

# A Comparison of the College Outcomes of AP<sup>®</sup> and Dual Enrollment Students

By Jeffrey N. Wyatt, Brian F. Patterson, and F. Tony Di Giacomo



**Jeffrey N. Wyatt** is an associate research scientist in the College Board's research department.

**Brian F. Patterson** was an assistant research scientist in the College Board's research department.

**F. Tony Di Giacomo** is a director in the College Board's research department.

### **Acknowledgments**

The authors would like to thank Bethany Fishbein for reviewing the existing literature on academic rigor.

### **About the College Board**

The College Board is a mission-driven not-for-profit organization that connects students to college success and opportunity. Founded in 1900, the College Board was created to expand access to higher education. Today, the membership association is made up of over 6,000 of the world's leading educational institutions and is dedicated to promoting excellence and equity in education. Each year, the College Board helps more than seven million students prepare for a successful transition to college through programs and services in college readiness and college success — including the SAT® and the Advanced Placement Program®. The organization also serves the education community through research and advocacy on behalf of students, educators, and schools. For further information, visit [www.collegeboard.org](http://www.collegeboard.org).

© 2015 The College Board. College Board, Advanced Placement, Advanced Placement Program, AP, SAT, and the acorn logo are registered trademarks of the College Board. PSAT/NMSQT is a registered trademark of the College Board and National Merit Scholarship Corporation. All other products and services may be trademarks of their respective owners. Visit the College Board on the Web: [www.collegeboard.org](http://www.collegeboard.org).

**For more information on  
College Board research and data,  
visit [research.collegeboard.org](http://research.collegeboard.org).**

RESEARCH

# Contents

Executive Summary .....	4
Introduction .....	5
The Current Study .....	7
Method .....	7
Samples .....	7
Measures .....	8
Analyses .....	9
Results .....	10
Descriptive Statistics .....	10
Model-Based Results .....	10
Conclusions .....	19
Limitations and Directions for Future Research .....	19
References .....	20
Appendix .....	23

## Tables

Table 1. Demographic Characteristics of Samples 1, 2, and 3 .....	11
Table 2. Summary Statistics for Samples 1, 2, and 3 .....	12
Table 3. Differences in Predicted Probabilities of Enrollment in Four-Year Institutions by Student Subgroup .....	13
Table 4. Differences in Predicted Probabilities of Four-Year Persistence by Student Subgroup .....	14
Table 5. Differences in Predicted Probabilities of Four-Year Graduation by Student Subgroup .....	16
Table 6. Differences in Predicted Probabilities of Six-Year Graduation by Student Subgroup .....	17
Table A1. Model Parameters for Four-Year Enrollment (Sample 1).....	23
Table A2. Predicted Probabilities of Four-Year Enrollment .....	24
Table A3. Model Parameters for Four-Year Persistence (Sample 2).....	25
Table A4. Predicted Probabilities of Four-Year Persistence .....	26
Table A5. Model Parameters for Four-Year Graduation (Sample 2).....	27
Table A6. Predicted Probabilities of Four-Year Graduation (Sample 2).....	28
Table A7. Model Parameters for Six-Year Graduation (Sample 2) .....	29
Table A8. Predicted Probabilities of Six-Year Graduation (Sample 2).....	30
Table A9. Model Parameters for First-Year Grade Point Average (Sample 3).....	31
Table A10. Predicted First-Year Grade Point Average (Sample 3).....	32

## Figures

Figure 1. Differences in predicted probabilities of four-year enrollment .....	14
Figure 2. Differences in predicted probabilities of four-year persistence .....	15
Figure 3. Differences in predicted probabilities of four-year graduation .....	16
Figure 4. Differences in predicted probabilities of six-year graduation.....	17
Figure 5. Differences in predicted first-year grade point average.....	18

## Executive Summary

Educators are increasingly focused on ensuring that students experience a rigorous curriculum in high school and graduate college and career ready. One way of introducing rigorous course work is to have students take college-level work, often in the form of either an AP® course and exam or a dual enrollment course. This study compared the outcomes of students who participated in either program and graduated high school in 2006. The outcomes investigated were four-year college enrollment, persistence at a four-year institution, graduation in four years, and graduation in six years, as well as first-year college grades. The results indicated that AP students who had obtained at least one score of 3 or higher on an AP Exam considerably outperformed on all examined outcomes except for four-year college enrollment, which was highest for students who had taken a dual enrollment course affiliated with a four-year college. AP students whose highest exam score was less than 3 performed as well or better than did students who took a dual enrollment course affiliated with a two-year college for all outcomes. AP students whose highest exam score was lower than 3 outperformed students who took a dual enrollment course affiliated with a four-year college on some outcomes and underperformed on others.

## Introduction

Over the last decade, educators have increasingly focused on trying to increase the percentage of students who graduate high school prepared to succeed in college. However, many secondary students in the United States graduate high school unprepared for the challenge of postsecondary work. In a telling survey, college professors estimated that 42% of students were not adequately prepared for college, and only 28% believed that public high schools adequately prepared students for college (Achieve, 2004). Other measures of college readiness have also indicated that many high school graduates are unprepared to succeed in college: ACT reported that only 26% of its 2013 test-takers were college ready, and the College Board reported that 43% of SAT® takers were college ready (ACT, 2013; College Board, 2013). The National Assessment of Educational Progress (NAEP) reported that 38% of the nation's 12th-grade students were college ready in reading, and 40% were college ready in mathematics (Fields, 2014). Many unprepared students either do not attend college or do need remediation upon entering college. Although estimates of remediation rates vary, one report estimates remediation rates to be approximately 28% of all incoming first-year students (Wirt, Choy, Rooney, Provasnik, Sen, & Tobin, 2004). Remediation is associated with markedly lower postsecondary graduation rates (Wirt et al., 2004). For example, 17% of students enrolled in a remedial reading course graduated within eight years, compared to 58% of students who did not take any remedial courses. The ramifications of postsecondary attainment rates are economic as well as educational as students earning a bachelor's degree have median annual earnings approximately \$21,000 higher than that of high school graduates (Baum, Ma, & Payea, 2013).

The economic advantages conferred upon postsecondary graduates are expected to increase for the foreseeable future. Increasingly, more complex skills and training will be required of workers. Of the top 20 fastest-growing jobs, 11 require postsecondary education in the form of an associate or higher degree. (Bureau of Labor Statistics, n.d.). Therefore, academic preparedness is an important foundation for future academic and economic success.

Over the last decade, many research studies have suggested that a rigorous curriculum in high school is important in preparing students for future academic success in college. For example, a rigorous course load (i.e., academic rigor or academic intensity) in high school is positively correlated with standardized test scores (Attewell & Domina, 2008; Bridgeman, Pollack, & Burton, 2004; Horn & Kojaku, 2001; Milewski & Sawtell, 2006), college enrollment rates (Attewell & Domina, 2008; Long, Conger, & Iatarola, 2012), institutional selectivity (Horn & Kojaku, 2001), lower rates of remediation (Adelman, Daniel, & Berkovits, 2003), and higher four-year college graduation rates (Adelman, 1999; 2006).

One way to introduce rigor is to have students take college-level courses while still in high school. One prolific approach to do so is through the Advanced Placement Program®. AP courses allow students to take college-level courses in high school class settings and demonstrate proficiency by taking a nationally standardized end-of-course exam. These courses must comply with the College Board's AP Course Audit, which was developed to ensure that AP courses adhere to college-level standards. College credits or placement into higher-level postsecondary courses are awarded depending on the score a student receives on the exam and the AP credit and placement policy at the institution where the student enrolls. AP Exams are scored on a 5-point scale, and each score is labeled as follows:

1 = "no recommendation," 2 = "possibly qualified," 3 = "qualified," 4 = "well qualified," or 5 = "extremely well qualified." The American Council on Education recommends awarding college credit for AP scores of 3 or higher (ACE, 2013).

Another way to introduce high school students to rigorous course work is through dual enrollment. Dual enrollment programs permit high school students to enroll in college-level courses and earn college credits. Unlike AP, dual enrollment students do not take a standardized exam and are awarded a course grade rather than an exam score. Often, students receive credits that can be used to fulfill both high school and college graduation requirements. For this reason, dual enrollment is often referred to as dual credit or concurrent enrollment. Dual enrollment courses are taught in the high school itself, at the college campus, or through distance education (Thomas, Marken, Gray, & Lewis, 2013). Dual enrollment courses may either be academically focused or may have a career, technical, or vocational focus. Approximately 70% of the courses taught in the nation's public schools are academically oriented in nature (Thomas et al., 2013).

Prior research has consistently found a positive relationship between AP participation and desirable college outcomes, especially for those students who take the AP Exam and earn a 3 or higher. AP students who are exempted from an introductory college course and take a subsequent course generally perform in that course as well as or better than students who took the introductory course (Dodd, Fitzpatrick, De Ayala, & Jennings, 2002; Morgan & Crone, 1993; Morgan & Klaric, 2007; Morgan & Ramist, 1998). Research investigating broader college outcomes such as grades has found that students taking an AP Exam were more likely to enroll in a four-year college (Chajewski, Mattern, & Shaw, 2011), earn a first-year grade point average (FYGPA) of a B or higher than students who did not take an AP Exam (Willingham & Morris, 1986) and have higher grades in general (Hargrove, Godin, & Dodd, 2008). AP Exam scores were positively associated with college grades (Geiser & Santelices, 2004), and students scoring 3 or higher were also found to have higher retention rates and mean FYGPAs (Mattern, Shaw, & Xiong, 2009) and higher college graduation rates (Dougherty, Mellor, & Jian, 2006; Mattern, Marini, & Shaw, 2013) than non-AP Exam takers.

The body of literature on dual enrollment is less extensive, possibly because it is more difficult to obtain dual enrollment course data. Dual enrollment programs are decentralized by institution or system, and there is not one single repository of data available for large-scale controlled studies. In addition, different grading standards between courses and institutions likely make it more difficult to obtain results that are representative of dual enrollment experiences throughout the nation. The dual enrollment research that has been conducted has generally found positive results. For example, dual enrollment students were found to have a higher likelihood of enrolling in a four-year college (Swanson, 2008), to have a smaller decline in high-school-to-college grades (University of Arizona, 1999), to have a higher likelihood of persisting (Eimers & Mullen, 2003; Hughes, Rodriguez, Edwards, & Belfield, 2012; Struhl & Vargas, 2012, Swanson, 2008), to have earned more college credits and higher college grades (Allen & Dadgar, 2012; Karp, Calcagno, Hughes, Jeong, & Bailey, 2007), and to have had higher graduation rates (Speroni, December 2011; Struhl & Vargas, 2012) than did students not taking dual enrollment. However, dual enrollment research lacks uniform results. For example, some studies found that dual enrollment is related to college enrollment only for on-campus locations and only for certain subjects (Speroni, November 2011, December 2011). Furthermore, some studies were unable to establish an association between dual enrollment participation and persistence (Allen & Dadgar, 2012; Karp et al., 2007).

