A MIXED-METHODS STUDY OF HIGH SCHOOL STUDENTS' ADVANCED PLACEMENT ENROLLMENT DECISIONS

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A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

Educational Policy – Doctor of Philosophy

2019

ABSTRACT

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The Advanced Placement (AP) program is often touted as an opportunity for academically talented high school students to be exposed to a rigorous, college-level classroom setting. Components of the AP program include a range of courses and corresponding standardized assessments. According to the College Board, which administers the AP program, students who take AP courses have an opportunity to gain advanced knowledge and skills, to improve the quality of their college applications, and earn college credits (College Board, 2017b). Based on this reputation, AP participation has increased dramatically in recent years. In the spring of 2017, over 2.7 million students took an Advanced Placement (AP) exam, a more than three-fold increase over the spring of 2001 (College Board, 2017a).

While AP enrollment has expanded dramatically, AP participation varies significantly across student groups. Relative to White students, Hispanic students are approximately 25% less likely to participate in the AP program and Black students are just half as likely. Low-income students, compared to their non-economically disadvantaged peers, are over sixty percent less likely to be an AP student (Theokas & Saaris, 2013). These patterns have led to calls to increase AP participation, especially amongst students from disadvantaged groups. Some, however, have expressed concerns that expanding AP enrollment without considering students' ability may set some up for failure (Finn & Winkler, 2011).

Because high school students typically have significant agency in the courses they take, I argue that understanding AP participation requires an understanding of students' decision-

making around whether to take an AP course. In this dissertation, I investigate students' AP enrollment decisions by answering the following research questions: 1) What are the patterns in AP enrollment for the overall student population and for the sub-population of academically talented students?; 2) How do student characteristics vary by AP enrollment status?; 3) What student-level factors or characteristics predict enrollment in AP classes?; and 4) How do perceptions of AP classes and students vary across student groups?

To answer these research questions, I use the conceptual frameworks of judgment and decision-making, social-emotional skills, and identity in a mixed-methods explanatory case study of two high schools in Michigan that includes student-level administrative data (n=16,939 student-year observations), student surveys (n=389), and student interviews (n=19) in 2018. Results show: (1) disadvantaged students participate in AP at lower rates, but that the size of the participation gap is sensitive to how AP participation is defined, and that many academically talented students do not take an AP class; (2) students who enroll in AP classes are, compared to their peers, less diverse, higher-achieving, wealthier, have more developed social-emotional skills, a stronger academic identity, and make decisions more deliberatively; (3) achievement is the strongest and most reliable predictor of AP enrollment, though constructs related to identity, social-emotional skills, and decision-making tendencies also appear to be related to enrollment; and (4) students generally perceive AP classes as difficult and AP students as academically talented, students of color are acutely aware of the lack of diversity in AP classes, and some students link their course selections to their future. I interpret these findings using the conceptual frameworks employed in this study and develop a conceptual model of students' AP enrollment decisions. Implications for researchers, educators, and policymakers are discussed.

ACKNOWLEDGEMENTS

I would not be where I am without the love, encouragement, and support I have enjoyed from my family, friends, colleagues, and mentors. Here, I briefly acknowledge those who have helped me along this journey. First and foremost is my family. My incredible wife, Kathy, and my children, Bryan and Sara, helped to keep me motivated during the many hours spent on coursework, assistantships, and the process of developing this dissertation. I would also like to acknowledge my parents who instilled in me a value for education and always pushed me to aim higher. I am also grateful for the support I have received from my siblings, grandmother, aunts, uncles, friends, and cousins.

Secondly, I would like to thank those who have mentored me during my time at Michigan State University. I am especially grateful to my advisor and dissertation chair, Rebecca Jacobsen, whose counsel helped me to grow as a scholar. I also owe a debt of gratitude to the members of my dissertation committee, Chris Torres, Richard Houang, and Terry Flennaugh for their excellent advice and feedback that helped to refine this dissertation. I would also like to thank Michael Sedlak for the support he has provided during my time at MSU.

Last, but certainly not least, I would like to thank my graduate student colleagues. I have been fortunate to encounter many wonderful people and apologize for any omissions, but I would like to thank David Casalaspi, Ben Creed, Kim Jansen Evert, David Reid, and Rachel White. Their advice and friendship these last years were a welcome source of support over these last years.

