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Advanced Placement® Exam Participation

Is AP® Exam Participation and Performance Related to Choice of College Major?

By Krista D. Mattern, Emily J. Shaw, and Maureen Ewing

Maureen Ewing is a senior director at the College Board.

Krista D. Mattern and Emily J. Shaw are associate research scientists at the College Board.

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Executive Summary

Previous research has found a positive relationship between AP® participation and performance with various college outcomes. Building on this work, the current study investigated the relationship between AP participation and performance with choice of college major. Specifically, this study examined whether students who take an AP Exam in a certain content domain are more likely to major in that domain than students who did not take an AP Exam in that area, controlling for relevant student characteristics. Results reveal a positive relationship between AP participation and majoring in a related field in college. This was true across all content areas examined; however, the effect was stronger for some areas than others. For example, there was a strong link between taking an AP Exam in computer science and majoring in computer sciences in college. Alternatively, taking an AP Exam in humanities or social sciences was not as strong of an indicator of a student subsequently majoring in that respective area in college. Additionally, students' AP scores in that content domain were also related to their likelihood of majoring in that domain. Results showed that students who took no AP Exams were more likely to be undeclared.

Introduction

The Advanced Placement Program® (AP), which began in 1955, offers high school students the opportunity to engage in college-level course work and demonstrate learning outcomes through a corresponding end-of-course examination. There are currently more than 30 AP courses offered in areas ranging from the foreign languages to the physical sciences to human geography. Each course has an associated exam, which is criterion-referenced and for which students earn a score on a scale ranging from 1 to 5; more than 90 percent of four-year institutions in the United States grant college credit and/or course exemption [http://professionals.collegeboard.org/testing/ap/scores/credit-policies].

Much research has been conducted on the predictive validity of AP Exam scores in relation to college success. Even after controlling for student characteristics, results have consistently found a positive relationship between AP participation and performance and various college outcomes, such as:

- grade earned in subsequent course (Casserly, 1986; Dodd, Fitzpatrick, De Ayala, & Jennings, 2002; Keng & Dodd, 2008; Morgan & Crone, 1993; Morgan & Ramist, 1998);
- first-year grade point average (Hargrove et al., 2008; Mattern, Shaw, & Xiong, 2009);
- retention to second-year (Mattern et al., 2009); and
- graduation (Dougherty, Mellor, & Jian, 2005).

Research has also examined the relationship between AP participation and students' choice of college major. Given that there is a renewed focus on fostering interest in particular careers, especially in the science, technology, engineering, and mathematics (STEM) fields, this research is particularly relevant. Research has found that AP participation and performance is related to an increased likelihood of majoring in a related domain or earning a greater number of college credits in the AP Exam subject area (e.g., Dodd et al., 2002; Morgan & Klaric, 2007; Morgan & Maneckshana, 2000; Tai, Liu, Almarode, & Fan, 2010).

Dodd et al. (2002) compared four cohorts of students from a large public university on a number of college outcomes including grades in subsequent courses and the number of credits taken in college in the corresponding AP content area. They examined four groups of students: AP students who placed out of one or more introductory courses in the sequence; AP students who took the introductory course prior to the subsequent course; an academically matched group of non-AP students who also took the introductory course; and students who were concurrently enrolled in a college-level course while in high school. The authors found that the AP students who earned credit for the introductory course earned grades in the subsequent course that were equal to or better than the other groups. These students also tended to earn more college credit in the subject area of the AP Examination, and they had equivalent or higher grades in the more advanced courses in that subject area.

More recently, Keng and Dodd (2008) and Murphy and Dodd (2009) conducted similar studies examining the 10 most frequently taken AP Exam subject areas to determine whether the findings from Dodd et al. (2002) still held after the AP Program had undergone significant expansion in the number of high schools offering AP courses as well as in the number of AP Exams taken. Both studies analyzed the same data, but the study by Murphy and Dodd (2009) was more comprehensive because all of the comparison groups were matched in terms of high school rank and admission test scores. Results from Murphy and Dodd indicated that AP students who earned credit for one or more introductory courses consistently earned, on

average, higher first-year college GPAs as well as higher GPAs in the subject area of the exam than the academically matched non-AP group. In addition, AP students who earned credit for one or more introductory courses also took more college credit hours in the subject area of the exam and overall compared to the matched non-AP group.

Morgan and Klaric (2007) examined over 70,000 students at 27 institutions in two groups: AP students who took at least one AP Exam and non-AP students. They examined the proportions of students who took particular AP Exams and graduated with degrees in closely related majors to the AP Exam domain. These percentages were compared with students who did not take any AP Exam but graduated with a major in that particular field. Morgan and Klaric found that the percentage of students who graduated with a degree related to the domain of their AP Exam was much higher than for students who did not take an AP Exam but graduated with the same degree. Most notably, students who took AP Exams in Studio Art, Art History, Computer Science AB, French Language, French Literature, German Language, Latin, and Music Theory were at least 10 times more likely to major in a related domain than the non-AP students.

The results of these studies and others, taken together, do support the further investigation of the AP program's role in college major choice and in increasing the number of STEM college graduates and the STEM workforce in the U.S.

Additionally, Tai et al. (2010) examined whether students taking AP Exams in science or mathematics were more likely to major in STEM-related concentrations in college. Using multinomial logistic regression analysis and controlling for student ability, gender, race/ethnicity, and socioeconomic status, they found that AP Calculus students were approximately four times more likely to major in the physical sciences or engineering over a non-science area. Also, students who participated in AP Exams covering biology, chemistry, or physics were more than twice as likely to major in the life sciences versus a non-science major.

Robinson (2003) similarly found that students across eight high schools in one diverse district that took AP courses in calculus and/or the sciences were more likely to major in STEM fields in college than students who did not take these courses. Shaw and Barbuti (2010) also examined the demographic, academic, and aspirational characteristics associated with student persistence in intended major (chosen while in high school) at the beginning of the third year of college. They found that taking one or more AP Exams in a STEM field was related to persistence in a STEM major in college at the beginning of the third year.

The results of these studies and others, taken together, do support the further investigation of the AP program's role in college major choice and in increasing the number of STEM college graduates and the STEM workforce in the U.S.

Current Study

There is further theoretical support for the idea that participation in AP courses and exams may be expected to factor into a students' choice of college major. In addition to including gender, race/ethnicity, and socioeconomic status, among other variables, most of the existing models and extensive examinations of major choice incorporate the role of experience (positive or negative) with related course work in the domain prior to choosing the major field (e.g., Allen & Robbins, 2008; Larson, Wei, Wu, Borgen, & Bailey, 2007; Lent, Sheu, Singley, Schmidt, Schmidt, & Gloster, 2008; Leuwerke Robbins, Sawyer, & Hovland, 2004; Maple & Stage, 1991; Maltese, 2008; Nauta & Epperson, 2003; Scott & Mallinckrodt, 2005; Trusty, 2002; Turner & Bowen, 1999). Trusty (2002) remarked that while all career development theories consider the individual's skills, abilities, and prior achievements, Krumboltz's (1979; 1996) social learning theory of career decision making particularly elevates the role of skill development through learning experiences such as course-taking. These learning experiences, coupled with environmental circumstances and the individual's cognitive and emotional reactions to these learning experiences and circumstances, influence the decision to pursue study in a particular area.

We were interested in examining whether students who took an AP Exam in a certain content domain were more likely to major in that content domain than students who had not taken an AP Exam in that content domain.

Building on previous research, the current study examined the relationship between AP Exam participation and performance and college major. Specifically, we were interested in examining whether students who took an AP Exam in a certain content domain were more likely to major in that content domain than students who had not taken an AP Exam in that content domain, controlling for relevant student characteristics (i.e., gender, ethnicity, parental education, HSGPA, and SAT® scores). Additionally, unlike previous research, this study examined the relationship between AP performance as well as participation (and the interaction of the two) with the likelihood of majoring in that area.

Method

Sample

Of the 67 four-year colleges and universities that submitted second-year performance data for the entering class of fall 2006 to the College Board for research on test validity and college success, 39 institutions also provided information on students' majors at the beginning of their third year of college and comprised the sample of the current study. These 39 institutions were among the 110 institutions participating in the National SAT Validity Study (Kobrin, Patterson, Shaw, Mattern, & Barbuti, 2008). The data from these colleges and universities were merged with College Board data including SAT scores, student responses to the SAT Questionnaire (SAT-Q), as well as student performance on AP Exams. Students complete the SAT-Q when they register to take the SAT. In order for students at these 39 institutions to be included in the sample for this study, they had to have a valid major provided by the college or

university. The resulting sample size was 39,440 students and 15 majors. Females comprised 53.1 percent of the sample. As for the ethnic/racial breakdown, 71.5 percent were white, 9.1 percent were Asian, 6.7 percent were Hispanic, 4.9 percent African American/black, 0.5 percent American Indian, 2.8 percent indicated "other," and 4.5 percent did not respond.

