



Choosing Double: The Relationship Between Successful AP[®] Exams and College Double Major

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Executive Summary

Students who double major have higher earnings and are more satisfied with their educational experience in college than those who graduate with a single major. In this study, we examine the extent to which a student's experience with academic acceleration programs in high school, specifically successful participation in the Advanced Placement Program® (AP®), defined here as scoring a 3 or higher on an AP Exam, is related to double major completion after controlling for academic preparation, motivation to double major, student background characteristics, and postsecondary institutional characteristics. We find that students who obtain a score of 3 or higher on an AP Exam are more likely to double major than students who do not earn a 3 or higher on any AP Exam. Furthermore, the greater the number of AP Exams with a score of 3 or higher, the higher the likelihood of the student double majoring. When controlling for academic preparation, motivation to double major and institutional factors, underrepresented minority and first-generation students are more likely to complete a double major than peers who are not minority and not first-generation students if they have completed one to three AP Exams with a score of 3 or above. Effects are, however, not significant for underrepresented minority and first-generation students who scored a 3 or higher on more than four AP Exams. We also find that all students graduating within four years, both students who scored a 3 or higher on more than one AP Exam and those who did not, are more likely to complete a double major than students who take more time to complete their degree. This indicates that students are not using additional time in college to acquire more credentials.

Table of Contents

Introduction	5
Current Study	7
Method	7
Sample	7
Measures	8
Analyses	10
Results	11
Descriptive Statistics	11
AP Exams and Double Major.....	13
AP Exams and Double Major: Underrepresented Minority and First-Generation Students	15
AP Exams and Double Major: Time to Degree	21
Discussion	22
References	23
About the College Board	25
Tables	
Table 1: Student and Institutional Characteristics by Double Major Status.....	11
Table 2: Academic Characteristics of Students by Double Major Status	13
Table 3: HGLM Parameter Estimates for AP Exam Performance and Double Major	13
Table 4: HGLM Parameter Estimates for Interaction Effects Between First- Generation, Underrepresented Minority, and Gender.....	17
Table 5: HGLM Parameter Estimates for Interaction Effects Between First- Generation/Underrepresented Minority Status and Number of Successful AP Exams	20

Figures

Figure 1: Likelihood of completing a double major by number of AP Exams with a score of 3 or higher..... 15

Figure 2: Likelihood of completing a double major by number of AP Exams with a score of 3 or higher, by first-generation and underrepresented minority status 16

Figure 3: Likelihood of completing a double major by number of AP Exams with a score of 3 or higher, by interaction of first-generation and underrepresented minority status 18

Figure 4: Likelihood of completing a double major by number of AP Exams with a score of 3 or higher, by interaction of gender and underrepresented minority status 19

Figure 5: Likelihood of completing a double major by number of AP Exams with a score of 3 or higher, by time-to-degree completion 22

Introduction

Participation in accelerated learning opportunities in high school is widespread with most public high schools in the United States offering at least one acceleration program such as Advanced Placement® (AP®), Dual Enrollment or International Baccalaureate (Thomas, Marken, Gray, & Lewis, 2013). Research on the AP Program in particular shows that AP students, especially those scoring a 3 or higher on one or more AP Exams, are more likely to enroll in college (Chajewski, Mattern, & Shaw, 2011), persist to a second year of college at the first institution they enrolled (Mattern, Shaw, & Xiong, 2009), earn higher grades in college (Godfrey, Matos-Elefonte, Ewing, Patel, 2014; Kaliski & Godfrey, 2014; Mattern, Shaw, & Xiong, 2009; Patterson, Packman, & Kobrin, 2011), and graduate from college in four years (Mattern, Marini, & Shaw, 2013), controlling for other relevant factors related to college success. Causal work also finds evidence that earning credit-granting AP scores increases the probability of on-time degree attainment (Smith, Hurwitz, & Avery, 2017).

While college enrollment, performance, and graduation are the most important outcomes in higher education, there are likely additional educational benefits students experience in college as a result of participating in a rigorous high school curriculum. One way in which a student's postsecondary experience may be enriched by participation in the AP Program in particular, is by increasing the likelihood that the student will complete a double major. Doing well on AP Exams in high school may be especially valuable for students in terms of completing a double major because many universities award college credit to students who score a 3 or higher on an AP Exam. Earning college credit prior to enrolling frees up both time and coursework for a student to pursue multiple degree opportunities. In a report on the state of double majoring in college education for the Teagle Foundation, Richard Pitt and Steven Tepper (2012) show descriptive results that indicate that students with a double major had about three more AP credits on average than students with only a single major. Furthermore, students with more than 12 AP credits were 83% more likely to double major than those with fewer AP credits. These findings are confirmed by Evans (2013) who uses national data and controls for a host of student academic and background variables as well as institutional characteristics to show that there is a strong, positive relationship between accumulating AP credits and the likelihood of earning a double major. Students with an average of 10 AP credits are seven percentage points more likely to double major than students who have no AP credits.