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CHAPTER 1: INTRODUCTION

The Advanced Placement (AP) program was started by the College Board in 1954 to offer academically talented students an opportunity to experience college-level courses while still in high school (Schneider, 2009). The AP program is divided into two components: AP courses and AP exams. High schools can offer AP courses by using an AP curriculum from the College Board and submitting syllabi from its AP courses to verify that the curriculum is implemented with fidelity. AP exams are standardized assessments designed to measure mastery of content knowledge and skills around which their associated AP courses are based and are offered during a testing window each spring. While students can opt to take AP exams without taking the associated course, and vice versa, AP exams are often characterized as the culmination of an AP course and many students do take an AP course and exam in the same year. A range of potential academic and material benefits for students are associated with participating in the AP program, such as: developing and honing skills – beyond what one would receive from a regular high school class – that will be valuable in college; signaling a student's academic ability when applying to colleges; and earning college credits for earning a high score on an AP exam (College Board, 2017b). Waiving courses means that a student could earn a college degree having taken fewer classes, saving money on tuition, room and board, books, and fees and also means that the student could graduate and enter the labor market sooner. These pecuniary benefits, not including earlier entry into the labor market, have an estimated value of roughly $3700 per AP exam passed using the annual estimated cost of attendance at Michigan State University.[1] Importantly, these three types of benefits: increased skill/knowledge, a signal on

[1] According to Michigan State University's Office of Financial Aid, the total annual cost of attendance at Michigan State University for an undergraduate is $29,450, including: tuition; fees and taxes; room and board; books and

college applications, and savings from course waivers are not dependent on each other as long as colleges consider AP experiences in admissions decisions and grant course waivers for high marks on AP exams, meaning that a student may receive one without necessarily experiencing the others. In other words, even if a student does not learn more in an AP class than a non-AP course, she may still improve the quality of her college application by having an AP class on her transcript and/or earn college credit for doing well on an AP exam. Thus, the topic of increasing AP enrollment warrants attention from educators, students and parents, and policymakers.

In its early years, the AP program catered mainly to elite private high schools and served just a few hundred students but has expanded significantly since then. In the 2016-2017 school year, over 2.7 million students in the United States took over 4.9 million AP exams (College Board, 2017a). This drastic expansion in AP participation in the decades since its inception has drawn the attention of educators, advocates, and researchers about the benefits of AP classes and the access students have to the AP program. As of 2016, eights states and the District of Columbia mandated that all high schools/districts offer AP classes (Education Commission of the States, 2016). Though the opportunities associated with taking AP classes are widely recognized, studies have identified significant under-enrollment in AP courses nationwide with, alarmingly, a significant proportion of this under-enrollment falling along the dimensions of urbanicity, race/ethnicity, and social class. According to a 2017 report from the Education Commission of the States and College Board, a higher proportion of suburban students attend a school where at least one AP course is offered relative to students in urban and rural areas. It comes then as little surprise that suburban students are also more likely to enroll in AP classes. In

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supplies; and personal and miscellaneous expenses. Assuming a full-time course load of 12 credits per semester, the total savings on total costs from waiving 3 credits is therefore $3681.25.

a study of AP enrollment by student demographics, Theokas & Saaris (2013) found that if Hispanic, American Indian, and Black students enrolled in AP classes at the same rate as their white peers, the overall population of AP students in the United States would be nearly 125,000 students larger. The authors identified an even larger AP enrollment gap by socioeconomic status with economically disadvantaged students enrolling in AP classes at only one-third the rate of non-economically disadvantaged students. If this enrollment gap were closed, AP enrollment would increase by over 500,000 students nationwide (Theokas & Saaris, 2013). While these dimensions of under-enrollment are important, an under-explored element of this issue is the rate at which academically talented students, those who are likely to succeed in an AP course, enroll, or under-enroll, in AP classes. Because these estimates for under-enrollment are based on the enrollment of White students and students who are not economically disadvantaged, under-enrollment of academically talented students from those two groups would cause the above estimates to understate under-enrollment in AP courses among students from disadvantaged groups. In other words, if a significant number of academically talented (those likely to succeed in AP) White and non-economically disadvantaged students also systematically do not enroll in AP classes, this would constitute another dimension of under-enrollment that would in turn impact the estimated number of disadvantaged students who could be expected to enroll in AP classes.

Despite increased attention to the subject of AP enrollment brought on by concerns about the size of these enrollment gaps and their implications for the futures of many students, much is unknown about what produces these enrollment gaps. The vast majority of high school students attend schools where AP courses are offered (Education Commission of the States, 2016), which suggests that lack of access does not fully explain AP under-enrollment. Further, the process

through which high school students sign up for courses gives them significant freedom in the courses they take. Typically, each spring high school students receive a catalogue of courses offered at the school and select from this list those that they wish to take the following academic year, suggesting that AP under-enrollment is not simply due to students not having the option to take an AP course. In sum, most high school students attend schools where AP is offered and where they have the option to enroll in an AP course, yet there remains significant inequity in AP courses as many students from certain groups are systematically less likely to enroll in one of these courses.

The broad availability of, and access to, AP courses suggests that the observed pattern in AP enrollment is related to high school students' decisions around AP enrollment and the social, psychological, and economic factors that shape those decisions. This is not to say that students from certain groups are to blame for their under-enrollment in AP courses. Indeed, research on this issue has identified several factors beyond AP course availability and policies around course enrollment that shape's students' decisions about which classes to take. Examples of these factors include the messages students receive about AP classes from their peer group and school staff, students' perceptions of the culture within the AP program, and students' expectations about their future (Brotman & Moore, 2008: Havis, 2015; Klopfenstein, 2004; VanSciver, 2006; Venzant Chambers, Huggins, Locke & Fowler, 2014; Yonezawa, Wells & Serna, 2002). Rather, these factors, coupled with the common practice of allowing students to select their own courses, highlight the importance of understanding students' decision-making processes around AP enrollment, which motivates this dissertation.