Measures

Demographic information. Demographic information including gender, race/ethnicity, and highest parental education was self-reported by the students and obtained from the SAT-Q. Highest parental education was used as an indicator of socioeconomic status. Household income was not used in the current study because of missing data.

High school grade point average (HSGPA). HSGPA was self-reported and obtained from the SAT-Q. Students' HSGPAs were on a 12-point scale ranging from a maximum of A+ (4.33) to a minimum of F (0.00).

SAT scores. Official SAT Reasoning Test™ scores obtained from the 2006 College-Bound Senior Cohort database were used in the analyses. This database is comprised of the students who participated in the SAT program and reported to graduate from high school in 2006. The student's most recent score was used in the analyses. The SAT is comprised of three sections — Critical Reading, Math and Writing — and the score scale ranges from 200 to 800 for each section.

AP scores. Official AP scores were obtained from College Board records. For each student, the number of AP Exams taken, along with the score on each exam, was obtained. Data on 35 AP Exams were available during this time period; AP Japanese Language and Culture and AP Chinese Language and Culture became operational after this cohort graduated from high school and, therefore, are not included in this study. To test the research question, AP Exams were categorized by content area to align with broad major fields. Refer to Table 1 for the classification of AP Exams into six major content domains.

College Major. The students' majors at the beginning of their third year (as reported by institutions) were classified based on Classification of Instruction Programs (CIP) codes or combinations of CIP codes (NCES, 2010). Table 2 lists the 15 categories used in the current study along with the number and percentage of students majoring in each.

Table 1

Classification of AP Exams into Major Content Domains

	AP Exam	Major Content Domain
A	Biology	Biological & Biomedical Sciences
	Environmental Science	
B	Computer Science A	Computer and Information Science
	Computer Science AB*	
C	French Language	Foreign Languages, Literatures, & Linguistics
	French Literature*	
	German Language	
	Italian Language and Culture	
	Latin Literature*	
	Latin: Vergil	
	Spanish Language	
	Spanish Literature	
D	Art History	Humanities & Liberal Arts
	English Language and Composition	
	English Literature and Composition	
	European History	
	Government and Politics: Comparative	
	Government and Politics: United States	
	Music Theory	
	Studio Art: 2-D Design	
	Studio Art: 3-D Design	
	Studio Art: Drawing	
	United States History	
	World History	
E	Calculus AB	Mathematics & Statistics/Engineering/Physical Sciences
	Calculus BC	
	Chemistry	
	Physics B	
	Physics C: Electricity and Magnetism	
	Physics C: Mechanics	
	Statistics	
F	Human Geography	Social Sciences
	Psychology	
	Macroeconomics	
	Microeconomics	

*AP Exams that have subsequently been retired.

Table 2

Distribution of College Majors by AP Exam Domain Participation

Major Category	Total	A Biological Sciences	B Computer Science	C Foreign Languages	D Humanities	E Math/ Physical Sciences	F Social Sciences	No AP
1. Agriculture/ Natural Resources	1.3	1.8	0.1	0.9	1.1	1.0	0.5	1.5
2. Biological and Biomedical Sciences	8.4	20.3	6.5	9.9	9.7	11.1	9.4	6.1
3. Business, Management, and Marketing	15.9	10.0	11.0	13.9	13.2	14.1	16.3	19.5
4. Communications/ Journalism	6.6	3.7	1.9	5.2	6.5	4.1	5.9	7.9
5. Computer and Information Science	2.3	1.9	17.9	1.5	2.1	3.3	2.1	1.9
6. Education	5.4	2.7	0.9	3.1	3.8	2.8	3.2	8.3
7. Architecture	1.1	1.0	0.9	1.1	1.3	1.6	1.1	0.7
8. Foreign Languages, Literatures, and Linguistics	1.5	1.2	0.8	5.1	1.9	1.4	1.6	1.1
9. Health Professions and Related Clinical Sciences	6.1	7.1	1.1	4.2	5.1	5.0	4.4	7.2
10. Humanities and Liberal Arts	13.3	10.8	4.7	13.4	15.1	8.8	12.0	13.0
11. Engineering/ Math/Statistics/ Physical Sciences	16.2	17.8	44.5	15.6	18.4	29.1	19.9	9.6
12. Security and Protective Services	1.6	0.8	0.2	0.5	0.8	0.6	0.7	2.8
13. Social Sciences	14.0	16.2	6.7	20.2	16.0	12.7	18.1	12.1
14. Social Services and Public Administration	0.7	0.3	0.2	0.3	0.6	0.4	0.5	0.9
15. Undeclared	5.6	4.4	2.7	5.1	4.4	4.2	4.4	7.4
Total	39,440	5,703	1,159	4,091	20,287	14,803	5,958	14,234

Analyses

Logistic regression analyses were conducted to predict majoring in a specific content domain in college. For each AP content domain, two regression models were run. The first model used the entire sample to estimate the effect of AP participation (number of AP Exams taken in that content domain) on the likelihood of majoring in that domain. The second model, based only on students who took at least one AP Exam in that domain, examined the effect of both AP participation (number of AP Exams taken in the content domain) and AP Exam performance (average AP score in that domain) as well as the interaction between the two. All

17.9 percent of AP computer science students majored in computer and information sciences, compared to 2.3 percent of the total sample.

models controlled for gender, race/ethnicity, highest parental education level, and academic achievement (HSGPA and SAT scores). Additionally, we examined whether or not taking one or more AP Exams was related to having an undeclared major.

Results

The distribution of students by college major for the total sample and for each AP content area is provided in Table 2. For the total sample, the largest percentage of students majored in engineering, math, statistics, or physical sciences (16.2 percent), closely followed by business, management and marketing (15.9 percent), and social sciences (14.0 percent). On the other hand, few students majored in computer and information sciences (2.3 percent), security and protective services (1.6 percent), foreign languages, literatures, or linguistics (1.5 percent), agriculture or natural resources (1.3 percent), architecture (1.1 percent), and social services and public administration (0.7 percent).

Whether students who took an AP Exam in a specific content area were more likely to major in that same content area was examined. As for the 5,703 students who took at least one biological sciences AP Exam (refer to Table 1 for AP Exam content classification) in high school, a higher percentage of students (20.3 percent) majored in biological and biomedical sciences, as compared to the total sample (8.4 percent). Similarly, 17.9 percent of AP computer science students majored in computer and information sciences, compared to 2.3 percent of the total sample. Similar results were found for AP foreign language and AP math and physical science students and, to a lesser degree, for AP humanities and AP social sciences students. Finally, students who did not take any AP Exams were more likely to have an undeclared major, as compared to the total sample. Next logistic regression analyses were conducted to test for the effect of AP Exam participation and performance on the choice of college major, controlling for relevant student characteristics.

AP® Biological Sciences

Descriptive Statistics. Table 3 provides the demographic characteristics and academic preparation of AP biological sciences students (N = 5,703) compared to the rest of the sample. As shown in Table 1, AP biological sciences consisted of two AP Exams: AP Biology and AP Environmental Sciences. Females, Asian students, and students whose parents have higher education levels comprise a larger percentage of the AP biological sciences group, as compared to the rest of the sample. They also tend to be more academically prepared in terms of SAT scores and HSGPA. The percentage of students majoring in biological/biomedical sciences by the number of AP biological sciences exams is presented in Figure 1. Overall, 8.4 percent of the sample majored in biological/biomedical sciences, as compared to 6.4 percent of students who took no AP biological sciences exams, 20.1 percent who took one of the two exams, and 26.1 percent who took both.

Table 3

Descriptive Statistics of AP Biological Sciences and Non-AP Biological Sciences Students

	AP Biological Sciences Students	Non-AP Biological Sciences Students
Number of Students	5,703	33,737
	Percentage of Students	
Female	54.9	52.8
Race/Ethnicity		
American Indian	0.3	0.6
Asian	17.0	7.8
Black/African American	3.5	5.2
Hispanic	6.1	6.8
Other	2.8	2.8
White	65.2	72.6
No Response	5.1	4.4
Highest Parental Education		
No High School Diploma	1.4	1.6
High School Diploma	12.9	20.5
Associate Degree	4.7	6.9
Bachelor's Degree	31.8	34.3
Graduate Degree	44.0	32.2
No Response	5.3	4.5
	Mean (SD) of Academic Measures	
SAT – CR	614 (85)	558 (93)
SAT – M	634 (84)	577 (96)
SAT – W	606 (84)	550 (91)
HSGPA	3.82 (0.40)	3.62 (0.50)

Logistic Regression Analyses. The results of the logistic regression analysis examining the effect of AP biological sciences exam participation on the likelihood of majoring in biological/biomedical sciences are provided in Table 4. The odds ratio for AP biological sciences exam count was 3.032. In other words, a student taking one AP biological sciences exam has a little over three times the odds of majoring in biological/biomedical sciences than a student who did not take any AP biological sciences exams. Additionally, a student taking two AP biological sciences exams has a little over six times the odds of majoring in biological/biomedical sciences than a student who did not take any AP biological sciences exams.