Both AP and dual enrollment administer college-level work to high school students and thus the mastery of the material through either program could yield similar benefits in terms of college preparation. However, there is a lack of empirical evidence comparing college outcome data between AP Exam takers and dual enrollment students. The few studies that have been conducted produced mixed results. Speroni (November 2011) found that dual



enrollment students were more likely to enroll in college but found that AP students<sup>1</sup> were more likely to enroll in a four-year college. Eimers and Mullen (2003) found that AP students or both AP and dual enrollment students earned higher FYGPAs than students with only dual enrollment credits or no credits. Other studies have found that AP students perform as well (Murphy & Dodd, 2009) or better (Hargrove, Godin, & Dodd, 2008; Kaliski & Godfrey, 2013) than dual enrollment students.

## The Current Study

The goal of this study was to evaluate postsecondary outcomes for students who have taken either AP<sup>®</sup> Exams or dual enrollment courses. As mentioned earlier, one obstacle to conducting large-scale studies of dual enrollment students is the lack of a central repository of data. This study attempted to address that issue by obtaining college records of terms completed prior to students' high school graduation<sup>2</sup> and using that as a measure of dual enrollment participation. After controlling for relevant student characteristics such as SAT<sup>®</sup> scores, high school grades, racial/ethnic identity, and parental education, this study compared college outcomes for AP and dual enrollment students. The outcomes investigated include four-year college enrollment, persistence to fourth year, FYGPA, graduation in four years, and graduation in six years. Unlike other methods of calculating graduation rates that only include students who initially enroll full time and graduate from the first institution attended, this graduation methodology includes students who graduate after transferring to another (other) college(s).

## Method

### Samples

**Sample 1.** Two national datasets were used in this study. The first dataset was obtained from the National Student Clearinghouse (NSC). NSC tracks student enrollment and degree attainment for over 3,100 two-year and four-year colleges and universities in the United States,<sup>3</sup> equivalent to 94% of the U.S. college-going population. NSC enrollment data were matched to the College Board's 2006 cohort database of 2,377,202 students who completed at least one SAT or PSAT/NMSQT<sup>®</sup>. Dual enrollment students were identified through the NSC records of terms that ended prior to the students' graduating from high school. NSC records indicated the type of college (two-year or four-year) sponsoring the course but not the course subject or grade. This sample was restricted to those students who attended a U.S. high school, took the current SAT that included the writing section, self-reported their gender, racial/ethnic identity, parental education, and high school grades. Students who took both a dual enrollment course and an AP Exam were eliminated from the study. These students were excluded because they were comparatively small in number and because the focus was to compare outcomes for AP and dual enrollment students. The sample contained 1,063,616 students.

**Sample 2.** This sample began with all students from Sample 1 but was then limited to those examinees who first enrolled at a four-year college or university. This sample was

1. Unlike many studies, Speroni evaluated AP course takers, not AP Exam takers.

2. This was accomplished by obtaining records from the National Student Clearinghouse (NSC). More details are provided in the Method section.

3. A list of participating organizations is located at: [http://www.studentclearinghouse.org/colleges/enrollment\\_reporting/participating\\_schools.php](http://www.studentclearinghouse.org/colleges/enrollment_reporting/participating_schools.php)

examined for persistence to the fourth year of college and four- and six-year graduation. This sample was composed of 728,968 students.

**Sample 3.** More detailed college performance data (i.e., college course grades or FYGPA) were available for students in the Higher Education Validity Sample, a subsample of the students in Sample 2. Specifically, this sample contains students from the higher education validity sample. Students in this sample attended one of the 110 four-year institutions partnered with the College Board to provide college performance data on their entering 2006 freshman class for research purposes. Institutions were recruited to be representative of the target population of 726 four-year institutions that received at least 200 SAT score reports in 2005. This sample of 110 institutions was diverse with respect to geographic location, control (i.e., public versus private), selectivity, and size. These data requirements yielded a sample of 128,623 students.

## Measures

**AP Exam Scores.** AP Exam scores were obtained from the 2006 College Bound cohort. Students whose highest AP score was 1 or 2 were placed into the AP < 3 group, while students with scores of 3 or higher were placed into the AP ≥ 3 group. The College Bound Seniors cohort consists of students expected to graduate<sup>4</sup> in 2006 who took at least one AP, PSAT/NMSQT, or SAT during high school.

**Dual Enrollment Participation.** Dual enrollment participation was obtained through records from NSC. Students enrolled in one or more courses associated with two-year institution prior to graduating high school were placed in the DE 2 group, while students who enrolled in one or more courses associated with a four-year institution prior to graduating high school were placed in the DE 4 group.

**SAT Scores.** SAT scores were obtained from the 2006 College Bound Seniors cohort, which includes students who graduated from high school in 2006 and had taken an SAT. The SAT consists of three sections: critical reading, mathematics, and writing, each with a score scale ranging from 200 to 800 with 10-point increments. If students took the SAT more than once, the most recent test score was used.

**HSGPA.** High school grade point average (HSGPA) was self-reported by students on the SAT Questionnaire (SAT-Q), which is completed during registration for the SAT or an SAT Subject Test. Grades were reported in letter grades ranging from an F (below 65) to an A+ (97–100).

**Highest Parental Education.** Parental education was also derived from self-reported data obtained from responses on the SAT-Q. Student responses were provided for both mother's and father's highest educational level. The highest degree (i.e., No High School Diploma, High School Diploma, Associate Degree, Bachelor's Degree, or Graduate Degree) of either parent was used to create this variable.

**Gender.** Students provided their gender (female or male) when they completed the SAT-Q.

**Racial/Ethnic Identity.** Students indicated their racial/ethnic identity on the SAT-Q. The categories include Native American or Alaska Native, Asian, Asian American, or Pacific Islander, Black or African American, Mexican or Mexican American, Puerto Rican, Other

4. Expected graduation is calculated based on the students' self-reported education level (e.g., 11th grade) at the time of either the SAT, PSAT/NMSQT, or AP Exam. Academic performance or achievement is not considered.

Hispanic, Latino, or Latin American, White, and Other. In this study, “Mexican or Mexican American,” “Puerto Rican,” and “Other Hispanic, Latino, or Latin American” were combined into a single category labeled “Hispanic.”

**Four-Year College Enrollment.** Four-year college enrollment data were obtained from NSC for the students in Sample 1. The variable was coded 0, indicating a student did not attend a four-year college and 1 indicating enrollment in a four-year college.

**FYGPA.** For Sample 3, FYGPA was obtained from participating colleges and universities.

**Persistence to Fourth Year.** For Sample 1, persistence was also calculated based on whether the student enrolled during any part of an academic year. To be coded as 0, a student must have failed to enroll during at least four noncontinuous<sup>5</sup> years, while a 1 indicates the student did persist for at least four years of noncontinuous enrollment. When calculated in this manner, the rate of persistence to second year is very high. We decided to look at persistence to the fourth year, which has more variability.

**Graduation in Four or Six Years.** Sample 1 contains enrollment and graduation data through the summer term of 2012, from which four-year and six-year graduation rates were calculated. A value of 0 indicates that the student did not graduate within four (or six) years, while a 1 indicates that the student did graduate within four (or six) years. All students who began at a four-year institution and earned a bachelor’s degree within four (or six) years from any institution are considered as having graduated. It should be noted that this graduation methodology differs from others that only consider graduation from the same institution from which the student was initially enrolled with a full-time status.

## Analyses

Students were classified into five groups: No AP/DE, AP < 3, AP ≥ 3, DE 2, and DE 4. No AP/DE indicates that the student took neither an AP Exam nor a dual enrollment course. It is possible for a student who took an AP course but not the exam to be included in this group. The AP < 3 includes students who took one or more AP Exams and whose highest exam score was 1 or 2, while the AP ≥ 3 group includes students whose highest AP Exam score was 3, 4, or 5. DE 2 includes students who participated in dual enrollment associated with a two-year institution, while DE 4 includes students who participated through a course(s) associated with a four-year institution. If a student participated in multiple dual enrollment courses, sponsored by both types of institutions, he or she was placed in the DE 4 group. A student is assigned a value of 1 in the group to which he or she belonged (e.g., AP ≥ 3) and a value of 0 for the other groups. A series of regression models were estimated to measure the relationship of AP and dual enrollment participation with four-year college enrollment, persistence to fourth year, FYGPA, and graduation in both four years and six years. Regression analyses model the expected differences in the dependent or outcome variable (e.g., college graduation), given differences in the independent or predictor variables (e.g., AP ≥ 3, DE 2), quantifying the degree to which the predictor and outcome variables are related. Additional variables were included in the regression model to measure the impact of AP performance on college outcomes after accounting for differences in academic performance demographic characteristics. These characteristics were measured using SAT scores, HSGPA, gender, racial/ethnic identity, and parental income.

5. In order to be considered as having persisted, students needed to have been enrolled in at least four of the six academic years. As an example, the student who enrolled for a year, took a year off, and returned for three years would have been considered to have persisted.

Logistic regression was employed to examine the AP effect for all dichotomous outcomes (e.g., graduation), whereas linear regression was used to measure the AP effect on FYGPA, which is a continuous outcome.

## Results

### Descriptive Statistics

Table 1 provides information on the demographic composition of the five groups. For Sample 1 and Sample 2, the No AP/DE group had the lowest percentage of female students. In Sample 3, the No AP/DE group had a percentage of female students similar to the percentage of female students in the AP  $\geq 3$  group. Across all three samples, Asian students represented a larger percentage of the AP groups than either of the No AP/DE group or the dual enrollment groups. In Sample 1 and Sample 2, African American students were less well represented in the AP and dual enrollment groups, compared to the No AP/DE group. In Sample 3, African Americans represented a higher percentage of the AP  $< 3$  students than of the No AP/DE students but accounted for a smaller percentage in the other three groups. The patterns of Hispanic students differed across samples. White students were represented better in the dual enrollment groups than in the No AP/DE group. Students with parents who obtained a graduate degree accounted for a larger percentage of students in the AP  $\geq 3$  group than the No AP/DE group.

Table 2 contains measures of high school academic achievement and college outcomes for each of the five participation groups. For all three samples, the No AP/DE students have the lowest academic performance in terms of both HSGPA and SAT scores. This group also had the lowest four-year enrollment rates, persistence rates, graduation rates, and college grades. The difference in high school performance between the No AP/DE students and any of the other AP or dual enrollment participation groups is greatest for Sample 1 and smallest for Sample 3. Compared to the No AP/DE students, the AP  $\geq 3$  students had the highest academic performance as measured by HSGPA and SAT scores and also had the most positive college outcomes. This finding was true across all three samples. Compared to the No AP/DE group, the DE 4 group had the second-highest academic performance as measured by both HSGPA and SAT scores and college outcomes. The AP  $< 3$  and DE 2 groups had lower HSGPA and SAT scores than did the AP  $\geq 3$  and DE 4 groups, but their scores were higher than those of the No AP/DE group. The AP  $< 3$  and DE 2 groups had very similar HSGPAs and SAT scores and college outcomes, although the AP  $< 3$  group tended to enroll in a four-year college and persist at a higher rate than did the DE 2 students.