Earning a double major is a valuable use of a student's time in college. Research shows that among students whose highest completed degree is a bachelor's, students who double major have higher earnings when compared to students who complete college with a single major. Del Rossi and Hersch (2008) find that double majors earn 2.3% more than single majors. However, the greatest benefits in income were earned by double majors who elected fields across two major categories, such as a major in the humanities combined with a STEM major. Hemelt (2010) similarly found that there is a wage premium to completing a double major, but that this wage premium differs by type of institution attended. Double

majors at research universities experienced a greater wage return than double majors at liberal arts colleges.

There are benefits of double majoring beyond financial returns. In a survey of 1,760 students enrolled at nine colleges and universities, 64% of students reported their double major improved their capacity to “think creatively” (Pitt & Tepper, 2012, p. 36), and 80% of students reported their double major enriched their “development of intellectual curiosity” (Pitt & Tepper, p. 36). In addition, double majors, especially those who choose majors in different disciplines, indicated that the experience not only exposed them to more diverse people but also that they were more likely to “see the world from other’s perspectives” (Pitt & Tepper, p. 35).

Considering the financial and personal payoffs students experience as a result of completing two majors, it is understandable that the number of graduates double majoring is increasing. According to recent statistics, about a quarter of all college students elect to double major with that number rising to more than 30%–40% of students at selective colleges (Pitt & Tepper, 2012). There is, however, some concern around the trend to complete not one but two majors in four years of college. After all, many students who enroll in college are not able to graduate with any type of credential. The six-year graduation rate for full-time undergraduate students who enrolled at a 4-year institution in the fall of 2008 is just 60%. The four-year graduation rate is much worse—only 40% of full-time undergraduate students who enrolled at a 4-year institution in fall of 2008 earned a bachelor’s degree within four years of entering college (U.S. Department of Education, 2015).

Some of the blame of the longer time spent in college has been placed on the increasing interest students have in double majoring. In a feature on the usefulness of double majors in the *Chronicle of Higher Education*, Alice Gomstyn writes that “spending a fifth year in college is an increasingly popular way [for students] to spread multiple-major courseloads over a more-manageable time period” (Gomstyn, 2003). She notes that this is despite the fact that additional time in college often means added financial strain on students and parents. The concern regarding the connection between double majoring and time to degree has even made higher education administrators consider enforcing restrictions on who can pursue a double major. A *Time* news article (Webley, 2013) titled “Should Colleges Ban Double Majors?” reported that a commission composed of representatives from six leading higher education institutions suggested that postsecondary institutions limit students’ choices to promote college completion and referenced a suggestion by a task force at a large flagship public university to ban students from double majoring unless they can complete coursework requirements within four years. While, to date, there is no indication that this restriction on double major completion was implemented, it is worthwhile to understand whether the concern that students are extending their time to degree to complete a double major is legitimate.

In addition to concerns that double majoring may prolong the time that students spend in college, there is also indication that making the decision to double major may be yet another

source of educational inequality. Pitt and Tepper find that first-generation students, as well as students who need to take out student loans or need to work while taking classes in order to pay for college, are much less likely to double major (Pitt & Tepper, 2012).

Current Study

The purpose of this study is to examine the extent to which a student's experience with academic acceleration programs in high school, specifically successful participation in AP, defined here as scoring a 3 or higher on an AP Exam, is related to double major completion after controlling for academic preparation, motivation to double major, student background characteristics, and postsecondary institutional characteristics. This study will extend the current literature in two ways. First, we extend the descriptive work by Pitt and Tepper (2012) by examining the extent to which students with AP Exam scores of 3 or higher are more likely to double major holding constant student background, high school preparation, and measured academic ability. The use of interactions in our modeling approach will help us better understand the differential effects of successful AP Exam completion on minority and first-generation students. Second, our analysis improves upon the preliminary models presented by Evans (2013) by considering whether or not students who double major are doing so at the expense of prolonging their college enrollment. In his models, Evans examines bachelor's degree completion within six years of enrollment. While his analysis is useful, it does not provide insight into the debate on whether or not double majoring leads to prolonged time in college. In our analysis, we will contribute to this debate by taking into consideration time to degree as well as enrollment in college during summer terms.

Method

Sample

Three sources of data were used in this study. The first dataset was obtained from the National Student Clearinghouse (NSC), which tracks student enrollment and degree attainment for over 3,100 2-year and 4-year colleges and universities in the United States, equivalent to 94% of the U.S. college-going population. Next, NSC data were matched to the College Board's 2006 graduating senior cohort database of 1,368,056 students. The College Board's 2006 graduating senior cohort consists of students who completed at least one Preliminary SAT/National Merit Scholarship Qualifying Test (PSAT/NMSQT[®]), SAT[®], or AP Exam in their four years of high school. These student-level data were then merged with institutional-level data collected by the College Board through its Annual Survey of Colleges.

The NSC reports college major data on the majority but not all of the students it tracks. For the cohort of students entering college in 2006, 85% of records include students' major/double major at time of degree completion. Student records that did not have a major entry or student records that included an honors program or honors designation in the major field were removed from the analysis because it was impossible to determine whether the

student was a single or a double major. There were 953 records with major entries that were not missing but included text that was not field specific (i.e., Blank, Not Applicable, Null, None), which we coded as a single major. Because the primary interest in this study is how AP Exam success, one of several high school acceleration options, is related to pursuing a double major, we also excluded students who participated in dual enrollment (N = 231,665), another high school acceleration option and an alternative to AP. The sample was further restricted to students who started college full-time at a 4-year institution immediately after graduating high school (operationalized as within 130 days of graduating from high school), completed college within six years of enrollment, and had valid data on all other measures in the study. The final sample included 365,836 students and 1,150 institutions.