A logistic model was run for the subset of students (N = 5,177) who took at least one AP biological sciences exam to examine the relationship between performance as well as participation on the likelihood of majoring in that domain. Figure 2 graphically

A student taking two AP biological sciences exams has a little over six times the odds of majoring in biological/biomedical sciences than a student who did not take any AP biological sciences exams.

shows that AP biological sciences exam performance is related to a student's likelihood of majoring in the biological/biomedical sciences. Only 10 percent of students whose average AP score was a 1 majored in that domain, as compared to nearly 30 percent of students with an score of 5. For the logistic regression results, both the number of exams and the average performance was positively related to majoring in biological/biomedical sciences (see Table 5). The interaction term was negative indicating that a higher level on one variable (e.g., 2 versus 1 exam) is related to smaller increases in the likelihood of majoring in biological/biomedical sciences for similar increases in the other variable (e.g., average score of 1 versus 2).

Figure 1: The percentage of students majoring in a specific domain by the number of AP Exams taken in that domain

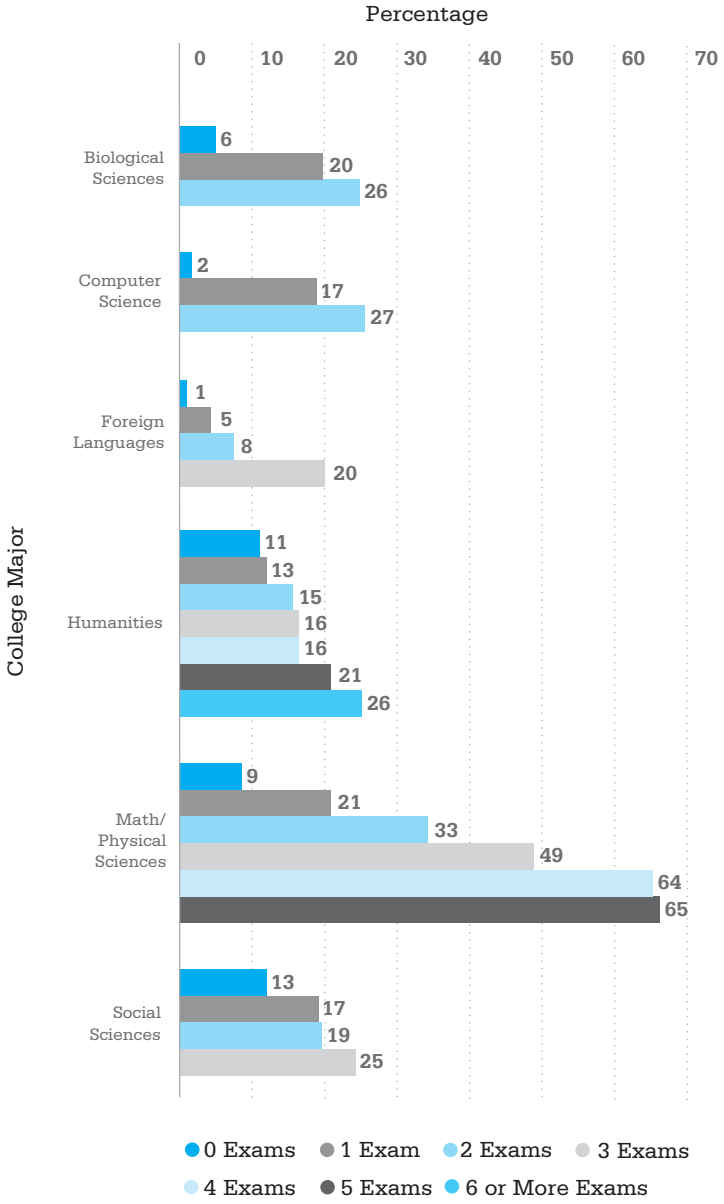

Table 4

Logistic Regression of Majoring in Biological/Biomedical Sciences (AP Biological Sciences Exam Count)

Variable	B	SE	Exp(B)	Sig.	VIF	*Pseudo* R_{CS}^2	*Pseudo* R_N^2
Intercept	-2.290	0.059	0.101	0.000		0.033	0.074
Gender (1=males, 0=female)	-0.298	0.042	0.742	0.000	1.163		
Ethnicity (1=nonminority, 0=underrepresented minority)	-0.215	0.053	0.807	0.000	1.051		
Highest Parental Degree: Graduate	-0.047	0.051	0.954	0.354	1.616		
Highest Parental Degree: Bachelor's	-0.223	0.051	0.800	0.000	1.508		
HSGPA	0.582	0.049	1.790	0.000	1.293		
SAT Critical Reading	-0.001	0.000	0.999	0.079	2.866		
SAT Mathematics	0.002	0.000	1.002	0.000	2.171		
SAT Writing	-0.001	0.000	0.999	0.020	2.998		
AP Biological Sciences Exam Count (0,1,2)	1.109	0.040	3.032	0.000	1.061		

Note. N = 36,259. **B**= log odds; Exp(**B**) = odds ratio; Pseudo R_{CS}^2= Cox and Snell R^2; Pseudo R_N^2= Nagelkerke R^2. HSGPA, SAT Critical Reading, SAT Mathematics, and SAT Writing were grand mean centered. Underrepresented minority students include American Indian, African American, Hispanic, and Other students. Nonminority students include White and Asian students.

Table 5

Logistic Regression of Majoring in Biological/Biomedical Sciences (Average AP Biological Sciences Exam Grade)

Variable	B	SE	Exp(B)	Sig.	VIF	*Pseudo* R_{CS}^2	*Pseudo* R_N^2
Intercept	-0.924	0.120	0.397	0.000		0.040	0.063
Gender (1=males, 0=female)	-0.289	0.076	0.749	0.000	1.124		
Ethnicity (1=nonminority, 0=underrepresented minority)	-0.092	0.107	0.912	0.391	1.067		
Highest Parental Degree: Graduate	-0.186	0.097	0.830	0.055	1.971		
Highest Parental Degree: Bachelor's	-0.388	0.101	0.679	0.000	1.840		
HSGPA	0.425	0.100	1.530	0.000	1.136		
SAT Critical Reading	-0.003	0.001	0.997	0.000	2.647		
SAT Mathematics	0.001	0.001	1.001	0.314	1.938		
SAT Writing	-0.001	0.001	0.999	0.395	2.608		
AP Biological Sciences Exam Count (1,2)	0.529	0.174	1.697	0.002	1.009		
Mean AP Biological Sciences Exam Score	0.419	0.038	1.521	0.000	1.717		
AP Biological Sciences Exam Count X Score	-0.319	0.142	0.727	0.024	1.008		

Note. N = 5,177. **B**= log odds; Exp(**B**) = odds ratio; Pseudo R_{CS}^2= Cox and Snell R^2; Pseudo R_N^2= Nagelkerke R^2. HSGPA, SAT Critical Reading, SAT Mathematics, SAT Writing, AP Biological Sciences Exam Count, and Mean AP Biological Sciences Exam Score were grand mean centered. Underrepresented minority students include American Indian, African American, Hispanic, and Other students. Nonminority students include White and Asian students.