### Model-Based Results

One problem with directly comparing college outcomes among the five groups (as in Table 2) is that their demographic and academic characteristics differ considerably. This difference makes it difficult to determine whether variance in outcomes is attributable to the impact of AP and dual enrollment programs or to precollegiate academic performance. For example, students in the AP  $\geq 3$  group have more positive college outcomes (e.g., four-year college enrollment) than do the No AP/DE students but also had higher HSGPA and SAT scores. Thus, it is difficult to conclude whether the more positive college outcomes of the AP  $\geq 3$  students is a result of higher academic performance overall or is associated with AP performance. To better isolate and measure the association of AP and dual enrollment participation with

**Table 1.**

## Demographic Characteristics of Samples 1, 2, and 3

		AP & Dual Enrollment Group				
Group	Category	No AP/DE	AP < 3	AP ≥ 3	DE 2	DE 4
<b>Sample 1 - Sample of SAT Takers</b>						
<i>n</i>		574,810	142,087	296,688	37,724	12,307
Gender	Female	52.2%	60.2%	55.2%	58.8%	58.8%
	Male	47.8%	39.8%	44.8%	41.2%	41.2%
Racial/ Ethnic Identity	Asian	5.9%	10.5%	12.2%	4.7%	5.0%
	African American	15.2%	13.8%	3.7%	7.9%	8.9%
	Hispanic	11.0%	13.2%	12.0%	8.3%	8.5%
	White	63.5%	57.9%	68.1%	75.3%	73.0%
	Other	4.4%	4.6%	4.0%	3.8%	4.6%
Highest Level of Parental Education	No HS Diploma	4.5%	5.0%	3.8%	2.7%	2.9%
	HS Diploma	38.4%	32.9%	17.7%	34.2%	29.5%
	Associate Degree	10.0%	9.0%	5.3%	12.2%	9.8%
	Bachelor's Degree	28.1%	30.1%	32.3%	30.5%	31.0%
	Graduate Degree	19.0%	23.0%	40.9%	20.3%	26.7%
<b>Sample 2 - Sample of Students Enrolling at a Four Year NSC Institution</b>						
<i>n</i>		329,352	106,848	259,754	22,910	10,104
Gender	Female	53.1%	60.7%	55.3%	59.1%	59.1%
	Male	46.9%	39.3%	44.7%	40.9%	40.9%
Racial/ Ethnic Identity	Asian	5.3%	9.9%	12.1%	4.6%	4.9%
	African American	14.8%	14.4%	3.8%	8.5%	8.7%
	Hispanic	7.8%	10.7%	9.5%	7.2%	7.7%
	White	68.0%	60.7%	70.7%	76.2%	74.3%
	Other	4.0%	4.3%	3.9%	3.5%	4.4%
Highest Level of Parental Education	No HS Diploma	2.9%	3.9%	2.7%	2.2%	2.4%
	HS Diploma	33.0%	30.1%	16.2%	29.5%	26.9%
	Associate Degree	9.4%	8.6%	5.1%	11.1%	9.4%
	Bachelor's Degree	31.6%	32.0%	33.1%	33.4%	32.4%
	Graduate Degree	23.1%	25.4%	42.9%	23.8%	28.9%
<b>Sample 3 - Higher Education Validity Sample</b>						
<i>n</i>		46,505	18,152	56,941	5,298	1,727
Gender	Female	52.7%	58.3%	52.6%	56.5%	60.5%
	Male	47.3%	41.7%	47.4%	43.5%	39.5%
Racial/ Ethnic Identity	Asian	5.7%	9.3%	11.5%	4.2%	4.9%
	African American	9.5%	12.5%	3.9%	5.2%	7.0%
	Hispanic	6.2%	10.0%	6.8%	7.6%	5.6%
	White	75.0%	64.5%	74.4%	80.1%	78.6%
	Other	3.7%	3.6%	3.4%	3.0%	3.8%
Highest Level of Parental Education	No HS Diploma	1.8%	3.0%	1.5%	2.1%	1.9%
	HS Diploma	28.1%	27.0%	13.8%	27.5%	22.4%
	Associate Degree	8.6%	8.1%	4.4%	10.2%	9.6%
	Bachelor's Degree	34.7%	34.1%	34.7%	36.1%	35.5%
	Graduate Degree	26.7%	27.9%	45.7%	24.0%	30.7%

Note. Percentages within columns may not sum to 100% due to rounding.

**Table 2.**

Summary Statistics for Samples 1, 2, and 3

Variable	AP & Dual Enrollment Group									
	No AP/DE		AP < 3		AP ≥ 3		DE 2		DE 4	
	M	SD	M	SD	M	SD	M	SD	M	SD
<b>Sample 1 - Sample of SAT Takers</b>										
HSGPA	3.09	0.61	3.41	0.53	3.70	0.48	3.37	0.58	3.48	0.57
SAT-CR	462	93	495	77	599	93	495	89	512	96
SAT-M	471	96	512	87	609	94	505	90	523	95
SAT-W	455	89	492	77	590	92	486	85	503	93
4-Year Enrollment	57.3%	49.5%	75.2%	43.2%	87.6%	33.0%	60.7%	48.8%	82.1%	38.3%
<b>Sample 2 - Sample of Students Enrolling at a Four Year NSC Institution</b>										
HSGPA	3.22	0.57	3.47	0.50	3.74	0.45	3.48	0.53	3.55	0.53
SAT-CR	485	88	503	74	607	87	510	86	522	94
SAT-M	496	91	523	83	618	88	523	86	533	93
SAT-W	478	85	501	74	599	87	502	82	514	91
4-Year Persistence	71.2%	45.3%	80.1%	39.9%	88.7%	31.7%	74.4%	43.6%	77.9%	41.5%
4-Year Graduation	30.3%	45.9%	38.6%	48.7%	60.6%	48.9%	39.6%	48.9%	44.1%	49.7%
6-Year Graduation	56.4%	49.6%	66.5%	47.2%	82.1%	38.3%	64.3%	47.9%	67.3%	46.9%
<b>Sample 3 - Higher Education Validity Sample</b>										
HSGPA	3.34	0.52	3.56	0.46	3.79	0.41	3.57	0.49	3.65	0.47
SAT-CR	508	81	516	70	618	80	522	83	536	88
SAT-M	524	83	543	78	633	81	540	83	552	86
SAT-W	501	79	515	71	609	80	515	79	528	86
FY GPA	2.69	0.78	2.76	0.73	3.21	0.62	2.78	0.76	2.94	0.69
Note. Sample 1: $n = 1,063,616$ ; Sample 2: $n = 728,968$ ; and Sample 3: $n = 128,623$ .										

college outcomes, a series of regressions were estimated, which included control variables<sup>6</sup> that have previously been linked to college success. This method allows an estimate of the extent to which AP or dual enrollment is related to college success after accounting for these differences in demographic characteristics and prior academic performance.

*Four-Year College Enrollment.* The first logistic regression predicted four-year college enrollment for students in Sample 1 and the results and model parameters for all five groups are displayed in Table A1. The parameters in Table A1 were used to calculate estimated four-year enrollment rates for students by gender, racial/ethnic identity, and parental education level that are displayed in Table A2. Table 3 shows the differences in the estimated four-year enrollment rate for the AP (i.e., AP < 3 and AP ≥ 3) and dual enrollment groups (i.e., DE 2 and DE 4), compared to the No AP/DE students.<sup>7</sup> HSGPA, SAT-CR, SAT-M, and SAT-W

6. These control variables included SAT scores, HSGPA, gender, ethnicity, and parental education level.

7. Interactions between AP and dual enrollment and demographic characteristics were not explicitly modeled. The further (closer) the base rate was from (to) 50%, the lower (higher) the increase or decrease associated with an AP or dual enrollment effect, all else being equal.

were set to their respective means (the average for the sample) when calculating the estimated enrollment rate in Table 3. Figure 1 depicts the range of the increase or decrease in four-year college enrollment rates as indicated by the data in Table 3. The AP < 3 group had higher estimated four-year enrollment rates of between 4.9% and 8.8%, whereas the AP ≥ 3 group has higher estimated enrollment rates of between 5.4% and 9.7%. The DE 2 students actually had lower estimated four-year enrollment rates of -5.9% to -3.7%, while the DE 4 students had the highest estimated enrollment rates, 8.1% to 15.3% higher than that of the No AP/DE students.

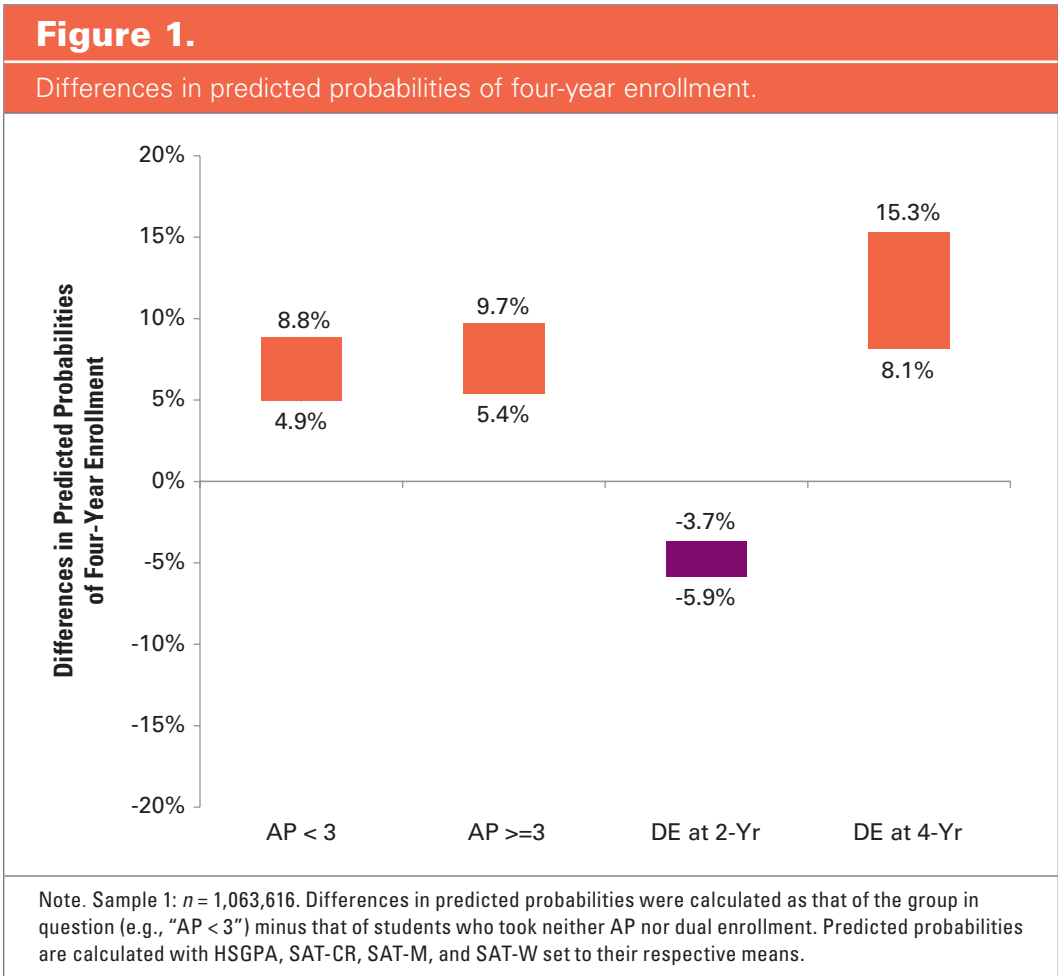
**Table 3.**

Differences in Predicted Probabilities of Enrollment in Four-Year Institutions by Student Subgroup