Measures

Double Major. Double major information was obtained from NSC. Institutions that participate in NSC may enter up to two major fields for a student record. We considered a student as having double majored if there were valid entries in both of the available major fields. Twenty-nine student records were coded as double major despite having only one major entry because the entry on one major field explicitly stated double major.

AP Exam Scores. AP Exam scores were obtained from official College Board records. AP Exam scores are criterion referenced and range from 1 to 5. A score of 1 represents ‘No recommendation for college credit’; 2 represents ‘Possibly qualified for college credit’; 3 represents ‘Qualified for college credit’; 4 represents ‘Well-qualified for college credit’; and 5 represents ‘Extremely well-qualified for college credit.’ Students who earn a score of 3 or higher on an AP Exam typically receive college credit or advanced placement into higher-level courses depending on the credit and placement policies at the postsecondary institution they ultimately attend. Students were classified by the following categories: (1) students who did not take any AP Exams or took an AP Exam but scored below a 3, (2) AP Exam takers who scored a 3 or higher on one to three AP Exams, (3) AP Exam takers who scored a 3 or higher on four to six AP Exams, (4) AP Exam takers who scored a 3 or higher on six to nine AP Exams, (5) AP Exam takers who scored a 3 or higher on 10 or more AP Exams. It is important to emphasize that the group of students used for comparison are those who either did not take any AP Exams or took AP Exams but did not earn a score of 3 or higher.

SAT Scores. SAT scores were obtained from official College Board records. The students in this study took the old version of the SAT that was in effect from 2005–2015 and consisted of three sections: critical reading, mathematics, and writing, each with a scale score ranging from 200–800 with 10-point increments. Each student’s total score (600–2400) summed across the three sections was used for the analysis. If a student took the SAT more than once, the most recent score was used.

HSGPA. High school grade point average (HSGPA) was self-reported by students on the SAT Questionnaire (SAT-Q), which students complete when registering for the SAT or any SAT Subject Test. HSGPA was reported in letter grades ranging from an F (below 65) to an A+ (97–100), which was converted to numerical grades for purpose of this analysis. HSGPA ranged from 0.0 to 4.0.

First-generation status. The SAT-Q also asks students to report the highest level of education achieved for both their mother and father. Response options include: no high school diploma, high school diploma, associate degree, bachelor's degree, or graduate degree. To indicate first-generation status, this information was recoded into a dichotomous variable: Students reporting neither parent having earned a bachelor's degree (or higher) were coded as first-generation students and assigned a '1,' and students reporting at least one parent having earned a bachelor's degree were marked as not first-generation status and coded as a '0.'

Gender. Students provided their gender (female or male) when they completed the SAT-Q. Females were coded as '1' and males were coded as '0.'

Underrepresented minority status. Students indicated their race/ethnicity on the SAT-Q. The categories comprise (1) Native American or Alaska Native; (2) Asian, Asian American, or Pacific Islander; (3) Black or African American; (4) Mexican or Mexican American; (5) Puerto Rican; (6) Other Hispanic, Latino, or Latin American; (7) White; and (8) Other. Based on the responses, a dichotomous variable was created to indicate underrepresented minority status. A value of 0 indicated that the student was not a member of an underrepresented minority group and included Asian and white students. A value of 1 indicated that the student was a member of an underrepresented minority group and included Native American or Alaska Native, Black or African American, Mexican or Mexican American, Puerto Rican, and Other Hispanic, Latino, or Latin American students. A second dichotomous variable captured students who indicated 'other' race/ethnicity as '1' with all other students assigned a value of '0.'

Number of summer terms enrolled. Total number of summer terms the student was enrolled in college was obtained from the NSC data. Institutions report student summer term enrollment to the NSC and set their own dates for start and end of summer term. Number of summer terms ranged from 0 to 6.

Interest in second and/or third major while in high school. Students provided their interest in a second, third, or fourth major when they completed the SAT-Q. A value of '1' indicated the student was interested in pursuing more than one major whereas a value of '0' indicated no interest at the time the survey was completed. Students who indicate interest in pursuing more than one major while in high school may be more motivated to complete a double major than students who do not report early interest.

Graduation in four, five, or six years. Graduation information for the 2006 Cohort was obtained from NSC. Students were identified as having graduated within four years if they

completed their bachelor's degree by August 31, 2010, within five years if they completed their bachelor's degree by August 31, 2011, and within six years if they completed their bachelor's degree by the end of the summer term in 2012.