Figure 2: The percentage of students majoring in a specific domain by their average AP score in that domain

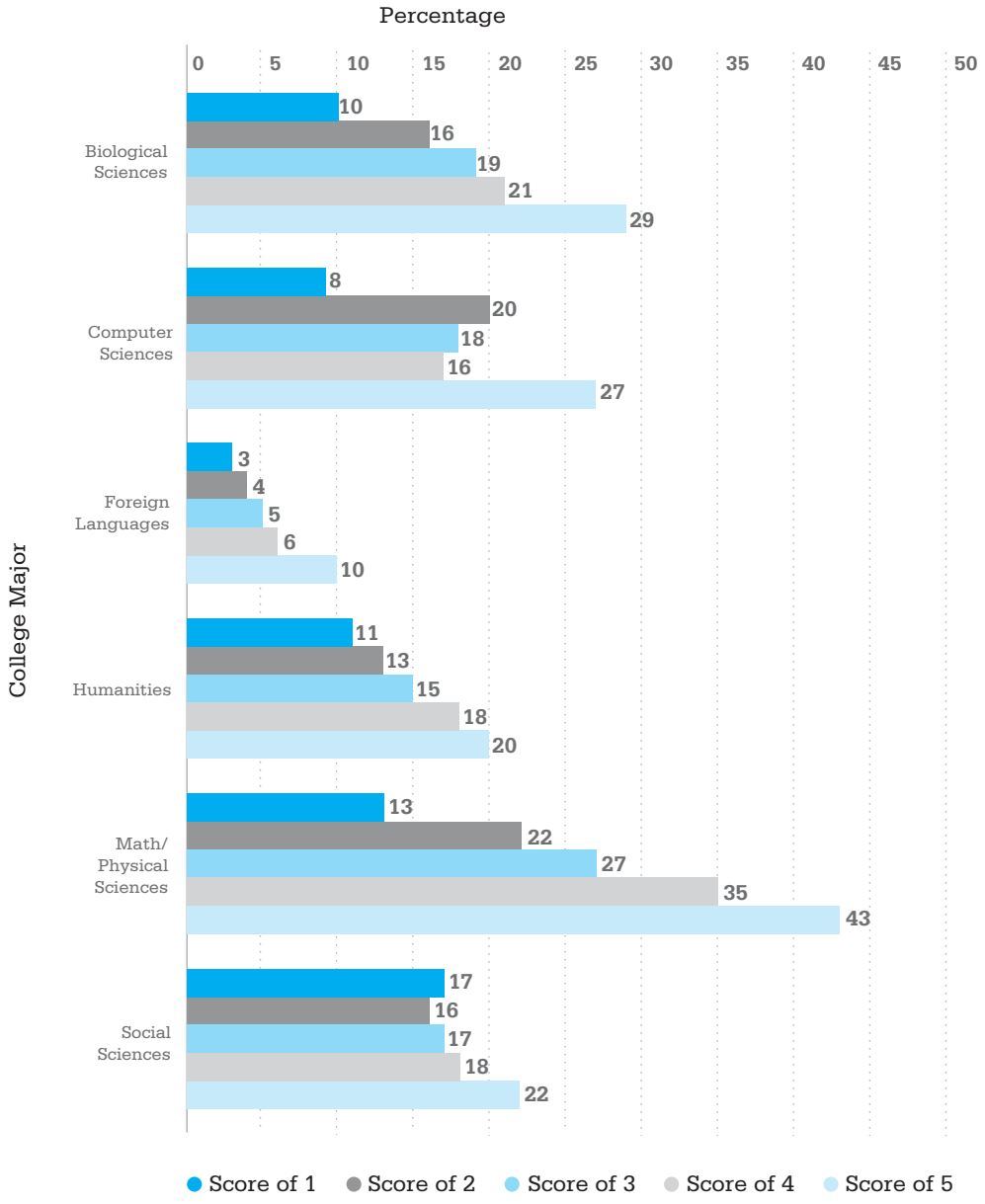

Figure 2 graphically illustrates the effect of AP math/physical sciences performance on majoring in math/physical sciences. Only 12.8 percent of students whose average AP score was a 1 majored in that domain, as compared to 43.3 percent of students whose average AP score was a 5.

AP Computer Sciences

Descriptive Statistics. Table 6 provides the demographic characteristics and academic preparation of AP computer sciences students (N = 1,159) compared to the rest of the sample. As shown in Table 1, AP computer sciences consisted of two AP Exams: AP Computer Science A and AP Computer Science AB. Males, Asian students, and students whose parents have higher education levels comprise a larger percentage of the AP computer sciences group, as compared to the rest of the sample. They also tend to be more academically prepared in terms of SAT scores and HSGPA. Refer to Figure 1 for the percentage of students majoring in computer sciences by number of AP computer sciences exams. Overall, 2.3 percent of the sample majored in computer sciences, as compared to 1.8 percent of students who took no AP computer sciences exams, 16.8 percent who took one of the two exams, and 27.1 percent who took both.

Table 6

Descriptive Statistics of AP Computer Sciences and Non-AP Computer Sciences Students

	AP Computer Sciences Students	Non-AP Computer Sciences Students
Number of Students	1,159	38,281
	Percentage of Students	
Female	15.9	54.3
Race/Ethnicity		
American Indian	0.9	0.5
Asian	24.2	8.6
Black/African American	2.3	5.0
Hispanic	5.2	6.7
Other	1.9	2.8
White	61.5	71.8
No Response	4.0	4.5
Highest Parental Education		
No High School Diploma	1.5	1.5
High School Diploma	10.4	19.7
Associate Degree	2.7	6.7
Bachelor's Degree	32.4	34.0
Graduate Degree	46.4	33.5
No Response	6.6	4.5
	Mean (SD) of Academic Measures	
SAT – CR	630 (82)	565 (94)
SAT – M	695 (70)	582 (96)
SAT – W	616 (84)	557 (92)
HSGPA	3.79 (0.42)	3.64 (0.50)

Logistic Regression Analyses. The results of the logistic regression analysis examining the effect of AP computer sciences exam participation on the likelihood of majoring in computer sciences are provided in Table 7. The odds ratio for AP computer sciences exam count was 4.563. In other words, a student taking one AP computer sciences exam has a little over 4.5 times the odds of majoring in computer sciences than a student who did not take any AP computer sciences exams. Additionally, a student taking two AP computer sciences exams has a little over 9 times the odds of majoring in computer sciences than a student who did not take any AP computer sciences exams.

Table 7

Results of Logistic Regression Analyses Predicting Majoring in Computer and Information Sciences (AP Computer Sciences Exam Count)

Variable	B	SE	Exp(B)	Sig.	VIF	*Pseudo* R_{CS}^2	*Pseudo* R_N^2
Intercept	-5.394	0.160	0.005	0.000		0.031	0.163
Gender (1=males, 0=female)	2.253	0.131	9.515	0.000	1.167		
Ethnicity (1=nonminority, 0=underrepresented minority)	0.024	0.110	1.024	0.828	1.051		
Highest Parental Degree: Graduate	-0.544	0.098	0.580	0.000	1.614		
Highest Parental Degree: Bachelor's	-0.266	0.092	0.766	0.004	1.508		
HSGPA	-0.196	0.082	0.822	0.016	1.291		
SAT Critical Reading	0.002	0.001	1.002	0.005	2.863		
SAT Mathematics	0.002	0.001	1.002	0.000	2.193		
SAT Writing	-0.002	0.001	0.998	0.004	2.992		
AP Computer Sciences Exam Count (0,1,2)	1.518	0.081	4.563	0.000	1.046		

Note. N = 36,259. **B**= log odds; Exp(**B**) = odds ratio; Pseudo R_{CS}^2= Cox and Snell R^2; Pseudo R_N^2= Nagelkerke R^2. HSGPA, SAT Critical Reading, SAT Mathematics, and SAT Writing were grand mean centered. Underrepresented minority students include American Indian, African American, Hispanic, and Other students. Nonminority students include White and Asian students.

Table 8

Logistic Regression of Majoring in Computer Sciences (Average AP Computer Sciences Exam Grade)

Variable	B	SE	Exp(B)	Sig.	VIF	*Pseudo* R_{CS}^2	*Pseudo* R_N^2
Intercept	-1.745	0.430	0.175	0.000		0.078	0.163
Gender (1=males, 0=female)	1.292	0.336	3.642	0.000	1.076		
Ethnicity (1=nonminority, 0=underrepresented minority)	0.347	0.301	1.414	0.250	1.073		
Highest Parental Degree: Graduate	-0.873	0.235	0.418	0.000	2.312		
Highest Parental Degree: Bachelor's	-0.771	0.241	0.462	0.001	2.226		
HSGPA	-0.119	0.216	0.887	0.581	1.181		
SAT Critical Reading	-0.001	0.001	0.999	0.578	2.096		
SAT Mathematics	-0.006	0.002	0.994	0.000	1.674		
SAT Writing	0.001	0.001	1.001	0.435	2.200		
AP Computer Sciences Exam Count (1,2)	0.351	0.304	1.420	0.248	1.489		
Mean AP Computer Sciences Exam Score	0.412	0.076	1.510	0.000	1.529		
AP Computer Sciences Exam Count X Score	0.146	0.241	1.157	0.545	1.449		

Note. N = 1,045. **B**= log odds; Exp(**B**) = odds ratio; Pseudo R_{CS}^2= Cox and Snell R^2; Pseudo R_N^2= Nagelkerke R^2. HSGPA, SAT Critical Reading, SAT Mathematics, and SAT Writing were grand mean centered. Underrepresented minority students include American Indian, African American, Hispanic, and Other students. Nonminority students include White and Asian students.