Group	Category	AP & Dual Enrollment Group			
		AP < 3	AP ≥ 3	DE 2	DE 4
Gender <sup>a</sup>	Female	7.2%	7.9%	-5.1%	12.3%
	Male	7.8%	8.5%	-5.4%	13.3%
Racial/ Ethnic Identity <sup>b</sup>	Asian	8.3%	9.1%	-5.6%	14.3%
	African American	4.9%	5.4%	-3.7%	8.1%
	Hispanic	8.3%	9.2%	-5.7%	14.4%
	White	7.2%	7.9%	-5.1%	12.3%
	Other	7.8%	8.5%	-5.4%	13.3%
Highest Level of Parental Education <sup>c</sup>	No HS Diploma	8.8%	9.7%	-5.9%	15.3%
	HS Diploma	8.8%	9.6%	-5.8%	15.2%
	Associate Degree	8.5%	9.4%	-5.7%	14.7%
	Bachelor's Degree	7.2%	7.9%	-5.1%	12.3%
	Graduate Degree	6.7%	7.3%	-4.8%	11.3%

a. Predicted probabilities for white students whose parent(s) highest degree earned was a bachelor's degree.  
b. Predicted probabilities for female students whose parent(s) highest degree earned was a bachelor's degree.  
c. Predicted probabilities for white female student(s).  
Note. Sample 1:  $n = 1,063,616$ . Differences in predicted probabilities were calculated as that of the group in question (e.g., "AP < 3") minus that of students who took neither AP nor dual enrollment. Predicted probabilities are calculated with HSGPA, SAT-CR, SAT-M, and SAT-W set to their respective grand means.

*Persistence to Fourth-Year at a Four-Year College.* Sample 2 was used for this analysis. A logistic regression was also conducted to examine the relationship between AP and dual enrollment participation and four-year persistence rates at a four-year college. The parameter estimates for this regression are displayed in Table A3, and the estimated persistence rates are displayed in Table A4. Table 4 contains the estimated increase or decrease in persistence rates for the AP and dual enrollment groups, compared to those of the No AP/DE students, and the range for these estimates are displayed in Figure 2. The estimated persistence rate for the AP < 3 students was between 3.3% and 4.8%, higher than that of the No AP/DE students, while the estimated persistence rate for the AP ≥ 3 students was 5.3% to 7.8% higher than that of the No AP/DE students. The DE 2 students had slightly lower estimated persistence rates, -1.6% to -1.2% lower than the No AP/DE students, while the DE 4 students had slightly higher persistence rates of 0.5% to 0.7%.

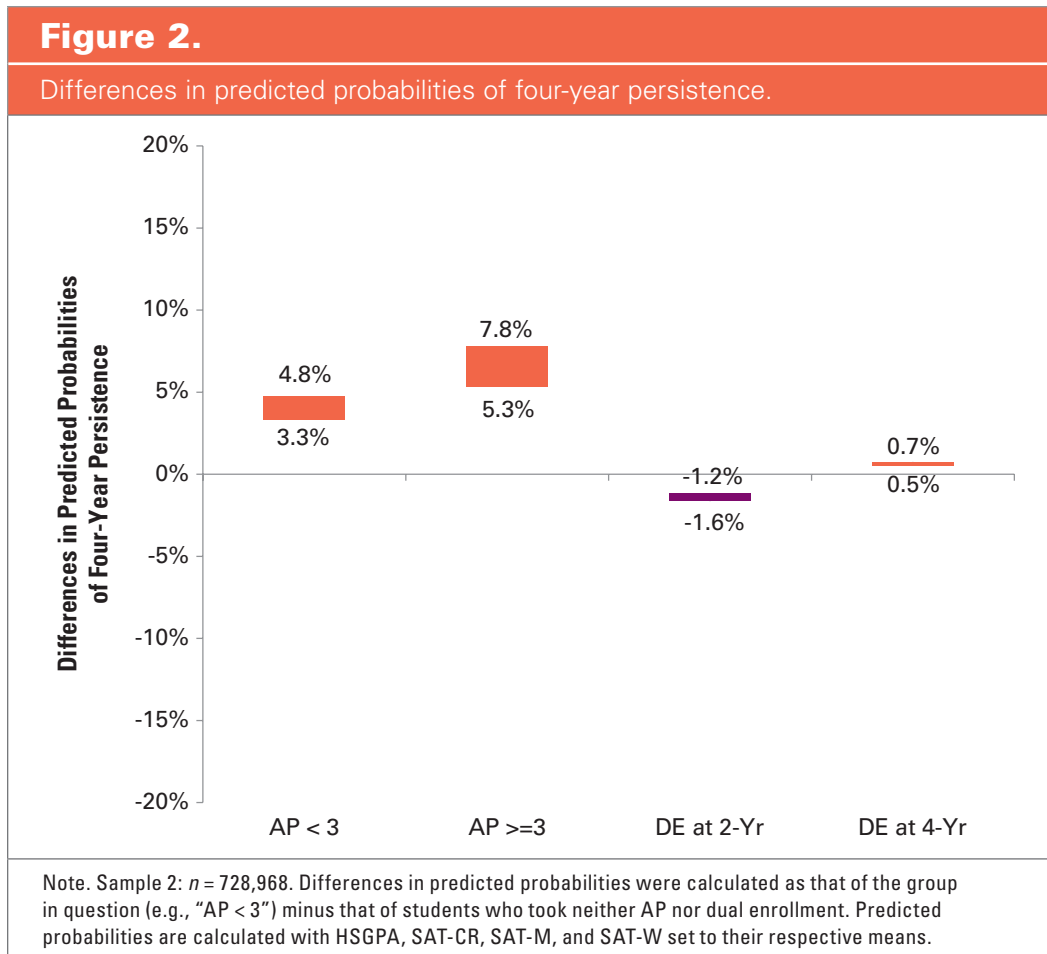


**Table 4.**  
Differences in Predicted Probabilities of Four-Year Persistence by Student Subgroup

Group	Category	AP & Dual Enrollment Group			
		AP < 3	AP >= 3	DE 2	DE 4
Gender <sup>a</sup>	Female	3.6%	5.8%	-1.3%	0.6%
	Male	3.9%	6.4%	-1.4%	0.6%
Racial/ Ethnic Identity <sup>b</sup>	Asian	3.6%	5.7%	-1.3%	0.6%
	African American	3.8%	6.1%	-1.3%	0.6%
	Hispanic	4.2%	6.8%	-1.5%	0.7%
	White	3.6%	5.8%	-1.3%	0.6%
	Other	3.9%	6.4%	-1.4%	0.6%
Highest Level of Parental Education <sup>c</sup>	No HS Diploma	4.6%	7.5%	-1.6%	0.7%
	HS Diploma	4.8%	7.8%	-1.6%	0.7%
	Associate Degree	4.4%	7.2%	-1.5%	0.7%
	Bachelor's Degree	3.6%	5.8%	-1.3%	0.6%
	Graduate Degree	3.3%	5.3%	-1.2%	0.5%

a. Predicted probabilities for white students whose parent(s) highest degree earned was a bachelor's degree.  
 b. Predicted probabilities for female students whose parent(s) highest degree earned was a bachelor's degree.  
 c. Predicted probabilities for white female students.  
 Note. Sample 2:  $n = 728,968$ . Differences in predicted probabilities were calculated as that of the group in question (e.g., "AP < 3") minus that of students who took neither AP nor dual enrollment. Predicted probabilities are calculated with HSGPA, SAT-CR, SAT-M, and SAT-W set to their respective grand means.





*Graduation Within Four Years.* Sample 2 was used for this analysis, and for the analysis on graduation within six years. A logistic regression was conducted to predict four-year college graduation.<sup>8</sup> The parameter estimates are displayed in Table A5, and the estimated four-year graduation rates by subgroup are displayed in Table A6. The difference between the estimated four-year graduation rates for the AP and dual enrollment groups, compared to the No AP/DE group, are included in Table 5 and Figure 3. The AP < 3 students had estimated four-year graduation rates of 3.3% to 3.5% higher than those of the No AP/DE students, while the AP >= 3 students had estimated four-year graduation rates of 11.1% to 11.5% higher. The DE 2 students had estimated four-year graduation rates 2.8% to 3.0% higher than that of the No AP/DE students, while the DE 4 students had estimated graduation rates that were 5.2% to 5.5% higher.

*Graduation Within Six Years.* The final logistic regression was conducted to predict estimated six-year graduation, and the parameter estimates are presented in Table A7, with estimated graduation rates by subgroup presented in Table A8. The difference in estimated six-year graduation rates between the AP and dual enrollment groups and the No AP/DE group are presented in Table 6. Figure 4 displays the range of the increase or decrease in estimated six-year graduation rates from Table 6. The AP < 3 students have an estimated increase in graduation rates 3.1% to 4.0% higher than that of the No AP/DE students, while the AP >= 3 students have an estimated increase 7.8% to 10.3% higher than that of the No AP/DE students. The DE 2 and DE 4 students have an estimated increase in graduation rates of 0.6% to 0.7% and 1.6% to 2.0%, respectively.

