT M	.085	.001	.450	97.132	.000
Constant	-3.137	.095		-33.160	.000
R-Squared Change	.192				
F Change	9434.539				
Sign. F. Change	.000				
AP Chemistry					
Model 1					
HSGPA*	-.214	.006	-.180	-33.980	.000
Grades in Natural Science**	.591	.018	.172	32.335	.000
Constant	1.153	.079		14.654	.000
Model 2					
HSGPA*	-.090	.005	-.076	-16.861	.000
Grades in Natural Science**	.296	.015	.086	19.276	.000
PSAT/NMSQT M	.085	.001	.551	139.973	.000
Constant	-3.196	.073		-44.037	.000
R-Squared Change	.276				
F Change	19592.332				
Sign. F. Change	.000				

Predictor	*B*	*SE B*	*BETA*	*T*	*Sig. T*
AP English Language					
Model 1					
HSGPA*	-.168	.003	-.205	-58.738	.000
Grades in English**	.402	.008	.180	51.642	.000
Constant	2.018	.034		59.690	.000
Model 2					
HSGPA*	-.049	.002	-.060	-23.405	.000
Grades in English**	.143	.006	.064	25.134	.000
PSAT/NMSQT VW	.042	.000	.691	313.719	.000
Constant	-1.972	.028		-71.695	.000
R-Squared Change	.424				
F Change	98419.906				
Sign. F. Change	.000				
AP English Literature					
Model 1					
HSGPA*	-.176	.002	-.213	-79.322	.000
Grades in English**	.369	.006	.160	59.645	.000
Constant	2.151	.027		80.347	.000
Model 2					
HSGPA*	-.031	.002	-.038	-19.357	.000
Grades in English**	.126	.004	.055	28.133	.000
PSAT/NMSQT VW	.042	.000	.704	406.461	.000
Constant	-2.131	.022		-97.358	.000
R-Squared Change	.434				
F Change	165210.60				
Sign. F. Change	.000				
AP Government and Politics: United States					
Model 1					
HSGPA*	-.195	.003	-.235	-59.227	.000
Grades in Social Science**	.380	.010	.152	38.289	.000
Constant	1.877	.043		43.951	.000
Model 2					
HSGPA*	-.031	.003	-.038	-11.114	.000
Grades in Social Science**	.225	.008	.090	27.570	.000
PSAT/NMSQT VMW	.026	.000	.590	193.406	.000
Constant	-2.430	.041		-58.660	.000
R-Squared Change	.293				
F Change	37405.813				
Sign. F. Change	.000				
AP Macroeconomics					
Model 1					
HSGPA*	-.231	.007	-.231	-34.422	.000
Grades in Social Science**	.307	.020	.105	15.650	.000
Constant	2.429	.085		28.718	.000
Model 2					
HSGPA*	-.066	.006	-.066	-11.108	.000
Grades in Social Science**	.135	.017	.046	8.063	.000
PSAT/NMSQT VM	.041	.000	.538	102.644	.000
Constant	-2.219	.085		-26.053	.000
R-Squared Change	.248				
F Change	10535.777				
Sign. F. Change	.000				
AP Psychology					
Model 1					
HSGPA*	-.291	.005	-.324	-58.006	.000
Grades in Social Science**	.317	.014	.125	22.400	.000
Constant	3.076	.062		49.691	.000
Model 2					
HSGPA*	-.103	.004	-.115	-23.477	.000
Grades in Social Science**	.164	.012	.065	13.934	.000
PSAT/NMSQT VMW	.029	.000	.568	132.402	.000
Constant	-1.755	.063		-27.876	.000
R-Squared Change	.262				
F Change	17530.402				
Sign. F. Change	.000				

Predictor	*B*	*SE B*	*BETA*	*T*	*Sig. T*
AP Statistics					
Model 1					
HSGPA*	-.240	.005	-.244	-44.547	.000
Grades in Math**	.528	.013	.221	40.336	.000
Constant	1.654	.057		28.907	.000
Model 2					
HSGPA*	-.094	.005	-.096	-20.572	.000
Grades in Math**	.339	.011	.142	30.918	.000
PSAT/NMSQT VM	.045	.000	.549	135.855	.000
Constant	-3.287	.060		-54.971	.000
R-Squared Change	.260				
F Change	18456.689				
Sign. F. Change	.000				
AP U.S. History					
Model 1					
HSGPA*	-.194	.003	-.205	-68.837	.000
Grades in Social Science**	.506	.008	.194	65.100	.000
Constant	1.572	.034		46.607	.000
Model 2					
HSGPA*	-.042	.002	-.044	-16.919	.000
Grades in Social Science**	.317	.007	.121	48.114	.000
PSAT/NMSQT VMW	.028	.000	.547	238.481	.000
Constant	-2.763	.034		-81.955	.000
R-Squared Change	.256				
F Change	56873.048				
Sign. F. Change	.000				

*HSGPA is negatively coded (A+ = 1, A = 2, A- = 3, ...D = 11, E/F = 12)
**A = 4, B = 3, C = 2, D = 1, E/F = 0.