Institutional characteristics. Institutional characteristics were obtained from the College Board's Annual Survey of Colleges. Responses to the survey administered in 2014 were used, as that was the most recently updated information available at the time of analysis. Institutional control and selectivity were included in the analyses in order to control for the fact that the likelihood to double major may vary across different types of institutions. Selectivity was determined by an institution's admittance rate. Admittance rate was calculated by dividing the number of students who were admitted to the institution by the number of students who applied to the institution. Potential values for selectivity ranged from 1% (admits 1% of applicants, or very selective) to 100% (open enrollment, or not selective). The mean selectivity in the sample was 60% (SD = 14%, min. = 18%, max. = 94%). Institutional control (private/public/for-profit) was also obtained from the Annual Survey of Colleges responses. Institutions designated as for-profit were combined with private institutions and coded as '1.' Public institutions were coded as '0.'

Analyses

Both descriptive analyses and a series of hierarchical generalized linear models (HGLM) were utilized to explore the relationship between successful AP Exam participation and the likelihood of completing college with a double major. To confirm this analysis required a multilevel approach, we first computed an unconditional model with a random intercept only and calculated the generalized interclass correlation coefficient (ICC) as recommended by Snijders and Bosker (1999). The resulting test statistic was significant (1.525, $p < .0001$), which indicates that the null hypothesis of homogeneity of graduation rates across institutions can be rejected and that a hierarchical model will provide more accurate results. The generalized ICC of 0.3168 indicates that approximately 32% of the variability in double major is accounted for by the higher education institutions in our sample. This leaves 68% of the variability to be accounted for by student characteristics and other unknown factors. We then proceeded with model building where we first sought to evaluate the relationship between the number of AP Exams with scores of 3 or higher and double major completion after controlling for student and institutional level variables. In our hierarchical models, we grand-mean centered all continuous variables at the student level, and all variables (categorical and continuous) at the institutional level as recommended by Raudenbush and Bryk (2002, p. 35). Finally, we examined models that tested interaction effects between minority and first-generation status, minority and gender, and minority and first-generation interactions with number of AP Exams with a score of 3 or higher. The purpose of these more complex models is to comprehensively understand the relationship between AP Exam participation and double major completion for traditionally disadvantaged students.

Results

Descriptive Statistics

Table 1 provides descriptive statistics for our sample of 365,836 students. We also show the rates of double major completion overall, as well as by student and institutional characteristics, and by number of AP Exams with a score of 3 or higher.

Table 1: Student and Institutional Characteristics by Double Major Status

		<i>N</i>	<i>N</i> Double Majored	% Double Majored
Total Sample		365,836	31,745	8.7
No AP Exam or No AP Exam with Score of 3 or higher		192,510	10,879	5.7
Number of AP Exams with Score of 3 or higher	One AP	52,551	4,330	8.2
	Two APs	34,483	3,503	10.2
	Three APs	25,568	3,117	12.2
	Four or More APs	60,724	9,916	16.3
Gender	Male	155,893	13,011	8.3
	Female	209,943	18,734	8.9
Race/Ethnicity	Asian American	36,416	3,547	9.7
	African American	26,577	1,359	5.1
	Hispanic	27,575	2,536	9.2
	White	261,177	23,030	8.8
	Native American	1,724	104	6.0
	Other	12,367	1,169	9.5
First-Generation College-Going Status	Yes	83,673	5,770	6.9
	No	282,163	25,975	9.2
Interest in second and/or third major while in High School	Yes	206,330	17,598	8.5
	No	159,506	14,147	8.9

Number of summer years enrolled	Zero	190,553	18,337	9.6
	One	97,850	8,039	8.2
	Two	50,948	3,679	7.2
	Three	20,815	1,352	6.5
	Four or more	5,670	338	6.0
Bachelor's Completion	Within 4 Years	237,528	24,798	10.4
	Between 4–5 years	101,181	5,967	5.9
	Between 5–6 years	27,127	980	3.6
Control	Public	239,433	16,008	6.7
	Private	126,403	15,737	12.4
Selectivity	<50%	128,029	16,118	12.6
	50%–75%	178,803	12,677	7.1
	>75%	59,004	2,950	5.0

Results indicate that 8.7% of all students in our sample completed a double major. Students who have scored a 3 or higher on more than four AP Exams complete double majors at almost triple the rate of students who did not score a 3 or higher on any AP Exam. Female students were slightly more likely to complete a double major than male students.

Nonminority students and students with parents who attended college were more likely to complete a double major than minority and first-generation students confirming the findings cited by Pitt and Tepper (2012). Students who completed their bachelor's degree within four years were more likely to complete a double major (10.4%) than students who took five (5.9%) or six years (3.6%) to graduate. In addition, students who spent less time enrolled in summer terms were more likely to complete a double major. At the institutional level, students who enrolled at private institutions were more likely to double major than students enrolled at public institutions, and students who enrolled at selective institutions were more likely to double major than students enrolled at less selective institutions.

Table 2 shows the academic characteristics of students in our sample by double major completion status. Students who completed a double major earned, on average, HSGPAs that were 0.15 points higher than students who completed a single major. Also, students with a double major received higher SAT scores.