8. Graduation rates from a four-year college.

**Table 5.**

Differences in Predicted Probabilities of Four-Year Graduation by Student Subgroup

Group	Category	AP & Dual Enrollment Group			
		AP < 3	AP ≥ 3	DE 2	DE 4
Gender <sup>a</sup>	Female	3.5%	11.5%	3.0%	5.5%
	Male	3.3%	11.1%	2.8%	5.2%
Racial/ Ethnic Identity <sup>b</sup>	Asian	3.4%	11.4%	2.9%	5.4%
	African American	3.4%	11.3%	2.9%	5.3%
	Hispanic	3.3%	11.1%	2.8%	5.2%
	White	3.5%	11.5%	3.0%	5.5%
	Other	3.4%	11.4%	2.9%	5.4%
Highest Level of Parental Education <sup>c</sup>	No HS Diploma	3.4%	11.3%	2.9%	5.3%
	HS Diploma	3.4%	11.4%	2.9%	5.3%
	Associate Degree	3.5%	11.5%	2.9%	5.4%
	Bachelor's Degree	3.5%	11.5%	3.0%	5.5%
	Graduate Degree	3.5%	11.3%	3.0%	5.5%

a. Predicted probabilities for white students whose parent(s) highest degree earned was a bachelor's degree.

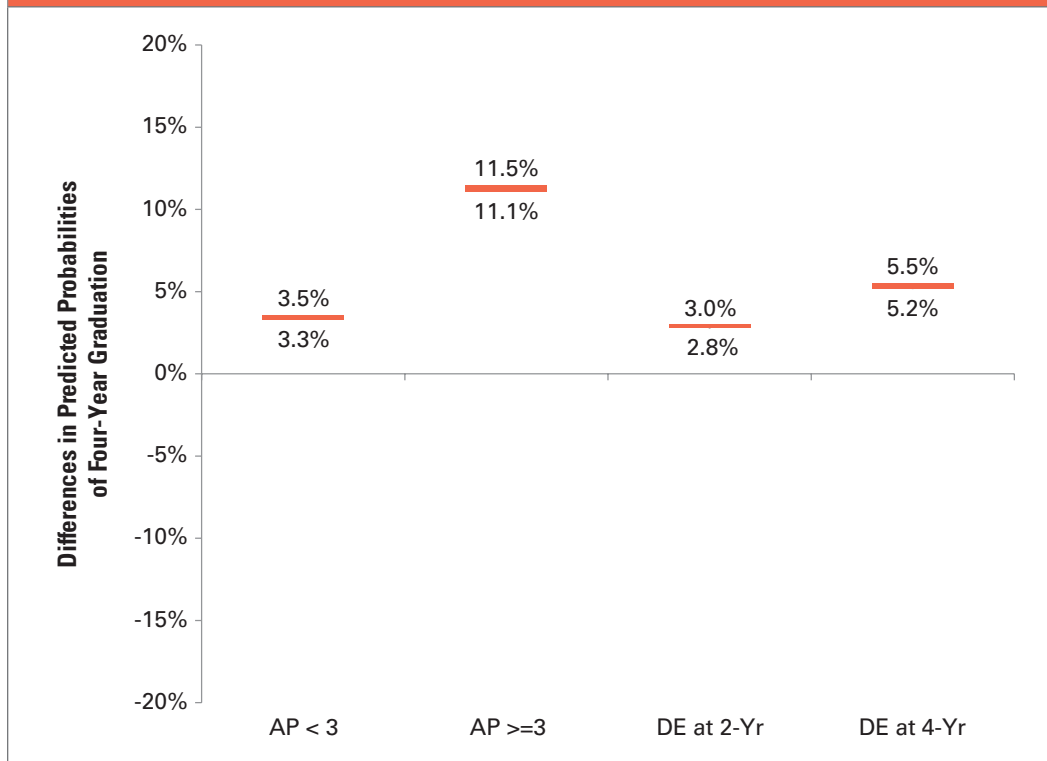
b. Predicted probability for female students whose parent(s) highest degree earned was a bachelor's degree.

c. Predicted probabilities for white female students.

Note. Sample 2:  $n = 728,968$ . Differences in predicted probabilities were calculated as that of the group in question (e.g., "AP < 3") minus that of students who took neither AP nor dual enrollment. Predicted probabilities are calculated with HSGPA, SAT-CR, SAT-M, and SAT-W set to their respective grand means.

**Figure 3.**

Differences in predicted probabilities of four-year graduation.



Note. Sample 2:  $n = 728,968$ . Differences in predicted probabilities were calculated as that of the group in question (e.g., "AP < 3") minus that of students who took neither AP nor dual enrollment. Predicted probabilities are calculated with HSGPA, SAT-CR, SAT-M, and SAT-W set to their respective means.

**Table 6.**

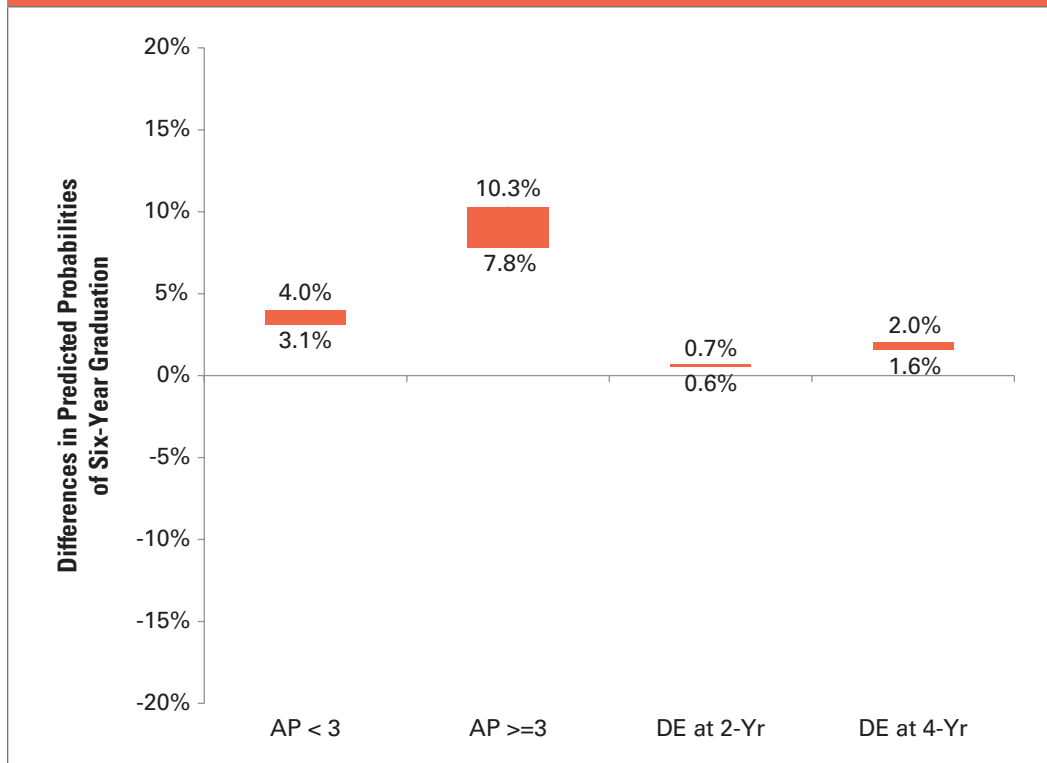
Differences in Predicted Probabilities of Six-Year Graduation by Student Subgroup

Group	Category	AP & Dual Enrollment Group			
		AP < 3	AP ≥ 3	DE 2	DE 4
Gender <sup>a</sup>	Female	3.3%	8.4%	0.6%	1.7%
	Male	3.9%	9.9%	0.7%	2.0%
Racial/ Ethnic Identity <sup>b</sup>	Asian	3.6%	9.0%	0.6%	1.8%
	African American	3.9%	10.0%	0.7%	2.0%
	Hispanic	4.0%	10.3%	0.7%	2.0%
	White	3.3%	8.4%	0.6%	1.7%
	Other	3.8%	9.6%	0.7%	1.9%
Highest Level of Parental Education <sup>c</sup>	No HS Diploma	4.0%	10.2%	0.7%	2.0%
	HS Diploma	4.0%	10.3%	0.7%	2.0%
	Associate Degree	3.8%	9.7%	0.7%	1.9%
	Bachelor's Degree	3.3%	8.4%	0.6%	1.7%
	Graduate Degree	3.1%	7.8%	0.6%	1.6%

a. Predicted probabilities for white students whose parent(s) highest degree earned was a bachelor's degree.  
 b. Predicted probabilities for female students whose parent(s) highest degree earned was a bachelor's degree.  
 c. Predicted probabilities for white female students.  
 Note. Sample 2:  $n = 728,968$ . Differences in predicted probabilities were calculated as that of the group in question (e.g., "AP < 3") minus that of students who took neither AP nor dual enrollment. Predicted probabilities are calculated with HSGPA, SAT-CR, SAT-M, and SAT-W set to their respective grand means.

**Figure 4.**

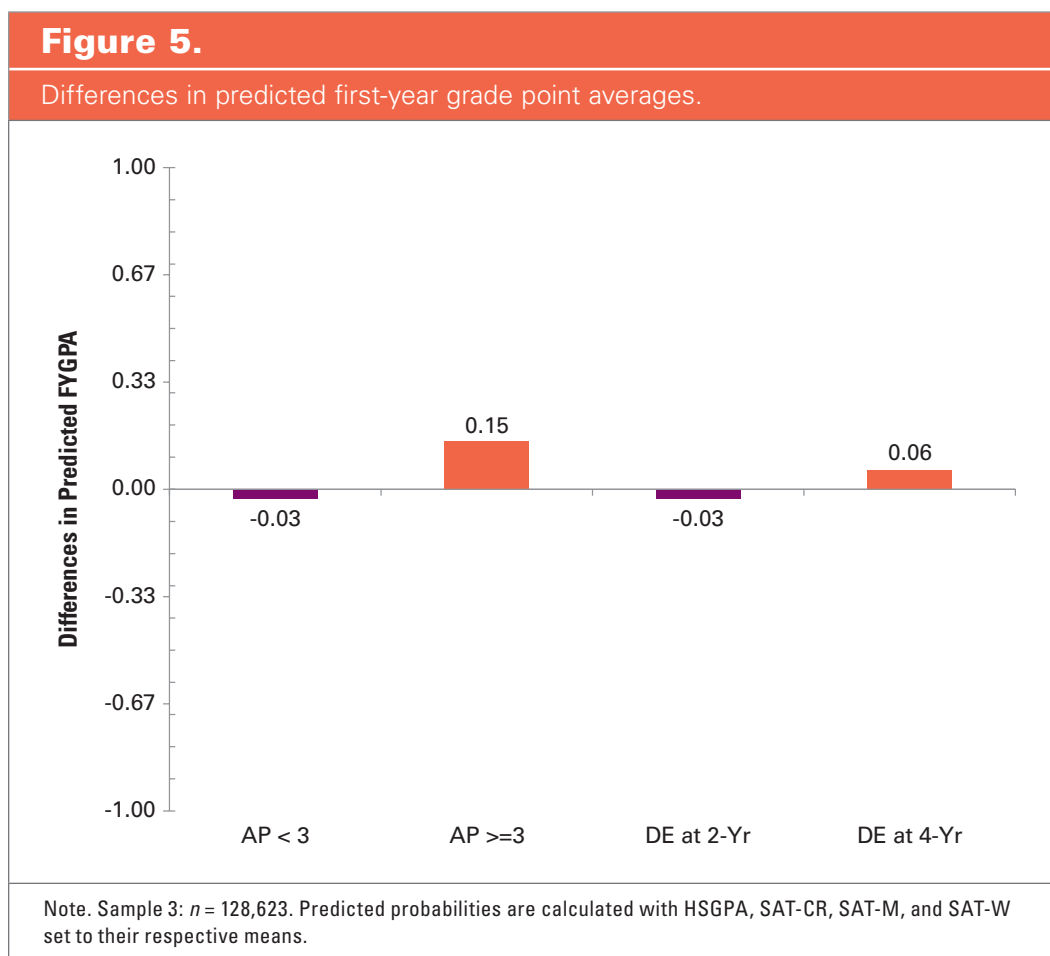
Differences in predicted probabilities of six-year graduation.