Additionally, a logistic model was run for the subset of students (N = 1,045) who took at least one AP computer sciences exam to examine the relationship between performance as well as participation on the likelihood of majoring in that domain. Figure 2 graphically illustrates the effect of AP computer sciences performance on majoring in computer sciences. Only 8.3

percent of students whose average AP score was a 1 majored in that domain, as compared to 27.3 percent of students whose average AP score was a 5; however, unlike the biological sciences results, there was not a monotonic relationship between AP score and percentage of students majoring in the domain. For the logistic regression results, the average performance was positively related to majoring in computer sciences; however, the effect of exam count and the interaction were not significant (see Table 8).

AP Foreign Languages

Descriptive Statistics. Table 9 provides the demographic characteristics and academic preparation of AP foreign language students (N = 4,091) compared to the rest of the sample. As shown in Table 1, AP foreign languages consisted of eight AP Exams: French Language, French Literature, German Language, Spanish Literature, Italian Language and Culture, Latin Literature, Latin: Vergil, and Spanish Language. Females, Asian and Hispanic students, and students whose parents have higher education levels comprise a larger percentage of the AP foreign language group, as compared to the rest of the sample. They also tend to be more academically prepared in terms of SAT scores and HSGPA. The percentage of students majoring in foreign languages by number of AP foreign language exams is provided in Figure 1. Overall, 1.5 percent of the sample majored in foreign languages, as compared to 1.1 percent of students who took no AP foreign language exams, 4.7 percent of students who took one exam, 7.8 percent of students who took two exams, and 20.0 percent of students who took three or more.

Table 9

Descriptive Statistics of AP Foreign Languages and Non-AP Foreign Languages Students

	AP Foreign Languages Students	Non-AP Foreign Languages Students
Number of Students	4,091	35,349
	Percentage of Students	
Female	61.5	52.2
Race/Ethnicity		
American Indian	0.2	0.6
Asian	11.0	8.9
Black/African American	2.8	5.2
Hispanic	17.5	5.4
Other	3.5	2.7
White	59.4	72.9
No Response	5.6	4.4
Highest Parental Education		
No High School Diploma	3.4	1.3
High School Diploma	12.8	20.2
Associate Degree	3.9	6.9
Bachelor's Degree	29.3	34.5
Graduate Degree	44.8	32.6
No Response	5.8	4.5
	Mean (SD) of Academic Measures	
SAT – CR	623 (89)	560 (93)
SAT – M	634 (88)	580 (96)
SAT – W	624 (87)	551 (90)
HSGPA	3.85 (0.38)	3.62 (0.50)

Logistic Regression Analyses. The results of the logistic regression analysis examining the effect of AP foreign languages exam participation on the likelihood of majoring in foreign languages are provided in Table 10. The odds ratio for AP foreign languages exam count was 2.592. In other words, with each addition of AP foreign languages exam participation, the odds of majoring in foreign languages increases by roughly 2.5 times.

Table 10

Results of Logistic Regression Analyses Predicting Majoring in Foreign Languages (AP Foreign Language Exam Count)

Variable	B	SE	Exp(B)	Sig.	VIF	*Pseudo* R_{CS}^2	*Pseudo* R_N^2
Intercept	-4.042	0.133	0.018	0.000		0.010	0.070
Gender (1=males, 0=female)	-0.621	0.103	0.538	0.000	1.165		
Ethnicity (1=nonminority, 0=underrepresented minority)	-0.150	0.119	0.861	0.208	1.072		
Highest Parental Degree: Graduate	-0.237	0.119	0.789	0.045	1.615		
Highest Parental Degree: Bachelor's	-0.139	0.115	0.870	0.228	1.508		
HSGPA	0.082	0.109	1.085	0.453	1.292		
SAT Critical Reading	0.003	0.001	1.003	0.000	2.864		
SAT Mathematics	-0.003	0.001	0.997	0.000	2.163		
SAT Writing	0.003	0.001	1.003	0.000	3.023		
AP Foreign Language Exam Count	0.952	0.075	2.592	0.000	1.083		

Note. N = 36,259. **B**= log odds; Exp(**B**) = odds ratio; Pseudo R_{CS}^2= Cox and Snell R^2; Pseudo R_N^2= Nagelkerke R^2. HSGPA, SAT Critical Reading, SAT Mathematics, and SAT Writing were grand mean centered. Underrepresented minority students include American Indian, African American, Hispanic, and Other students. Nonminority students include White and Asian students.

Table 11

Results of Logistic Regression Analyses Predicting Majoring in Foreign Languages (Average AP Foreign Language Exam Grade)

Variable	B	SE	Exp(B)	Sig.	VIF	*Pseudo* R_{CS}^2	*Pseudo* R_N^2
Intercept	-3.145	0.218	0.043	0.000		0.025	0.078
Gender (1=males, 0=female)	-0.661	0.194	0.516	0.001	1.106		
Ethnicity (1=nonminority, 0=underrepresented minority)	0.586	0.230	1.797	0.011	1.383		
Highest Parental Degree: Graduate	-0.271	0.219	0.763	0.216	2.109		
Highest Parental Degree: Bachelor's	-0.341	0.232	0.711	0.142	1.896		
HSGPA	-0.264	0.219	0.768	0.227	1.093		
SAT Critical Reading	0.000	0.001	1.000	0.850	2.717		
SAT Mathematics	-0.005	0.001	0.995	0.000	2.007		
SAT Writing	0.004	0.002	1.004	0.015	2.908		
AP Foreign Language Exam Count	0.583	0.232	1.792	0.012	1.306		
Mean AP Foreign Language Exam Score	0.359	0.073	1.431	0.000	1.210		
AP Foreign Language Exam Count X Score	-0.046	0.176	0.955	0.794	1.271		

Note. N = 3,674. **B**= log odds; Exp(**B**) = odds ratio; Pseudo R_{CS}^2= Cox and Snell R^2; Pseudo R_N^2= Nagelkerke R^2. HSGPA, SAT Critical Reading, SAT Mathematics, and SAT Writing were grand mean centered. Underrepresented minority students include American Indian, African American, Hispanic, and Other students. Nonminority students include White and Asian students.

Additionally, a logistic model was run for the subset of students (N = 3,674) who took at least one AP foreign languages exam to examine the relationship between performance as well as participation on the likelihood of majoring in that domain. Figure 2 graphically illustrates the effect of AP foreign languages performance on majoring in foreign languages. Only 2.8 percent of students whose average AP score was a 1 majored in that domain, as compared to 9.8 percent of students whose average AP score was a 5. For the logistic regression results, the number of exams and the average performance were positively related to majoring in foreign languages; the effect of the interaction term was not significant (see Table 11).

AP Humanities

Table 12

Descriptive Statistics of AP Humanities and Non-AP Humanities Students

	AP Humanities Students	Non-AP Humanities Students
Number of Students	20,287	19,153
	Percentage of Students	
Female	54.8	51.4
Race/Ethnicity		
American Indian	0.4	0.6
Asian	11.5	6.5
Black/African American	4.4	5.5
Hispanic	7.8	5.6
Other	2.8	2.8
White	68.2	75.0
No Response	5.0	4.0
Highest Parental Education		
No High School Diploma	1.6	1.5
High School Diploma	15.5	23.6
Associate Degree	5.3	8.0
Bachelor's Degree	34.0	33.8
Graduate Degree	38.8	28.7
No Response	4.8	4.4
	Mean (SD) of Academic Measures	
SAT – CR	606 (85)	525 (85)
SAT – M	617 (89)	552 (94)
SAT – W	596 (84)	519 (84)
HSGPA	3.81 (0.41)	3.47 (0.52)

Descriptive Statistics. Table 12 provides the demographic characteristics and academic preparation of AP humanities students (N = 20,287) compared to the rest of the sample. As shown in Table 1, AP humanities consisted of 12 AP Exams: Art History, English Language and Composition, English Literature and Composition, European History, Government and Politics: Comparative, Government and Politics: United States, Music Theory, Studio Art: 2-D Design, Studio Art: 3-D Design, Studio Art: Drawing, United States History, and World History. Females, Asian students, and students whose parents have higher education levels comprise a larger percentage of the AP humanities group, as compared to the rest of the sample. They also tend to be more academically prepared in terms of SAT scores and HSGPA. See Figure 1 for the percentage of students majoring in humanities by number of AP humanities exams. Overall, 13.3 percent of the sample majored in humanities, as compared to 11.3 percent of students who took no AP humanities exams. There was a roughly monotonically increasing relationship between the number of exams taken and the percent majoring, with a low of 13.1 percent for students who took one exam and a high of 25.6 percent for students who took six or more.