Table 2: Academic Characteristics of Students by Double Major Status

	Double Major			Single Major		
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>
HSGPA	31,745	3.72	0.45	334,091	3.57	0.51
SAT-CR	31,745	600	99	334,091	552	98
SAT-M	31,745	607	96	334,091	567	100
SAT-W	31,745	595	97	334,091	547	96

AP Exams and Double Major

The primary question of this study is to understand if, when holding other markers of achievement constant, students who score a 3 or higher on AP Exams are more likely to double major in college than students who did not score a 3 or higher on any AP Exams. Model 2 in Table 3 shows the parameter estimates for all of the student-level and institutional-level variables included in the model. Results indicate that controlling for student demographics (gender, minority status, parental education), academic preparation (SAT scores, HSGPA), motivation to pursue a second major, time to degree, number of summer terms enrolled, and institutional factors (control, selectivity), the number of AP Exams with a score of 3 or higher remained predictive of the likelihood of completing a double major. Students who obtained a score of 3 or higher on one or more AP Exams were more likely to double major than students who did not earn that score. The greater the number of AP Exams with scores of 3 or higher, the higher the likelihood of double majoring.

Table 3: HGLM Parameter Estimates for AP Exam Performance and Double Major

	Model 1	Model 2	Model 3
	Est.	Est.	Est.
Fixed Effects			
Intercept	-2.98	-3.11	-3.25
Female		0.12***	0.11***
Minority		0.17***	0.17***
Other		0.11***	0.11***
First-Generation		0.07***	0.07***
SAT*		0.00***	0.00***
HSGPA*		0.13***	0.12***

Other Major Interest		0.02	0.02
Number of Summer Years*		0.07***	0.07***
BA Yrs (4 = 1)		0.20***	0.20***
BA Yrs (5 = 1)		0.11***	0.11***
Institutional Control*		0.68***	0.68***
Institutional Selectivity*		0.00	0.00
Number of AP Exams with 3+ score*		0.08***	
1–3 AP with 3+			0.22***
4–6 AP with 3+			0.45***
7–9 AP with 3+			0.54***
10 or more AP with 3+			0.74***
Variance Estimate			
Intercept	1.53	1.22	1.22

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: SAT, HSGPA, Number of Summer Years, Institutional Control, Institutional Selectivity, Number of AP Exams with a score of 3 or higher have been grand-mean centered. For Institutional Control, Private = 1; Public = 0. Minority 1 = Black, Hispanic/Latino, Native American; 0 = Asian American, White.

Model 3 is a modification of Model 2 in that it considers the number of successful AP Exams as a categorical variable. Looking at the number of successful AP Exams categorically can showcase if there is a variation in the effects of AP Exams on the likelihood of double majoring depending on the number of successful AP Exams completed. Figure 1 displays the results of Model 3 graphically by taking a typical student as described by the descriptive statistics in Table 1 and Table 2, and considering how the likelihood of this average student completing a double major changes depending on how many successful AP Exams this student has completed. The typical student in the case of our sample is a white or Asian American, female, who is not a first-generation student, and who described herself as having an interest in a second major while still in high school. This student was not enrolled in college during any summer terms, completed her bachelor's degree in four years at a public institution that accepted on average 63.91% of applicants. Her high school grade point average was 3.59 and she earned a combined SAT score of 1680 on the old SAT scale. Using this prototypical student as an example aids in demonstrating how the likelihood of double major completion changes as a student with these same characteristics successfully completes additional AP Exams.

Figure 1: Likelihood of completing a double major by number of AP Exams with a score of 3 or higher

Likelihood of Completing Double Major	
No AP Exams with 3+ score	5.1%
1–3 AP Exams with 3+ score	6.3%
4–6 AP Exams with 3+ score	7.8%
7–9 AP Exams with 3+ score	8.5%
10 or more AP Exams with 3+ score	10.1%

Note: The results in this figure are based on parameter estimates in Model 3, Table 3. These values are associated with a typical student on all sample descriptive characteristics other than number of 3+ AP Exams. The average student is female, white or Asian American, not first-generation, had an interest in a second major while in high school, was not enrolled in college during any summer terms, and completed a bachelor's degree in four years at a public institution that accepted on average 63.91% of applicants. Her high school grade point average was 3.59, and she earned a combined SAT score of 1680 on the old SAT scale.

Considering the profile of the typical student, students who did not score a 3 or higher on any AP Exams are only 5.13% likely to double major whereas students with four to six successful AP Exams were 7.81% likely to double major and that percentage increased to 10.13% for students with 10 or more successful AP Exams.

AP Exams and Double Major: Underrepresented Minority and First-Generation Students

Figure 1 shows that scoring a 3 or higher on an AP Exam is predictive of double major completion after controlling for academic preparation, motivation, student background characteristics, and postsecondary institutional characteristics for the typical student. It is important to understand if this same beneficial relationship is evident when considering traditionally underrepresented students. As mentioned previously, one of the findings of Pitt and Tepper (2012) is that first-generation students are less likely to double major than students whose parents attended college. The descriptive statistics of our sample presented in Table 1 support their finding. Prior research on the educational outcomes of first-generation and underrepresented minority AP Exam takers shows that students from underrepresented backgrounds do benefit from exposure to the AP Program (Godfrey, Wyatt, & Beard, 2016; Smith, Jagesic, Wyatt, & Ewing, forthcoming). However, it is possible that successful AP Exam participation is more beneficial for advantaged students in terms of completing a double major and less beneficial for minority and first-generation students who face additional strain in their pursuit of higher education.