Note. Sample 2:  $n = 728,968$ . Differences in predicted probabilities were calculated as that of the group in question (e.g., "AP < 3") minus that of students who took neither AP nor dual enrollment. Predicted probabilities are calculated with HSGPA, SAT-CR, SAT-M, and SAT-W set to their respective means.

*First Year GPA (FYGPA)*. Sample 3 was used for this analysis, and a linear regression was used to predict first-year GPA (FYGPA) because it is a continuous outcome (e.g., 0.00–4.00) rather than a binary outcome (e.g., graduated or did not graduate). The results of the regression are presented in Table A9 and graphically in Figure 5. Given that FYGPA is a continuous outcome, Figure 5 — and Table A10 — show the single-point estimates of the increase in FYGPAs rather than the range of estimates that were presented for the binary outcomes (e.g., college graduation).

The AP < 3 students had an FYGPA that was 0.03 lower than that of the No AP/DE students, while the AP ≥ 3 students had an FYGPA that was 0.15 higher. The DE 2 students had an FYGPA that was 0.03 lower than that of the No AP/DE students, while the DE 4 students had an FYGPA that was 0.06 higher. As an example, white females<sup>9</sup> who obtained the mean for the sample on HSGPA and SAT scores are predicted to achieve a 3.00 FYGPA: AP < 3 students would be predicted to obtain a 2.97, whereas the AP ≥ 3 would be predicted to obtain a 3.15, DE 2 would be predicted to obtain a 2.97, and DE 4 would be predicted to obtain a 3.06.



9. These are students whose parents obtained a bachelor’s degree. See Table A10 for more detailed information.

## Conclusions

Prior research has indicated that participation in rigorous high school course work is an important predictor of future college success. The popularity of AP and dual enrollment, two common ways of providing rigorous course work to high school students, has grown in recent years. Students, parents, and educators often have to choose or recommend one program or the other. As such, these stakeholders need data and research to help guide them in making their decisions. One important factor in any such decision is the degree to which these courses are related to college success.

Overall, the results indicated that AP students who scored a 3 or higher on at least one AP Exam had more positive college outcomes than did dual enrollment students who took a dual enrollment course(s) affiliated with either a two-year or four-year institution. Students taking AP but scoring below a 3 performed as well or better than the students taking dual enrollment affiliated with a two-year institution on every college outcome, although both groups had lower college grades than the No AP/DE students. Comparisons between students taking an AP Exam and scoring less than a 3 with students taking dual enrollment who were affiliated with a four-year college were mixed, with results differing by outcome. Compared to students who completed a dual enrollment course affiliated with a four-year institution, AP students scoring lower than a 3 had lower rates of four-year college enrollment, lower four-year graduation rates, and lower college grades while having a higher persistence rate, and a higher six-year graduation rate.

Although there tends to be divergence within the literature on the relationship between dual enrollment course taking and college success, our findings on college outcomes for students taking dual enrollment courses affiliated with a four-year institution are consistent with the preponderance of existing dual enrollment research. The findings that dual enrollment students who take one or more courses at a two-year institution have lower enrollment rates, persistence rates, and grades at four-year institutions were unexpected in light of prior research findings. Our findings that AP students, particularly those scoring 3 or higher, have greater college success as measured by enrollment, grades, persistence, and graduation is, however, consistent with prior research findings.

## Limitations and Directions for Future Research

Although this study is noteworthy for having used nationwide college enrollment data, some limitations should be noted. First, dual enrollment participation was determined by matching students' high school records to college enrollment data from NSC, and there is some degree of error in that matching process. In addition, no dual enrollment course information is available. For this reason, courses taken by dual enrollment students may differ systematically from those taken by AP students. Furthermore, some of the dual enrollment courses may be career or technically (CTE) oriented. This confound may have been mitigated because participants in the study had taken the SAT, a requirement for a four-year college entry, and were likely considering and preparing for a four-year school. Accordingly, the results of this study may not necessarily generalize to AP or to dual enrollment students who did not take the SAT. Additionally, this study only addressed outcomes at four-year colleges and universities and so these results should not be expected to generalize to students attending two-year institutions. Lastly, this study could not control for differences in motivation between AP and dual enrollment students.

Limitations notwithstanding, these analyses were able to contribute to the literature by providing a nationally based comparison of college outcomes for AP and dual enrollment students. This study, along with others, should assist students, parents, and policymakers in making informed choices between AP and dual enrollment course work.

## References

- ACE Credit. (2013). College Board Advanced Placement® (AP®) examinations. *The national guide to college credit for workforce training*. Washington, DC: American Council on Education. Retrieved February 11, 2013, from <http://www2.acenet.edu/credit/?fuseaction=browse.getOrganizationDetail&FICE=300271>
- Achieve, Inc. (2004). *The American diploma project. Ready or not: Creating a high school diploma that counts*. Washington, DC: Achieve, Inc., The Education Trust, & Thomas B. Fordham Foundation.
- ACT (2013). *The condition of college & career readiness 2013*. Retrieved from: <https://www.act.org/research/policymakers/cccr13/pdf/CCCR13-NationalReadinessRpt.pdf>
- Adelman, C. (2006). *The tool box revisited: Paths to degree completion from high school through college*. Washington, DC: U.S. Department of Education.
- Adelman, C. (1999). *Answers in the tool box: Academic intensity, attendance patterns, and bachelor's degree attainment*. Washington, DC: U.S. Department of Education.
- Adelman, C., Daniel, B., & Berkovits, I. (2003). *Postsecondary attainment, attendance, curriculum, and performance: Selected results from the NELS:88/2000 postsecondary education transcript study (PETS), 2000* (NCES 2003-394). Washington, DC: U.S. Department of Education, National Center for Education Statistics.
- Allen, D., & Dadgar, M. (2012). Does dual enrollment increase students' success in college? Evidence from a quasi-experimental analysis of dual enrollment in New York City. *New Directions for Higher Education, 2012*(158), 11–19.
- Attewell, P., & Domina, T. (2008). Raising the bar: Curricular intensity and academic practice. *Educational Evaluation and Policy Analysis, 30*(1), 51–71.
- Bailey, T. R., & Karp, M. M. (2003). *Promoting college access and success: A review of credit-based transition programs*. Washington, DC: U.S. Department of Education, Office of Vocational and Adult Education.
- Baum, B., Ma, J., & Payea, K. (2013). *Education pays 2013. The benefit of higher education for individuals and society*. New York: The College Board. Retrieved from: <http://trends.collegeboard.org/sites/default/files/education-pays-2013-full-report.pdf>
- Bridgeman, B., Pollack, J., & Burton, N. (2004). *Understanding what SAT Reasoning Test™ scores add to high school grades: A straightforward approach* (College Board Research Report No. 2004-4). New York: The College Board. Retrieved from: <http://research.collegeboard.org/rr2004-4.pdf>
- Bureau of Labor Statistics. *Occupational outlook handbook*. Retrieved from: <http://www.bls.gov/ooh/fastest-growing.htm>
- Chajewski, M., Mattern, K. D., & Shaw, E. J. (2011). Examining the role of Advanced Placement® Exam participation in four-year college enrollment. *Educational Measurement: Issues and Practice, 30*(4) 16–27.
- College Board (2013). *2013 SAT report on college and career readiness*. Retrieved from: <http://media.collegeboard.com/homeOrg/content/pdf/sat-report-college-career-readiness-2013.pdf>
- Dodd, B. G., Fitzpatrick, S. J., De Ayala, R. J., & Jennings, J. A. (2002). *An investigation of the validity of AP grades of 3 and a comparison of AP and non-AP student groups*. (College Board Research Report No. 2002-9). New York: The College Board. Retrieved from: <http://research.collegeboard.org/rr2002-9.pdf>

- Dougherty, C., Mellor, L., & Jian, S. (2006). *The relationship between Advanced Placement and college graduation*. (National Center for Accountability: 2005 AP Study Series, Report 1). Austin, Texas: National Center for Educational Accountability.
- Eimers, M. T., & Mullen, R. (2003). *Dual credit and Advanced Placement: Do they help prepare students for success in college?* Paper presented at Association of Institutional Research Annual Forum, Tampa, FL.
- Fields, R. (2014). *Towards the national assessment of educational progress (NAEP) as an indicator of academic preparedness for college and job training*. Washington, DC: National Assessment Governing Board.
- Geiser, S., & Santelices, V. (2004). *The role of Advanced Placement and honors courses in college admissions*. (Research & Occasional Paper Series No. CSHE 4.04). University of California, Berkeley.
- Hargrove, L., Godin, D., & Dodd, B. (2008). *College outcomes comparisons by AP and non-AP high school experiences*. (College Board Research Report No. 2008-3). New York: The College Board. Retrieved from: <http://research.collegeboard.org/rr2008-3.pdf>
- Horn, L., & Kojaku, L. (2001). *High school academic curriculum and the persistence path through college* (NCES 2001-163). Washington, DC: U.S. Department of Education, National Center for Education Statistics.
- Hughes, K. L., Rodriguez, O., Edwards, L., & Belfield, C. (2012). *Broadening the benefits of dual enrollment: Reaching underachieving and underrepresented students with career-focused programs*. New York: Community College Research Center, Teachers College, Columbia University.
- Kaliski, P. K., & Godfrey, K. E. (2014). *Does the level of rigor of a high school science course matter? An investigation of the relationship between science courses and first-year college outcomes* (College Board Research Report 2014-2).
- Karp, M., Calcagno, J. C., Hughes, K., Jeong, D. W., & Bailey, T. (2007). *The postsecondary achievement of participants in dual enrollment: An analysis of student outcomes in two states*. New York: Community College Research Center, Teachers College, Columbia University.
- Long, M. C., Conger, D., & Iatarola, P. (2012). Effects of high school course-taking on secondary and postsecondary success. *American Educational Research Journal*, 49(2), 285–322.
- Mattern, K. D., Marini, J. P., & Shaw, E. J. (2013). *Are AP students more likely to graduate from college on time?* (College Board Research Report 2013-5). Retrieved from: <http://research.collegeboard.org/sites/default/files/publications/2014/1/research-report-2013-5-are-ap-students-more-likely-graduate-college.pdf>
- Mattern, K. D., Shaw, E. J., & Xiong, X. (2009). *The relationship between AP Exam performance and college outcomes* (College Board Research Report 2009-4). New York: The College Board. Retrieved from: <http://research.collegeboard.org/rr2009-4.pdf>
- Milewski, G. B., & Sawtell, E. A. (2006). *Relationships between PSAT/NMSQT scores and academic achievement in high school* (College Board Research Report No. 2006-6). New York: The College Board. Retrieved from: <http://research.collegeboard.org/rr2006-6.pdf>
- Morgan, R., & Crone, C. (1993). *Advanced Placement examinees at the University of California: An examination of freshman-year courses and grades of examinees in biology, calculus, and chemistry*. (ETS Statistical Report 93-210). Princeton, NJ: Educational Testing Service.