Table 13

Results of Logistic Regression Analyses Predicting Majoring in Humanities (AP Humanities Exam Count)

Variable	B	SE	Exp(B)	Sig.	VIF	*Pseudo* R_{CS}^2	*Pseudo* R_N^2
Intercept	-2.322	0.055	0.098	0.000		0.040	0.073
Gender (1=males, 0=female)	-0.142	0.034	0.867	0.000	1.162		
Ethnicity (1=nonminority, 0=underrepresented minority)	0.159	0.046	1.173	0.001	1.062		
Highest Parental Degree: Graduate	0.175	0.043	1.191	0.000	1.614		
Highest Parental Degree: Bachelor's	0.154	0.042	1.166	0.000	1.508		
HSGPA	-0.336	0.036	0.715	0.000	1.323		
SAT Critical Reading	0.005	0.000	1.005	0.000	2.953		
SAT Mathematics	-0.007	0.000	0.993	0.000	2.162		
SAT Writing	0.003	0.000	1.003	0.000	3.020		
AP Humanities Exam Count	0.109	0.012	1.116	0.000	1.332		

Note. N = 36,259. **B**= log odds; Exp(**B**) = odds ratio; Pseudo R_{CS}^2= Cox and Snell R^2; Pseudo R_N^2= Nagelkerke R^2. HSGPA, SAT Critical Reading, SAT Mathematics, and SAT Writing were grand mean centered. Underrepresented minority students include American Indian, African American, Hispanic, and Other students. Nonminority students include White and Asian students.

Logistic Regression Analyses. The results of the logistic regression analysis examining the effect of AP humanities exam participation on the likelihood of majoring in humanities are provided in Table 13. The odds ratio for AP humanities exam count was 1.116, which is smaller than what was found for the other domains, but still significant. However, it should be pointed out that students could take up to 12 AP Exams in this content domain and therefore the accumulated effect could be quite substantial.

Table 14

Results of Logistic Regression Analyses Predicting Majoring in Humanities (Average AP Humanities Exam Grade)

Variable	B	SE	Exp(B)	Sig.	VIF	*Pseudo* R_{CS}^2	*Pseudo* R_N^2
Intercept	-1.992	0.070	0.136	0.000		0.050	0.088
Gender (1=males, 0=female)	-0.117	0.046	0.889	0.011	1.156		
Ethnicity (1=nonminority, 0=underrepresented minority)	0.204	0.062	1.227	0.001	1.103		
Highest Parental Degree: Graduate	0.157	0.059	1.170	0.008	1.833		
Highest Parental Degree: Bachelor's	0.162	0.059	1.176	0.006	1.709		
HSGPA	-0.453	0.054	0.636	0.000	1.149		
SAT Critical Reading	0.003	0.000	1.003	0.000	2.857		
SAT Mathematics	-0.008	0.000	0.992	0.000	1.919		
SAT Writing	0.002	0.000	1.002	0.000	2.597		
AP Humanities Exam Count	0.119	0.017	1.127	0.000	1.137		
Mean AP Humanities Exam Score	0.198	0.031	1.219	0.000	2.093		
AP Humanities Exam Count X Score	-0.017	0.017	0.983	0.334	1.055		

Note. N = 18,536. **B**= log odds; Exp(**B**) = odds ratio; Pseudo R_{CS}^2= Cox and Snell R^2; Pseudo R_N^2= Nagelkerke R^2. HSGPA, SAT Critical Reading, SAT Mathematics, and SAT Writing were grand mean centered. Underrepresented minority students include American Indian, African American, Hispanic, and Other students. Nonminority students include White and Asian students.

Additionally, a logistic model was run for the subset of students (N = 18,536) who took at least one AP humanities exam to examine the relationship between performance as well as participation on the likelihood of majoring in that domain. Figure 2 reveals a positive relationship between AP humanities performance and majoring in humanities. Only 11.0 percent of students whose average AP score was a 1 majored in that domain, as compared to 19.5 percent of students whose average AP score was a 5. For the logistic regression results, the number of exams and the average performance were positively related to majoring in humanities; the effect of the interaction term was not significant (see Table 14).

AP Math/Physical Sciences

Descriptive Statistics. Table 15 provides the demographic characteristics and academic preparation of AP math/physical sciences students (N = 14,803) compared to the rest of the sample. As shown in Table 1, AP math/physical sciences consisted of seven AP Exams: Calculus AB, Calculus BC, Chemistry, Physics B, Physics C: Electricity and Magnetism, Physics C: Mechanics, and Statistics. Males, Asian students, and students whose parents have higher education levels comprise a larger percentage of the AP math/physical sciences group, as compared to the rest of the sample. They also tend to be more academically prepared in terms of SAT scores and HSGPA. The percentage of students majoring in math/physical sciences by number of AP math/physical sciences exams is provided in Figure 1. Overall, 16.2 percent of the sample majored in math/physical sciences, as compared to 8.5 percent of students who took no AP math/physical sciences exams. There was a monotonically increasing relationship between the number of exams taken and the percent majoring, with a low of 20.6 percent for students who took one exam and a high of 65.0 percent for students who took five or more.

Table 15

Descriptive Statistics of AP Math/Physical Sciences and Non-AP Math/Physical Sciences Students

	AP Math/Physical Sciences Students	Non-AP Math/Physical Sciences Students
Number of Students	14,803	24,637
	Percentage of Students	
Female	45.6	57.7
Race/Ethnicity		
American Indian	0.3	0.6
Asian	14.8	5.7
Black/African American	3.2	5.9
Hispanic	6.4	6.9
Other	2.6	2.9
White	68.1	73.6
No Response	4.6	4.4
Highest Parental Education		
No High School Diploma	1.6	1.5
High School Diploma	13.9	22.8
Associate Degree	4.6	7.8
Bachelor's Degree	33.9	33.9
Graduate Degree	40.7	29.8
No Response	5.3	4.2
	Mean (SD) of Academic Measures	
SAT – CR	609 (86)	541 (90)
SAT – M	652 (76)	545 (86)

SAT – W	601 (84)	533 (88)
HSGPA	3.86 (0.38)	3.52 (0.51)

Table 16

Results of Logistic Regression Analyses Predicting Majoring in Mathematics/Physical Sciences (AP Math/Physical Sciences Exam Count)

Variable	B	SE	Exp(B)	Sig.	VIF	*Pseudo* R_{CS}^2	*Pseudo* R_N^2
Intercept	-2.774	0.057	0.062	0.000		0.164	0.278
Gender (1=males, 0 = female)	1.024	0.036	2.786	0.000	1.164		
Ethnicity (1=nonminority, 0=underrepresented minority)	-0.078	0.048	0.925	0.105	1.053		
Highest Parental Degree: Graduate	-0.076	0.044	0.927	0.082	1.615		
Highest Parental Degree: Bachelor's	0.051	0.042	1.052	0.230	1.508		
HSGPA	0.386	0.039	1.471	0.000	1.311		
SAT Critical Reading	-0.001	0.000	0.999	0.001	2.863		
SAT Mathematics	0.009	0.000	1.009	0.000	2.504		
SAT Writing	-0.004	0.000	0.996	0.000	2.992		
AP Math/Physical Sciences Exam Count	0.424	0.017	1.527	0.000	1.439		

Note. N = 36,259. **B**= log odds; Exp(**B**) = odds ratio; Pseudo R_{CS}^2= Cox and Snell R^2; Pseudo R_N^2= Nagelkerke R^2. HSGPA, SAT Critical Reading, SAT Mathematics, and SAT Writing were grand mean centered. Underrepresented minority students include American Indian, African American, Hispanic, and Other students. Nonminority students include White and Asian students.

Table 17

Results of Logistic Regression Analyses Predicting Majoring in Mathematics/Physical Sciences (Average AP Math/Physical Sciences Exam Score)

Variable	B	SE	Exp(B)	Sig.	VIF	*Pseudo* R_{CS}^2	*Pseudo* R_N^2
Intercept	-1.676	0.078	0.187	0.000		0.158	0.225
Gender (1=males, 0=female)	0.956	0.046	2.602	0.000	1.152		
Ethnicity (1=nonminority, 0=underrepresented minority)	-0.014	0.066	0.986	0.832	1.078		
Highest Parental Degree: Graduate	-0.043	0.059	0.958	0.464	1.914		
Highest Parental Degree: Bachelor's	0.101	0.059	1.106	0.087	1.803		
HSGPA	0.184	0.058	1.202	0.001	1.094		
SAT Critical Reading	-0.001	0.000	0.999	0.001	2.308		
SAT Mathematics	0.004	0.000	1.004	0.000	2.126		
SAT Writing	-0.005	0.000	0.995	0.000	2.438		
AP Math/Physical Sciences Exam Count	0.437	0.026	1.548	0.000	1.422		
Mean AP Math/Physical Sciences Exam Score	0.311	0.021	1.365	0.000	1.636		
AP Math/Physical Sciences Exam Count X Score	0.005	0.021	1.005	0.806	1.251		

Note. N = 13,506. **B**= log odds; Exp(**B**) = odds ratio; Pseudo R_{CS}^2= Cox and Snell R^2; Pseudo R_N^2= Nagelkerke R^2. HSGPA, SAT Critical Reading, SAT Mathematics, and SAT Writing were grand mean centered. Underrepresented minority students include American Indian, African American, Hispanic, and Other students. Nonminority students include White and Asian students.