Figure 2 depicts estimates from Model 3 in Table 3 to showcase the differences in relationships between the number of successful AP Exams and double major for first-generation/not first-generation students and number of successful AP Exams and double major for minority/white or Asian American students. These results show that when controlling for demographic factors, SAT, HSGPA, interest in second major, time to degree, summer terms, and institutional control and selectivity, traditionally disadvantaged students—underrepresented minority and first-generation—are more likely to complete a double major than advantaged students (not first-generation and white or Asian American). This is true both for students who have completed no AP Exams as well as for students who have many AP Exams with a score of 3 or higher. The same pattern of greater number of 3 or higher AP Exam scores leading to greater likelihood of double major that is observed in Figure 1 is evident in both the first-generation and minority student subgroups.

Figure 2: Likelihood of completing a double major by number of AP Exams with a score of 3 or higher, by first-generation and underrepresented minority status

	First Generation Status		Minority Status	
	First Generation	Not First-Generation	Minority	Nonminority
No AP Exams with 3+ score	5.5%	5.1%	6.0%	5.1%
1–3 AP Exams with 3+ score	6.7%	6.3%	7.3%	6.3%
4–6 AP Exams with 3+ score	8.3%	7.8%	9.1%	7.8%
7–9 AP Exams with 3+ score	9.0%	8.5%	9.9%	8.5%
10 or more AP Exams with 3+ score	10.7%	10.1%	11.7%	10.1%

Note: The results in this figure are based on parameter estimates in Model 3, Table 3. These values are associated with a typical student on all sample descriptive characteristics other than number of 3 or greater AP Exams, by first-generation status and minority status.

To understand if there are differential effects of successful AP Exams on double major completion for students who have both first-generation and minority status, we made use of models with interaction effects. In Table 4, Model 4 we tested interactions between first-generation and minority status, minority and gender status, and first-generation and gender status. We included gender as a subgroup of interest because prior research suggests that female students experience more positive academic outcomes in higher education, and that this is especially true for underrepresented minority female students (Klevan, Weinberg, & Middleton, 2015). We wanted to see if this difference in academic achievement is evident in the case of double majoring as well.

The results of the interaction between first-generation and minority students are shown in Table 4, Model 4. These results are also depicted in Figure 3 and indicate that first-

generation students are more likely to double major than students who are not first-generation, and minority students are more likely to double major than white or Asian American students holding constant the other variables included in the model. Furthermore, students who are both underrepresented minority and first-generation are more likely to double major than white or Asian American first-generation students. Considering that minority first-generation students are doubly disadvantaged due to race and first-generation status, it is notable that their likelihood of double major is greater. As with all other subgroups, the greater the number of AP Exam scores that are 3 or higher, the greater the likelihood of the underrepresented minority, first-generation student completing a double major.

Table 4: HGLM Parameter Estimates for Interaction Effects Between First-Generation, Underrepresented Minority, and Gender

	Model 4	Model 5	Model 6
	Est.	Est.	Est.
First-Generation & Minority	0.21***		
First-Generation & Race Other	0.10		
Female & Minority		0.11**	
Female & Race Other		0.11	
First-Generation & Female			0.0339
Intercept	-3.24	-3.24	-3.25
Female	0.11***	0.10***	0.11***
Minority	0.10***	0.09**	0.16***
Other	0.09**	0.04	0.11***
First-Generation	0.02	0.06***	0.04
SAT*	0.00***	0.00***	0.00***
HSGPA*	0.12***	0.12***	0.12***
Other Major Interest	0.02	0.02	0.02
Number of Summer Years*	0.07***	0.07***	0.07***
BA Yrs (4 = 1)	0.20***	0.20***	0.20***
BA Yrs (5 = 1)	0.11***	0.11***	0.11***
Institutional Control	0.68***	0.68***	0.68***
Institutional Selectivity*	0.00	0.00	0.00
Number of AP Exams with 3+ score			
1–3 AP with 3+	0.21***	0.22***	0.22***

4–6 AP with 3+	0.45***	0.45***	0.45***
7–9 AP with 3+	0.54***	0.54***	0.54***
10 or more AP with 3+	0.73***	0.73***	0.73***

* p<0.05, ** p<0.01, *** p<0.001

Note: SAT, HSGPA, Number of Summer Years, Institutional Control, Institutional Selectivity, Number of AP Exams with a score of 3 or higher have been grand-mean centered. For Institutional Control, Private = 1; Public = 0. Minority 1 = Black, Hispanic/Latino, Native American; 0 = Asian American, White.

Figure 3: Likelihood of completing a double major by number of AP Exams with a score of 3 or higher, by interaction of first-generation and underrepresented minority status

	First-Generation & Minority	First-Generation & Nonminority	Not First-Generation & Minority	Not First-Generation & Nonminority
No AP Exams with 3+ score	7.0%	5.3%	5.7%	5.2%
1–3 AP Exams with 3+ score	8.6%	6.4%	6.9%	6.3%
4–6 AP Exams with 3+ score	10.6%	8.0%	8.6%	7.9%
7–9 AP Exams with 3+ score	11.4%	8.7%	9.3%	8.5%
10 or more AP Exams with 3+ score	13.6%	10.3%	11.1%	10.2%

Note: The results in this figure are based on parameter estimates in Model 4, Table 4. These values are associated with a typical student on all sample descriptive characteristics other than the number of 3+ AP Exams, first-generation status, and minority status.