- Morgan, R., & Klaric, J. (2007). *AP students in college: An analysis of five-year academic careers*. College Board Research Report (2007-4). New York: The College Board.  
Retrieved from: <https://research.collegeboard.org/sites/default/files/publications/2012/7/researchreport-2007-4-ap-students-college-analysis-five-year-academic-careers.pdf>
- Morgan, R., & Ramist, L. (1998). *Advanced Placement students in college: An investigation of course grades and 21 colleges*. (ETS Statistical Report No. 98-13). Princeton, NJ: Educational Testing Service.
- Murphy, D., & Dodd, B. (2009). *A comparison of college performance or matched AP and non-AP student groups*. (College Board Research Report 2009-6). Retrieved from: <https://research.collegeboard.org/sites/default/files/publications/2012/7/researchreport-2009-6-comparison-college-performance-matched-ap-non-ap-student-groups.pdf>
- National Commission on Excellence in Education. (1983). *A nation at risk: The imperative for educational reform*. Washington DC: U.S. Department of Education. NCEE. Retrieved from: <http://www2.ed.gov/pubs/NatAtRisk/index.html>
- Speroni, C. (December 2011). *High school dual enrollment programs: Are we fast-tracking students too fast?* An NCPWR Working Paper. National Center for Postsecondary Research.
- Speroni, C. (November 2011). *Determinants of students' success: The role of Advanced Placement and dual enrollment programs*, An NCPWR Working Paper, National Center for Postsecondary Research.
- Struhl, B., & Vargas, J., (2012). *Taking college courses in high school: A strategy for college readiness. The college outcomes of dual enrollment in Texas*. Retrieved from: [http://www.jff.org/sites/default/files/publications/TakingCollegeCourses\\_101712.pdf](http://www.jff.org/sites/default/files/publications/TakingCollegeCourses_101712.pdf)
- Swanson, J. L. (2008). *An analysis of the impact of high school dual enrollment course participation on post-secondary academic success, persistence, and degree completion (Doctoral dissertation)*. Iowa City, IA: University of Iowa, College of Education.
- Thomas, N., Marken, S., Gray, L., and Lewis, L. (2013). *Dual credit and exam-based courses in U.S. public high schools: 2010–11* (NCES 2013-001). Washington, DC: U.S. Department of Education. National Center for Education Statistics. Retrieved from: <http://nces.ed.gov/pubsearch>
- University of Arizona. (1999). *Community college and AP credit: An analysis of the impact on freshman grades*. Tucson, AZ: Author. Internet: [www.aer.arizona.edu/Enrollment/Papers/dualenr.pdf](http://www.aer.arizona.edu/Enrollment/Papers/dualenr.pdf)
- U.S. Department of Education. (2008). *Leading education indicators: Trends in education*. Retrieved from <http://www.ed.gov/nclb/accountability/results/trends/index/html>
- Willingham, W. W., & Morris, M. (1986). *Four years later: A longitudinal study of Advanced Placement students in college*. (College Board Research Report No. 86-2). New York: The College Board. Retrieved from: <http://research.collegeboard.org/rr1986-2.pdf>
- Wirt, J., Choy, S., Rooney, P., Provasnik, S., Sen, A., & Tobin, R. (2004). *The condition of education 2004* (NCES 2004-077). Washington, DC: U.S. Department of Education, National Center for Education Statistics.



**Table A1.**

Model Parameters for Four-Year Enrollment (Sample 1)

Predictor		Est.	SE	p	OR
Intercept		0.891	0.006	<.001	n/a
Gender	Female	0.140	0.005	<.001	1.151
Racial/ Ethnic Identity	Asian	-0.279	0.009	<.001	0.757
	African American	0.601	0.008	<.001	1.824
	Hispanic	-0.287	0.008	<.001	0.751
	Other	-0.138	0.012	<.001	0.871
Highest Level of Parental Education	No HS Diploma	-0.424	0.012	<.001	0.654
	HS Diploma	-0.403	0.006	<.001	0.669
	Associate Degree	-0.336	0.009	<.001	0.715
	Graduate Degree	0.132	0.007	<.001	1.141
AP/Dual Enrollment Group	AP < 3	0.416	0.007	<.001	1.515
	AP >= 3	0.461	0.008	<.001	1.586
	DE 2	-0.249	0.012	<.001	0.780
	DE 4	0.782	0.025	<.001	2.185
HSGPA <sup>a</sup>		0.580	0.004	<.001	1.786
SAT-CR <sup>a, b</sup>		0.129	0.004	<.001	1.138
SAT-M <sup>a, b</sup>		0.356	0.004	<.001	1.428
SAT-W <sup>a, b</sup>		0.273	0.005	<.001	1.314
<p>a. Predictor was centered to its grand mean.</p> <p>b. Predictor was divided by 100 to more closely match the scale of the others.</p> <p>Note. OR: odds ratio. n/a: not applicable. Sample 1: <math>n = 1,063,616</math>. The reference group was white males whose parents earned at most a bachelor's degree and who took neither AP nor dual enrollment courses.</p>					

<b>Table A2.</b>						
Predicted Probabilities of Four-Year Enrollment						
Group	Category	Student AP & Dual Enrollment Category				
		No AP, DE	AP < 3	AP ≥ 3	DE at 2-Yr	DE at 4-Yr
Gender <sup>a</sup>	Female	73.7%	81.0%	81.6%	68.6%	86.0%
	Male	70.9%	78.7%	79.4%	65.5%	84.2%
Racial/ Ethnic Identity <sup>b</sup>	Asian	68.0%	76.3%	77.1%	62.3%	82.3%
	African American	83.6%	88.6%	89.0%	79.9%	91.8%
	Hispanic	67.8%	76.1%	76.9%	62.1%	82.1%
	White	73.7%	81.0%	81.6%	68.6%	86.0%
	Other	71.0%	78.7%	79.5%	65.6%	84.2%
Highest Level of Parental Education <sup>c</sup>	No HS Diploma	64.7%	73.6%	74.4%	58.9%	80.0%
	HS Diploma	65.2%	74.0%	74.8%	59.4%	80.4%
	Associate Degree	66.7%	75.2%	76.1%	61.0%	81.4%
	Bachelor's Degree	73.7%	81.0%	81.6%	68.6%	86.0%
	Graduate Degree	76.2%	82.9%	83.5%	71.4%	87.5%

a. Predicted probabilities for white students whose parent(s) highest degree earned was a bachelor's degree.  
b. Predicted probabilities for female students whose parent(s) highest degree earned was a bachelor's degree.  
c. Predicted probabilities for white female students.  
Note. Sample 1:  $n = 1,063,616$ . Predicted probabilities are calculated with HSGPA, SAT-CR, SAT-M, and SAT-W set to their respective means.

**Table A3.**

Model Parameters for Four-Year Persistence (Sample 2)

Predictor		Est.	SE	p	OR
Intercept		1.364	0.007	<.001	n/a
Gender	Female	0.139	0.006	<.001	1.149
Racial/ Ethnic Identity	Asian	0.014	0.012	.247	1.014
	African American	-0.080	0.010	<.001	0.923
	Hispanic	-0.249	0.011	<.001	0.780
	Other	-0.139	0.015	<.001	0.870
Highest Level of Parental Education	No HS Diploma	-0.398	0.017	<.001	0.672
	HS Diploma	-0.466	0.008	<.001	0.628
	Associate Degree	-0.335	0.011	<.001	0.715
	Graduate Degree	0.122	0.008	<.001	1.129
AP/Dual Enrollment Group	AP < 3	0.263	0.009	<.001	1.300
	AP ≥ 3	0.452	0.009	<.001	1.571
	DE 2	-0.083	0.016	<.001	0.920
	DE 4	0.039	0.025	.121	1.040
HSGPA <sup>a</sup>		0.560	0.006	<.001	1.750
SAT-CR <sup>a, b</sup>		-0.078	0.006	<.001	0.925
SAT-M <sup>a, b</sup>		0.165	0.005	<.001	1.179
SAT-W <sup>a, b</sup>		0.181	0.006	<.001	1.199

a. Predictor was centered to its mean.  
b. Predictor was divided by 100 to more closely match the scale of the others.  
Note. OR: odds ratio. n/a: not applicable. Sample 2:  $n = 728,968$ . The reference group was white males whose parents earned at most a bachelor's degree and who took neither AP nor dual enrollment courses.

<b>Table A4.</b>						
Predicted Probabilities of Four-Year Persistence						
Student AP & Dual Enrollment Category						
Group	Category	No AP, DE	AP < 3	AP ≥ 3	DE at 2-Yr	DE at 4-Yr
Gender <sup>a</sup>	Female	81.8%	85.4%	87.6%	80.5%	82.4%
	Male	79.6%	83.6%	86.0%	78.3%	80.3%
Racial/ Ethnic Identity <sup>b</sup>	Asian	82.0%	85.6%	87.8%	80.8%	82.6%
	African American	80.6%	84.4%	86.7%	79.2%	81.2%
	Hispanic	77.8%	82.0%	84.6%	76.3%	78.5%
	White	81.8%	85.4%	87.6%	80.5%	82.4%
	Other	79.6%	83.6%	86.0%	78.3%	80.3%
Highest Level of Parental Education <sup>c</sup>	No HS Diploma	75.1%	79.7%	82.6%	73.5%	75.8%
	HS Diploma	73.8%	78.6%	81.6%	72.2%	74.6%
	Associate Degree	76.3%	80.7%	83.5%	74.7%	77.0%
	Bachelor's Degree	81.8%	85.4%	87.6%	80.5%	82.4%
	Graduate Degree	83.5%	86.9%	88.9%	82.4%	84.1%

a. Predicted probabilities for white students whose parent(s) highest degree earned was a bachelor's degree.  
b. Predicted probabilities for female students whose parent(s) highest degree earned was a bachelor's degree.  
c. Predicted probabilities for white female students.  
Note. Sample 2:  $n = 728,968$ . Predicted probabilities are calculated with HSGPA, SAT-CR, SAT-M, and SAT-W set to their respective means.