Logistic Regression Analyses. The results of the logistic regression analysis examining the effect of AP math/physical sciences exam participation on the likelihood of majoring in math/physical sciences are provided in Table 16. The odds ratio for AP math/physical sciences exam count was 1.527. Similar to the results for AP humanities, the effect is not large. However, students could take up to seven AP Exams in this content domain, and therefore the accumulated effect is quite substantial for students who take several of the exams compared to a student who did not take any.

Additionally, a logistic model was run for the subset of students (N = 13,506) who took at least one AP math/physical sciences exam to examine the relationship between performance as well as participation on the likelihood of majoring in that domain. Figure 2 graphically illustrates the effect of AP math/physical sciences performance on majoring in math/physical sciences. Only 12.8 percent of students whose average AP score was a 1 majored in that domain, as compared to 43.3 percent of students whose average AP score was a 5. For the logistic regression results, the number of exams and the average performance were positively related to majoring in math/physical sciences; the effect of the interaction term was not significant (see Table 17).

AP Social Sciences

Table 18

Descriptive Statistics of AP Social Sciences and Non-AP Social Sciences Students

	AP Social Sciences Students	Non-AP Social Sciences Students
Number of Students	5,958	33,482
	Percentage of Students	
Female	50.8	53.6
Race/Ethnicity		
American Indian	0.5	0.5
Asian	16.5	7.8
Black/African American	3.4	5.2
Hispanic	8.6	6.4
Other	2.9	2.8
White	63.2	73.0
No Response	4.9	4.4
Highest Parental Education		
No High School Diploma	1.6	1.5
High School Diploma	13.6	20.5
Associate Degree	4.1	7.0
Bachelor's Degree	33.8	34.0
Graduate Degree	41.5	32.5
No Response	5.4	4.5
	Mean (SD) of Academic Measures	
SAT – CR	615 (84)	558 (93)
SAT – M	638 (86)	576 (96)
SAT – W	606 (83)	550 (91)
HSGPA	3.81 (0.40)	3.62 (0.50)

Descriptive Statistics. Table 18 provides the demographic characteristics and academic preparation of AP social sciences students (N = 5,958) compared to the rest of the sample. As shown in Table 1, AP social sciences consisted of four AP Exams: Human Geography,

Psychology, Macroeconomics, and Microeconomics. Similar to the previous AP groups, males, Asian students, and students whose parents have higher education levels comprise a larger percentage of the AP social sciences group compared to the rest of the sample. They also tend to be more academically prepared in terms of SAT scores and HSGPA. The percentage of students majoring in social sciences by number of AP social sciences exams is provided in Figure 1. Overall, 14.0 percent of the sample majored in social sciences, as compared to 13.3 percent of students who took no AP social sciences exams. There was a positive relationship between the number of exams taken and the percent majoring, with a low of 17.4 percent for students who took one exam and a high of 24.7 percent for students who took three or four.

Table 19

Results of Logistic Regression Analyses Predicting Majoring in Social Sciences

Variable	B	SE	Exp(B)	Sig.	VIF	*Pseudo* R_{CS}^2	*Pseudo* R_N^2
Intercept	-1.519	0.045	0.219	0.000		0.023	0.042
Gender (1=males, 0 = female)	-0.234	0.034	0.791	0.000	1.161		
Ethnicity (1=nonminority, 0=underrepresented minority)	-0.407	0.040	0.666	0.000	1.054		
Highest Parental Degree: Graduate	0.142	0.041	1.152	0.001	1.615		
Highest Parental Degree: Bachelor's	-0.063	0.041	0.939	0.123	1.508		
HSGPA	-0.134	0.035	0.874	0.000	1.291		
SAT Critical Reading	0.003	0.000	1.003	0.000	2.870		
SAT Mathematics	-0.004	0.000	0.996	0.000	2.181		
SAT Writing	0.002	0.000	1.002	0.000	2.995		
AP Social Sciences Exam Count	0.249	0.028	1.282	0.000	1.070		

Note. N = 36,259. **B**= log odds; Exp(**B**) = odds ratio; Pseudo R_{CS}^2= Cox and Snell R^2; Pseudo R_N^2= Nagelkerke R^2. HSGPA, SAT Critical Reading, SAT Mathematics, and SAT Writing were grand mean centered. Underrepresented minority students include American Indian, African American, Hispanic, and Other students. Nonminority students include White and Asian students.

Table 20

Logistic Regression of Majoring in Social Sciences (Average AP Social Sciences Exam Grade)

Variable	B	SE	Exp(B)	Sig.	VIF	*Pseudo* R_{CS}^2	*Pseudo* R_N^2
Intercept	-1.189	0.112	0.304	0.000		0.030	0.049
Gender (1=males, 0=female)	-0.207	0.077	0.813	0.008	1.150		
Ethnicity (1=nonminority, 0=underrepresented minority)	-0.433	0.095	0.649	0.000	1.095		
Highest Parental Degree: Graduate	0.314	0.105	1.369	0.003	1.982		
Highest Parental Degree: Bachelor's	0.144	0.105	1.155	0.172	1.843		
HSGPA	-0.258	0.094	0.773	0.006	1.146		
SAT Critical Reading	0.002	0.001	1.002	0.024	2.387		
SAT Mathematics	-0.005	0.001	0.995	0.000	1.940		
SAT Writing	0.002	0.001	1.002	0.001	2.405		
AP Social Sciences Exam Count	0.253	0.066	1.288	0.000	1.075		
Mean AP Social Sciences Exam Score	0.129	0.035	1.137	0.000	1.487		
AP Social Sciences Exam Count X Score	-0.038	0.057	0.963	0.509	1.078		

Note. N = 5,412. **B**= log odds; Exp(**B**) = odds ratio; Pseudo R_{CS}^2= Cox and Snell R^2; Pseudo R_N^2= Nagelkerke R^2. HSGPA, SAT Critical Reading, SAT Mathematics, and SAT Writing were grand mean centered. Underrepresented minority students include American Indian, African American, Hispanic, and Other students. Nonminority students include White and Asian students.

Logistic Regression Analyses. The results of the logistic regression analysis examining the effect of AP social sciences exam participation on the likelihood of majoring in social sciences are provided in Table 19. The odds ratio for AP social sciences exam count was 1.282, which is significant but a small effect.

Additionally, a logistic model was run for the subset of students (N = 5,412) who took at least one AP social sciences exam to examine the relationship between performance as well as participation on the likelihood of majoring in that domain. Figure 2 graphically illustrates the effect of AP social sciences performance on majoring in social sciences. With the exception of students who had an average score of 1 on the AP social sciences exam(s), the percentage of students majoring in social sciences increased as a function of average AP score, with a high of 21.7 percent for students whose average AP score was a 5. For the logistic regression results, the number of exams and the average performance were positively related to majoring in social sciences; the effect of the interaction term was not significant (see Table 20).

AP Students and Undeclared Majors

Table 21

Descriptive Statistics of AP and Non-AP Students

	AP Students	Non-AP Students
Number of Students	25,206	14,234
	Percentage of Students	
Female	52.8	53.8
Race/Ethnicity		
American Indian	0.4	0.7
Asian	11.3	5.1
Black/African American	4.3	6.0
Hispanic	7.6	5.1
Other	2.8	2.8
White	68.8	76.2
No Response	4.7	4.0
Highest Parental Education		
No High School Diploma	1.6	1.4
High School Diploma	15.8	25.8
Associate Degree	5.4	8.7
Bachelor's Degree	34.1	33.6
Graduate Degree	38.2	26.3
No Response	4.9	4.1
	Mean (SD) of Academic Measures	
SAT – CR	596 (86)	514 (84)
SAT – M	617 (88)	529 (86)
SAT – W	588 (85)	507 (82)
HSGPA	3.78 (0.42)	3.41 (0.53)

Descriptive Statistics. Table 21 provides the demographic characteristics and academic preparation of AP students (N = 25,206) who took at least one AP Exam compared to students

who took no AP Exams. Asian students and students whose parents have higher education levels comprise a larger percentage of the AP group, as compared to the group that took no AP Exams. They also tend to be more academically prepared in terms of SAT scores and HSGPA.

Logistic Regression Analyses. The results of the logistic regression analysis examining the effect of AP Exam participation on the likelihood of having an undeclared major are provided in Table 22. The odds ratio for AP participation was 0.855, indicating that AP students are less likely to be undeclared compared to students who took no AP Exams, though the effect is small.