The results of the interaction between gender and underrepresented minority status shown in Model 5, Table 4 are significant and are depicted in Figure 4. Female minority students are more likely to double major than minority male, nonminority female, and nonminority male students holding constant other factors. As seen previously, the greater the number of AP Exam scores that are 3 or higher, the greater the likelihood of the student completing a double major.

These models show that once academic preparation (SAT, HSGPA), academic motivation (interest in second major, time to degree, summer terms) and institutional factors (control, selectivity) are taken into consideration, student groups who are generally thought of as struggling in postsecondary education, are more likely to double major than their more advantaged peers. This result is likely due to the many background controls used in this study, but also due to the sample being restricted to students who graduate from college.

Figure 4: Likelihood of completing a double major by number of AP Exams with a score of 3 or higher, by interaction of gender and underrepresented minority status

	Female & Minority	Male & Minority	Female & Other Race	Male & Other Race	Female & Nonminority	Male & Nonminority
No AP Exams with 3+ score	6.2%	5.1%	5.9%	4.8%	5.1%	4.7%
1–3 AP Exams with 3+ score	7.6%	6.2%	7.2%	5.9%	6.2%	5.7%
4–6 AP Exams with 3+ score	9.4%	7.7%	8.9%	7.4%	7.8%	7.1%
7–9 AP Exams with 3+ score	10.2%	8.4%	9.7%	8.0%	8.4%	7.7%
10 or more AP Exams with 3+ score	12.1%	10.0%	11.5%	9.6%	10.1%	9.2%

Note: The results in this figure are based on parameter estimates in Model 5, Table 4. These values are associated with an average student on all sample descriptive characteristics other than number of 3+ AP Exams, gender, and underrepresented minority status.

To see if there are any differences in the extent to which the number of AP Exam scores of 3 or higher is related to the likelihood of double major completion differentially when comparing first-generation students and non-first-generation students, and minority students and white or Asian American students, we tested the interactions between first-generation status and number of successful AP Exams and minority status and number of successful AP Exams, respectively. The results of these interactions are presented in Models 7 and 8 in Table 5. The tests show that first-generation students who score a 3 or higher on one to three AP Exams are more likely to pursue a double major than students who are not first-generation and score a 3 or higher on one to three AP Exams. The same pattern is observed in Model 8 for underrepresented minority students. This positive trend also holds for students who score a 3 or higher on four to six AP Exams; however, the difference ceases to be statistically significant. Because of the lack of statistical significance in the categories of students who scored a 3 or higher on four or more AP Exams, there is not enough information on the extent to which successful AP Exam participation has a differing effect on underrepresented minority or first-generation students who successfully complete four or more AP Exams in comparison to their white or Asian American, or non-first-generation peers who successfully complete four or more AP Exams.

Table 5: HGLM Parameter Estimates for Interaction Effects Between First-Generation/Underrepresented Minority Status and Number of Successful AP Exams

	Model 7	Model 8
Effect	Est.	Est.
Minority & 1–3 AP with 3+	0.20***	
Minority & 4–6 AP with 3+	0.01	
Minority & 7–9 AP with 3+	-0.02	
Minority & 10 or more AP with 3+	-0.34	
Race Other & 1–3 AP with 3+	-0.04	
Race Other & 4–6 AP with 3+	-0.14	
Race Other & 7–9 AP with 3+	-0.14	
Race Other & 10 or more AP with 3+	-0.61*	
First-Generation & 1–3 AP with 3+		0.09*
First-Generation & 4–6 AP with 3+		0.07
First-Generation & 7–9 AP with 3+		-0.14
First-Generation & 10 or more AP with 3+		-0.11
Intercept	-3.24	-3.24
Female	0.11***	0.11***
Minority	0.09**	0.16***
Other	0.17**	0.11***
First-Generation	0.06***	0.03
SAT*	0.00***	0.00***
HSGPA*	0.12***	0.12***
Other Major Interest	0.02	0.02
Number of Summer Years*	0.07***	0.07***
BA Yrs (4 = 1)	0.20***	0.2***
BA Yrs (5 = 1)	0.11***	0.11***
Institutional Control*	0.68***	0.68***
Institutional Selectivity*	0.00	0.00
Number of AP Exams with 3+ score		
1–3 AP with 3+	0.19***	0.20***
4–6 AP with 3+	0.45***	0.44***

7–9 AP with 3+	0.54***	0.54***
10 or more AP with 3+	0.77***	0.73***

* p<0.05, ** p<0.01, *** p<0.001

Note: SAT, HSGPA, Number of Summer Years, Institutional Control, Institutional Selectivity, Number of AP Exams with a score of 3 or higher have been grand-mean centered. For Institutional Control, Private = 1; Public = 0. Minority 1 = Black, Hispanic/Latino, Native American; 0 = Asian American, White.