**Table A5.**

Model Parameters for Four-Year Graduation (Sample 2)

Predictor		Est.	SE	p	OR
Intercept		-0.617	0.006	<.001	n/a
Gender	Female	0.504	0.006	<.001	1.656
Racial/ Ethnic Identity	Asian	-0.302	0.010	<.001	0.739
	African American	-0.400	0.010	<.001	0.670
	Hispanic	-0.508	0.010	<.001	0.602
	Other	-0.302	0.013	<.001	0.739
Highest Level of Parental Education	No HS Diploma	-0.394	0.018	<.001	0.675
	HS Diploma	-0.346	0.007	<.001	0.708
	Associate Degree	-0.217	0.010	<.001	0.805
	Graduate Degree	0.117	0.006	<.001	1.124
AP/Dual Enrollment Group	AP < 3	0.141	0.008	<.001	1.152
	AP >= 3	0.462	0.007	<.001	1.586
	DE 2	0.120	0.015	<.001	1.128
	DE 4	0.220	0.022	<.001	1.246
HSGPA <sup>a</sup>		0.645	0.006	<.001	1.907
SAT-CR <sup>a, b</sup>		-0.016	0.005	.001	0.984
SAT-M <sup>a, b</sup>		0.156	0.004	<.001	1.169
SAT-W <sup>a, b</sup>		0.270	0.005	<.001	1.310
<p>a. Predictor was centered to its mean.</p> <p>b. Predictor was divided by 100 to more closely match the scale of the others.</p> <p>Note. OR: odds ratio. n/a: not applicable. Sample 2: <math>n = 728,968</math>. The reference group was white males whose parents earned at most a bachelor's degree and who took neither AP nor dual enrollment courses.</p>					

**Table A6.**

Predicted Probabilities of Four-Year Graduation (Sample 2)

		Student AP & Dual Enrollment Category				
Group	Category	No AP, DE	AP < 3	AP ≥ 3	DE at 2-Yr	DE at 4-Yr
Gender <sup>a</sup>	Female	47.2%	50.7%	58.6%	50.2%	52.7%
	Male	35.0%	38.3%	46.1%	37.8%	40.2%
Racial/ Ethnic Identity <sup>b</sup>	Asian	39.8%	43.2%	51.2%	42.7%	45.1%
	African American	37.4%	40.8%	48.7%	40.3%	42.7%
	Hispanic	35.0%	38.2%	46.0%	37.7%	40.1%
	White	47.2%	50.7%	58.6%	50.2%	52.7%
	Other	39.8%	43.2%	51.2%	42.7%	45.1%
Highest Level of Parental Education <sup>c</sup>	No HS Diploma	37.6%	41.0%	48.9%	40.4%	42.9%
	HS Diploma	38.7%	42.1%	50.1%	41.6%	44.1%
	Associate Degree	41.8%	45.3%	53.3%	44.8%	47.3%
	Bachelor's Degree	47.2%	50.7%	58.6%	50.2%	52.7%
	Graduate Degree	50.1%	53.6%	61.4%	53.1%	55.6%

a. Predicted probabilities for white students whose parent(s) highest degree earned was a bachelor's degree.  
b. Predicted probabilities for female students whose parent(s) highest degree earned was a bachelor's degree.  
c. Predicted probabilities for white female students.  
Note. Sample 2:  $n = 728,968$ . Predicted probabilities are calculated with HSGPA, SAT-CR, SAT-M, and SAT-W set to their respective means.

**Table A7.**

Model Parameters for Six-Year Graduation (Sample 2)

Predictor		Est.	SE	p	OR
Intercept		0.670	0.007	<.001	n/a
Gender	Female	0.349	0.006	<.001	1.418
Racial/ Ethnic Identity	Asian	-0.131	0.011	<.001	0.877
	African American	-0.364	0.009	<.001	0.695
	Hispanic	-0.441	0.010	<.001	0.644
	Other	-0.264	0.014	<.001	0.768
Highest Level of Parental Education	No HS Diploma	-0.415	0.016	<.001	0.660
	HS Diploma	-0.430	0.007	<.001	0.650
	Associate Degree	-0.290	0.010	<.001	0.748
	Graduate Degree	0.119	0.007	<.001	1.126
AP/Dual Enrollment Group	AP < 3	0.179	0.008	<.001	1.196
	AP ≥ 3	0.487	0.008	<.001	1.628
	DE 2	0.031	0.015	.040	1.031
	DE 4	0.090	0.023	<.001	1.094
HSGPA <sup>a</sup>		0.701	0.006	<.001	2.015
SAT-CR <sup>a, b</sup>		-0.111	0.005	<.001	0.895
SAT-M <sup>a, b</sup>		0.180	0.004	<.001	1.197
SAT-W <sup>a, b</sup>		0.235	0.005	<.001	1.265
<p>a. Predictor was centered to its mean.</p> <p>b. Predictor was divided by 100 to more closely match the scale of the others.</p> <p>Note. OR: odds ratio. n/a: not applicable. Sample 2: <math>n = 728,968</math>. The reference group was white males whose parents earned at most a bachelor's degree and who took neither AP nor dual enrollment courses.</p>					

**Table A8.**

Predicted Probabilities of Six-Year Graduation (Sample 2)

		Student AP & Dual Enrollment Category				
Group	Category	No AP, DE	AP < 3	AP ≥ 3	DE at 2-Yr	DE at 4-Yr
Gender <sup>a</sup>	Female	73.5%	76.8%	81.8%	74.1%	75.2%
	Male	66.2%	70.0%	76.1%	66.8%	68.1%
Racial/ Ethnic Identity <sup>b</sup>	Asian	70.8%	74.4%	79.8%	71.5%	72.7%
	African American	65.8%	69.7%	75.8%	66.5%	67.8%
	Hispanic	64.1%	68.1%	74.4%	64.8%	66.1%
	White	73.5%	76.8%	81.8%	74.1%	75.2%
	Other	68.0%	71.8%	77.6%	68.7%	70.0%
Highest Level of Parental Education <sup>c</sup>	No HS Diploma	64.7%	68.6%	74.9%	65.4%	66.7%
	HS Diploma	64.3%	68.3%	74.6%	65.0%	66.4%
	Associate Degree	67.5%	71.3%	77.1%	68.1%	69.4%
	Bachelor's Degree	73.5%	76.8%	81.8%	74.1%	75.2%
	Graduate Degree	75.7%	78.9%	83.5%	76.3%	77.3%

a. Predicted probabilities for white students whose parent(s) highest degree earned was a bachelor's degree.  
b. Predicted probabilities for female students whose parent(s) highest degree earned was a bachelor's degree.  
c. Predicted probabilities for white female students.  
Note. Sample 2:  $n = 728,968$ . Predicted probabilities are calculated with HSGPA, SAT-CR, SAT-M, and SAT-W set to their respective means.



**Table A9.**

Model Parameters for First-Year Grade Point Average (Sample 3)

Predictor		Est.	SE	p
Intercept		2.828	0.005	<.001
Gender	Female	0.171	0.004	<.001
Racial/ Ethnic Identity	Asian	-0.035	0.007	<.001
	African American	-0.176	0.007	<.001
	Hispanic	-0.194	0.007	<.001
	Other	-0.073	0.010	<.001
Highest Level of Parental Education	No HS Diploma	-0.026	0.014	.060
	HS Diploma	-0.085	0.005	<.001
	Associate Degree	-0.044	0.008	<.001
	Graduate Degree	0.029	0.004	<.001
AP/Dual Enrollment Group	AP < 3	-0.030	0.006	<.001
	AP ≥ 3	0.149	0.005	<.001
	DE 2	-0.031	0.009	.001
	DE 4	0.061	0.016	<.001
HSGPA <sup>a</sup>		0.392	0.004	<.001
SAT-CR <sup>a, b</sup>		0.024	0.003	<.001
SAT-M <sup>a, b</sup>		0.043	0.003	<.001
SAT-W <sup>a, b</sup>		0.097	0.003	<.001

a. Predictor was centered to its mean.  
b. Predictor was divided by 100 to more closely match the scale of the others.  
Note. Sample 3:  $n = 128,623$ . The reference group was white males whose parents earned at most a bachelor's degree and who took neither AP nor dual enrollment courses.

**Table A10.**

Predicted First-Year Grade Point Average (Sample 3)

Student AP & Dual Enrollment Category						
Group	Category	No AP, DE	AP < 3	AP ≥ 3	DE at 2-Yr	DE at 4-Yr
Gender <sup>a</sup>	Female	2.999	2.969	3.148	2.968	3.060
	Male	2.828	2.798	2.977	2.797	2.889
Racial/ Ethnic Identity <sup>b</sup>	Asian	2.964	2.934	3.113	2.933	3.025
	African American	2.823	2.793	2.972	2.792	2.884
	Hispanic	2.805	2.775	2.954	2.774	2.866
	White	2.999	2.969	3.148	2.968	3.060
	Other	2.926	2.896	3.075	2.895	2.987
Highest Level of Parental Education <sup>c</sup>	No HS Diploma	2.973	2.943	3.122	2.942	3.034
	HS Diploma	2.914	2.884	3.063	2.883	2.975
	Associate Degree	2.955	2.925	3.104	2.924	3.016
	Bachelor's Degree	2.999	2.969	3.148	2.968	3.060
	Graduate Degree	3.028	2.998	3.177	2.997	3.089

a. Predicted probabilities for white students whose parent(s) highest degree earned was a bachelor's degree.  
b. Predicted probabilities for female students whose parent(s) highest degree earned was a bachelor's degree.  
c. Predicted probabilities for white female students.  
Note. Sample 3:  $n = 128,623$ . Predicted probabilities are calculated with HSGPA, SAT-CR, SAT-M, and SAT-W set to their respective means.

# The Research department actively supports the College Board's mission by:

- Providing data-based solutions to important educational problems and questions
- Applying scientific procedures and research to inform our work
- Designing and evaluating improvements to current assessments and developing new assessments as well as educational tools to ensure the highest technical standards
- Analyzing and resolving critical issues for all programs, including AP<sup>®</sup>, SAT<sup>®</sup>, PSAT/NMSQT<sup>®</sup>
- Publishing findings and presenting our work at key scientific and education conferences
- Generating new knowledge and forward-thinking ideas with a highly trained and credentialed staff

## Our work focuses on the following areas

Admission	Measurement
Alignment	Research
Evaluation	Trends
Fairness	Validity