Appendix B: A Test for Invariance in Independent Semipartial Correlations

Suppose that in K independent populations, we wish to calculate the increment to the squared multiple correlation in predicting a variable Y from another variable X, after controlling for a set of predictors **Z**. We can describe this increment as $\rho_k^2 = R_{kYX.Z}^2 - R_{kY.Z}^2$, where $R_{kYX.Z}^2$ is the squared multiple correlation for predicting Y from X after controlling for **Z** in the kth population, and $R_{kY.Z}^2$ is the squared multiple correlation from predicting Y from **Z** in the kth population. The square root of the increment, ρ_k, is known as the *semipartial correlation* between Y and X, controlling for **Z**, for the kth population. We wish to compare $\rho_{1,}\rho_{2,\ldots,}\rho_k$ for invariance across the K populations: does the addition of X to the regression of Y on **Z** produce the same increment across all K populations?

A statistical test of invariance in ρ_k can be developed by noting that ρ_k is just the bivariate correlation between Y and the residual in X after regressing X on the set of predictors **Z**. Steiger and Browne (1984) provide the theory that permits the derivation of the required standard error for testing the significance of ρ_k in a single population. Steiger (2005) describes the extension to multiple independent populations, allowing tests of invariance of ρ_k. All of the following developments were derived using these two sources.

To begin, let $X^* = X - bZ$ be the residual score for X after its regression on **Z**, ignoring the intercept in that regression. Then as noted above, we know that $\rho_k = \rho_{kYX^*}$, where ρ_{kYX^*} is just the bivariate correlation between Y and X^* in the kth population. Assuming multivariate normality among all variables involved, standard theory suggests that the covariance between any pair of sample bivariate correlations $(r_{ij},\ r_{gh})$ based on a sample of size n can be expressed

$$\psi_{ij,\,gh} = (1/2n)\,\rho_{ij}\rho_{gh}\,(\rho_{ig}^2 + \rho_{ih}^2 + \rho_{jg}^2 + \rho_{jh}^2) + \rho_{ig}\rho_{jh} + \rho_{ih}\rho_{jg} - \rho_{ij}\,(\rho_{jg} + \rho_{jh} + \rho_{ig} + \rho_{in}) - \rho_{gh}\,(\rho_{jg}\,\rho_{ig} + \rho_{jh} + \rho_{in})$$

where ρ_{ij} is the population value of r_{ij}, the sample correlation. For the case in which $i = g$, $j = h$, the covariance above is just the variance of r_{ij}. In this case, $\psi_{ij,\,gh}$ simplifies to

$$\Psi_{ij,gh} = Var(r_{ij}) = \frac{(1-\rho_{ij}^2)^2}{n}\ .$$

This expression for the variance of a sample bivariate correlation can be found in the literature (e.g., Rao, 1973).

Now let $N_k = n_k + 1$ be the sample size for the sample from the kth population that yields the sample semipartial correlation r_k corresponding to the population correlation ρ_k, already defined. Let **N** be a $K \times K$ diagonal matrix whose diagonal elements are the $(n_1, n_2, \ldots, n_k)$. Also define a second $K \times K$ diagonal matrix ψ whose diagonal elements are $(1 - \rho_k^2)^2$, $k = 1, 2, \ldots, K$, which are proportional (by n_k) to the variances of the sample semipartial correlations in the K populations. We will then define $\hat{\psi}$ as the matrix ψ with r_k substituted for ρ_k. It can be shown that the ordinary least squares (OLS) estimator of the common semipartial correlation ρ, assuming invariance of these semipartial correlations across the K populations, is

$$\hat{\rho}_{OLS} = \frac{\sum_{j=1}^{K} n_j r_j}{\sum_{j=1}^{K} n_j}\ .$$

Define $\hat{\Omega} = N^{-1}\hat{\psi}$. The generalized least squares (GLS) estimator of the common semipartial correlation across the K populations (assuming invariance again) is

$$\hat{\rho}_{GLS} = (1'\hat{\Omega}1)^{-1}1'\hat{\Omega}^{-1}r$$

where 1 is a $K \times 1$ unit vector and $r' = (r_1, r_2, \ldots, r_K)$ is a $1 \times K$ vector of sample semipartial correlations from the K samples. It can be shown that the GLS estimator is equal to

$$\hat{\rho}_{GLS} = A^{-1}\sum_{j=1}^{K}\frac{n_j r_j}{(1-r_j^2)^2}\ ,$$

with the quantity A equal to

$$A = \sum_{j=1}^{K}\frac{n_j}{(1-r_j^2)^2}\ .$$

Once the GLS estimator is available, a test statistic for the null hypothesis

$H_0 : \rho_k = \rho$ for $k = 1, 2, \ldots, K$

can be shown to be

$$\chi^2 = (r - 1\hat{\rho}_{GLS})'\hat{\Omega}^{-1}(r - 1\hat{\rho}_{GLS})\ .$$

Under the null hypothesis, this statistic will have a chi-square distribution in large samples with $df = K - 1$. We used this test statistic to test the null hypothesis of invariance in the semipartial correlations, with K varying depending on which groups were being compared.


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