However, the significant effects shown for underrepresented minority and first-generation students who scored a 3 or higher on one to three AP Exams suggest that controlling for other indicators of achievement, AP Exam success in this case may have greater benefits for traditionally underrepresented students. In other words, AP Exam success in this case may have greater benefits for traditionally underrepresented students.

The lack of statistical significance for minority and first-generation students who score a 3 or higher on more than four AP Exams is likely due to the underrepresentation of minority and first-generation students in the category of students earning a score of 3 or higher on more than four AP Exams. The percentage of nonminority students who have more than four AP Exam scores of 3 or higher is 18% compared to 9% of underrepresented minority students. Similarly, the percentage of first-generation students who have more than four AP Exam scores of 3 or higher is 8% compared to 19% of not first-generation students.

AP Exams and Double Major: Time to Degree

A concern of those advocating for curbing double major availability and eligibility is that students may be pursuing two majors at the cost of completing a college degree within the four years normally allotted. This is a legitimate concern considering the low four-year graduation rates coupled with increasing costs of tuition. To understand if students who double major are more likely to take more than four years to complete a bachelor's degree, we included a time-to-degree control in Models 2 and 3 presented in Table 3. We also added in a control for number of summers enrolled in college to see if students who double major are more likely to enroll in summer classes to earn additional credits. The estimates show that contrary to expectations, the group of students most likely to double major, when holding constant student demographics, background, academic preparation, and institutional characteristics are those who complete a bachelor's degree within four years and do not take any summer classes. To depict this result graphically we used the typical student in our sample, as described in Figure 1, to highlight how the likelihood of completing a double major changes with both adjustments in time to degree and number of AP Exams with a score of 3 or higher.

Figure 5: Likelihood of completing a double major by number of AP Exams with a score of 3 or higher, by time-to-degree completion

	No AP Exams with 3+ score	1–3 AP Exams with 3+ score	4–6 AP Exams with 3+ score	7–9 AP Exams with 3+ score	10 or more AP Exams with 3+ score
BA within 4 yrs	5.1%	6.3%	7.8%	8.5%	10.1%
BA within 4–5 years	4.7%	5.8%	7.2%	7.8%	9.4%
BA within 5–6 yrs	4.2%	5.2%	6.5%	7.1%	8.5%

Note: The results in this figure are based on parameter estimates in Model 3, Table 3. These values are associated with a typical student on all sample descriptive characteristics other than number of 3+ AP Exams, and time to graduation.

When comparing students who completed college within four years and students who completed college within four to five years, and within five to six years, Figure 5 shows that holding student and institutional factors constant, students who graduate within four years are more likely to complete a double major than students graduating within four to five years, while students graduating within five to six years are least likely to complete a double major. This is true for students who do not have any AP Exams with a score of 3 or higher as well as students who have many AP Exam scores that are 3 or higher. This difference highlights the fact that students who take more time to complete their bachelor’s degree do not use that time to get more out of their educational experience in terms of pursuing a double major. The increasing interest in completing more than one major is likely not a contributing factor to students staying in school for more than four years. Rather, a second major is most likely to be completed by students who are already high achievers.

Discussion

With a surplus of college graduates applying for entry-level positions, students face the challenge of distinguishing themselves on the job market where competition for entry-level jobs is steadily increasing (Weber & Korn, 2014). Many students are setting themselves apart by completing more than one college major. As we summarized, research has shown that this decision does have both financial and personal payoffs. Double majors earn more and tend to express that their college experience is enriched by the pursuit of multiple majors (Del Rossi & Hersch, 2008; Hemelt, 2010; Pitt & Tepper, 2012). While double majoring may come with a payoff, it does require more coursework planning. Earning college credit via AP Exams can help students in the pursuit of a double major by giving them more flexibility and time to take more courses while in college. Earning credit or advanced placement before enrolling in college provides students with the additional time to maximize their academic achievements once they do enter college. This study shows that earning scores of 3 or higher on AP Exams is significantly related to double major

completion, even when holding constant the effects of academic preparation and achievement in high school, motivation to pursue a double major, parental education levels, and postsecondary institution type. Furthermore, our findings suggest that after taking into account prior achievement, underrepresented minority and first-generation students who have scored a 3 or higher on one to three AP Exams are more likely to double major than their peers who are neither first-generation nor minority. This finding is encouraging because it highlights that while scoring a 3 or higher on an AP Exam is helpful for all students in the pursuit of a double major, it is even more helpful for first-generation and underrepresented minority students, groups that are known to struggle in higher education. While these effects are not statistically significant for first-generation and minority students who score a three or higher on more than four AP Exams, this is likely due to the underrepresentation of minority and first-generation students among students scoring a 3 or higher on more than four AP Exams.

The findings presented in this study also highlight that students are not staying in college longer in order to complete the degree requirements for more majors. On the contrary, we find that holding prior achievement, demographics, and institutional environment constant, students who stay in college longer are less likely to complete a double major. This finding is not only evident in our HGLM results, but also in our sample descriptive statistics. Higher education administrators need not worry about the increasing trend to double major, as the students who do so tend to be the group most likely to complete their bachelor's degree within four years.

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