Table 22

Results of Logistic Regression Analyses Predicting an Undeclared Major

Variable	B	SE	Exp(B)	Sig.	VIF	*Pseudo* R_{CS}^2	*Pseudo* R_N^2
Intercept	-2.802	0.080	0.061	0.000		0.011	0.031
Gender (1=males, 0 = female)	0.276	0.050	1.318	0.000	1.163		
Ethnicity (1=nonminority, 0=underrepresented minority)	-0.134	0.061	0.875	0.029	1.064		
Highest Parental Degree: Graduate	0.006	0.060	1.006	0.924	1.615		
Highest Parental Degree: Bachelor's	-0.117	0.058	0.890	0.045	1.508		
HSGPA	-0.491	0.050	0.612	0.000	1.336		
SAT Critical Reading	-0.001	0.000	0.999	0.014	2.889		
SAT Mathematics	-0.001	0.000	0.999	0.000	2.234		
SAT Writing	0.000	0.000	1.000	0.452	3.006		
AP Participation (1 = Yes, 0 = No)	-0.156	0.055	0.855	0.004	1.374		

Note. N = 36,259. **B**= log odds; Exp(**B**) = odds ratio; Pseudo R_{CS}^2= Cox and Snell R^2; Pseudo R_N^2= Nagelkerke R^2. HSGPA, SAT Critical Reading, SAT Mathematics, and SAT Writing were grand mean centered. Underrepresented minority students include American Indian, African American, Hispanic, and Other students. Nonminority students include White and Asian students.

Discussion

The findings corroborate previous research, in that students who take an AP Exam in a particular content area are more likely to major in a related discipline in college, even when taking into account relevant student characteristics (Keng & Dodd, 2008; Morgan & Klaric, 2007; Tai, Liu, Almarode, & Fan, 2010). Furthermore, of the subsample of students who took at least one AP Exam in a particular content domain, those with higher scores had an increased likelihood of majoring in that content area. These results provide support for the AP program as a medium by which to expose students to advanced academic material in various content areas, potentially confirming or sparking interest in particular career paths. Also, AP courses can provide opportunities for students to be academically successful in a particular domain, thereby fostering self-efficacy beliefs in that area, which in turn has been shown to promote sustained interest in related careers (Bandura, 1986, 1997; Larose, Ratelle, Guay, Senecal, & Harvey, 2006; Luzzo, Hasper, Albert, Bibby, & Martinelli, 1999).

The relationship between AP participation and college major was stronger for some domains than others. In particular, students who took an AP computer science exam(s) as well as students who took a math and/or physical science exam(s) were much more likely to major in a similar content domain. The base rate of computer science majors was extremely low for the entire sample (2.3 percent); however, 27.1 percent of students who took both computer science exams majored in that domain, which is nearly 12 times larger. Likewise, 16.2 percent of the sample majored in a STEM-related field, as compared to 65.5 percent of students who

took five or more AP Exams in mathematics and/or physical sciences; though few students in this sample took five or more AP mathematics and/or physical sciences exams (N = 183).

The STEM results are particularly noteworthy, given the interest in increasing the number of students who major in a STEM-related field (Chang, 2009; Chen, 2009; Obama, 2010). In fact, it is believed that there must be a greater investment in STEM fields to produce more graduates in these disciplines so that the U.S. maintains a competitive position in the global economy. Increasing access and encouraging participation in AP Exams in the math and sciences could potentially help the U.S. keep and perhaps increase its competitive position globally. However, it should be pointed out that merely taking an AP Exam in a related domain is probably not the solution, given that performance on the AP Exam was also related to choice of college major. Therefore, it is imperative that high school students take academically challenging courses throughout their high school career so that they are academically prepared for the rigorous material of college courses, particularly in the STEM fields. Research examining the role of course-taking behavior in high school on subsequent college major has found that taking rigorous math and science courses is related to an increased likelihood of majoring in a STEM-related field (Maltese, 2008; Trusty, 2002).

Also noteworthy are the results for students with undeclared majors. Similar to the result that AP participation and performance in a particular content domain is related to majoring in that domain, students taking no AP Exams were more likely to be undeclared by the beginning of their third year of college; though the effect was small. It is possible that the lack of exposure to a variety of advanced academic material has left some students undecided about their future because they have not yet taken a course that has sparked their interest. With that in mind, the question remains whether being undecided with regard to major has academic consequences. Though there is often a negative connotation associated with undeclared/undecided majors, research has shown that students with undecided majors are not academically less able in term of standardized test scores and high school grades (Baird, 1967) and that this is not related to college retention (Lewallen, 1993). Instead, research has shown that undeclared students earned higher GPAs and were more likely to graduate (Lewallen, 1995). It should be pointed out, however, that those studies are based on students being undeclared during their senior year of high school or in the first year in college. The generalizability of those results to third-year college students is highly suspect. Specifically, it would seem highly unlikely for a third-year student who is undeclared to graduate in the same time frame as a student with a declared major, given the mandatory course requirements associated with degree completion.

A study by Shaw, Kobrin, Patterson, and Mattern (2011) sheds some light on the subject of college performance of undeclared third-year students. Examining the predictive validity of the SAT by college major, they found that third-year students with undeclared majors had significantly lower GPAs (2.72), as compared to the total sample (3.10). Even more noteworthy was the difference in retention rates, with only 70 percent of undeclared majors returning for their third year, as compared to 91 percent of the total sample. Additionally, SAT scores and HSGPA overpredicted their cumulative GPA, indicating that these students were underperforming based on their academic preparation. Along with the results of the current study, undeclared students seem to have the ability to perform better in college but simply may need help identifying their academic interests and enroll in courses that align with those interests (Allen & Robbins, 2008); exposure to different content areas through the AP program could potentially serve this need. On the other hand, perhaps taking no AP courses and being undeclared both signal a lack of academic commitment or motivation on the student's part. Either way, interventions and resources should be directed at these students to help increase the likelihood of their college success.

A limitation of this research is that we examined students' major at the beginning of their third year of college; and therefore, these results only tangentially address whether AP exposure is related to the major with which a student ultimately graduates and receives a degree. Research has shown that a large percentage of students, nearly three out of four students, change their college major (Kramer, Higley, & Olsen, 1994). Though there has been a substantial amount of research conducted on whether students change their major, less is known about when this occurs. It would seem reasonable to assume that the majority of major switching occurs during the first two years of college, and that most students are relatively settled on their choice of major by their third year of college; however, future research should explicitly examine whether, when, and how often students change their major to more fully understand this complex phenomenon. It would also be useful to understand the institutional characteristics that may moderate these major selection behaviors.

In a similar vein, the term "college major" in this study reflects what was on a student's college record at the beginning of the third year. Information about the student's major during their first and second years was not available. Therefore, knowing that a high percentage of students sometimes change their major multiple times, these results may not generalize to a student's initial major. This raises the question of whether AP participation and performance is a better indicator of student's initial major, intermediate major(s), or final major. Furthermore, are students who take more AP courses less likely to switch majors? Future research should examine the role of AP on the choice of college major along with persistence in that major.

Another limitation of the study deals with the issue of self-selection. Students are not randomly assigned to AP courses, but rather students choose which courses to take. The decision to take an AP course could be related to a number of factors, one of which being interest in the content domain. Therefore, is a student's choice of college major a function of AP participation, or are both AP participation and college major choice both a function of academic interest? In other words, did AP participation lead to an increased academic interest in the particular content domain, or did academic interest in a particular content domain lead to an increased likelihood of participating in an AP course covering that domain? Unless the current state of U.S. education — which allows students to choose their courses in high school — changes dramatically, it may be impossible to determine the causal nature of these findings.

Finally, students who dropped out of their institution during the first or second year were not included in these analyses. Therefore, we do not know about the relationship between AP participation and performance and college major for those students. Additionally, based on the results from Shaw and Barbuti (2010) which found that undeclared majors were less likely to return to an institution, it becomes clear that this is a very complex and intertwined process. Future research should examine how each of these factors are interrelated to understand the effect of students' participation and performance in the AP program on their choice of major, their persistence in that major, and ultimately their persistence to graduate at that institution.

In summary, this study found that students who take an AP Exam in a particular content area are more likely to major in a related discipline in college, even when taking into account relevant student characteristics. This was true across all content areas examined; however, the effect was stronger for some areas than others. For example, there was a strong link between taking an AP Exam in computer science and majoring in computer science in college. Alternatively, taking an AP Exam in humanities or social sciences was not as strong of an indicator of a student subsequently majoring in that respective area in college. In addition, a student's score on an AP Exam in a specific content area was also positively related to their likelihood of majoring in that content area in college. These results suggest that the AP

program may help expose students to advanced academic material in various content areas, potentially confirming or sparking student interests in particular career paths.

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