This dissertation adds to the existing knowledge of AP enrollment and the role of high school students' decision-making in AP enrollment through a mixed-methods study of this topic

at two high schools in Michigan. A strength of this mixed-methods approach is that it overcomes many of the limitations often associated with purely quantitative or purely qualitative approaches to research to identify causal mechanisms that are generalizable. This design combines analyses of school-based administrative data, attitudinal and perception data from a student survey, and interviews with select students to paint a rich picture of students' decision-making process(es) around AP enrollment and to examine whether and how those processes vary across different groups of students. This research will be oriented around the following research questions:

1. What are the patterns in AP enrollment across student groups for the overall student population and for the sub-population of students who are most likely to be successful in AP classes?
2. How do student characteristics, including demographics, achievement, and psychological constructs, vary by AP enrollment status?
3. What student-level factors or characteristics predict enrollment in AP classes?
4. How do perceptions of AP classes and students vary across student groups?

This dissertation contributes to the literature on AP enrollment in two ways. The first is by describing a model to predict AP success using multiple measures of achievement and a criterion for identifying AP-caliber students that can be used to identify students to recruit into the AP program and to measure under-enrollment by academically talented students. The second contribution of this study is a proposed model of how students decide whether to take an AP class. This study proceeds as follows: chapter 2 discusses the relevant literature on AP enrollment; chapter 3 reviews the conceptual frameworks employed in this study; chapter 4 describes the design and methods of the present research, chapter 5 presents results related to research questions 1-3; and chapter 6 presents results relating to research question 4. Chapter 7

concludes with a discussion of the results of this dissertation along with implications, limitations, and directions for future research.

CHAPTER 2: RELEVANT LITERATURE

Though the subject of participation in the Advanced Placement (AP) program has received greater attention in recent years, how high school students make decisions around enrolling in AP classes remains understudied. In this chapter I review the relevant literature on several elements related to high school students' AP enrollment decisions. This includes studies that examine the potential benefits of AP courses, studies that describe demographic patterns in AP enrollment, research on students' perceptions of, and experiences in, AP classes that shape their participation, and literature related to the normative question of whether it is advisable to increase AP participation.

The Benefits of AP Classes

Since its inception, the Advanced Placement (AP) program from the College Board has been touted as one of the best ways for high school students to gain exposure to college-level coursework that helps to accelerate learning and to prepare students for more challenging academics in the future, a subject about which there has been some debate. Descriptively, students who were successful in an AP class are over 20 percentage points more likely to attend college and are approximately 25 percentage points more likely to remain in college after their first year relative to the national average (Mann, Sponsler, Welch, & Wyatt, 2017). Also, college students who have taken an AP class report that their experience in AP helped prepare them for their postsecondary coursework (Cooney, Mckillip, & Smith, 2013). However, other research has found that after controlling for other factors, students who take AP classes are no more likely to be successful in their first year of college or to persist into their second year (Klopfenstein & Thomas, 2009).

In addition to the potential academic benefits of being exposed to college-level coursework, students may benefit from AP classes in other ways. Some high schools may opt to assign greater weight to AP courses when calculating cumulative GPA, using a 4.5 or 5.0 as the maximum GPA rather than the traditional 4.0. Additionally, taking AP classes can also help students to signal their academic preparation or ability on college applications as AP classes are widely regarded, which can be a powerful incentive to take AP classes (Hertberg-Davis & Callahan, 2008).

Along with AP courses, students are eligible to take AP exams that correspond to the College Board's AP curricula.[2] Scores on AP exams range from a low of 1 to a high of 5. Students who score high on an AP exam may be eligible to receive college credits as many colleges and universities allow students to waive classes and earn credits for achieving a 3 or higher on an AP exam.[3] In other words, doing well in AP can help students accumulate a significant number of college credits before matriculating into college, reducing the cost of earning a degree and enabling them to enter the labor market sooner. For instance, a student attending Michigan State University who receives credit for a high score on an AP exam can expect to save approximately $3700 on tuition, living expenses, room and board, books, and fees.[4] Regardless of the academic benefits, the ability to earn college credits through AP participation makes AP enrollment an important topic of study. However, analyses of AP enrollment suggest that not all students have an equal opportunity to realize the benefits of AP classes.

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[2] Though a student is not required to take an AP class in order to sit for the AP exam, many students take an AP exam in the same year they take the relevant AP course.
[3] This varies somewhat across postsecondary institutions as some colleges and universities require a 4 or 5 to receive credit while others do not award any credits for AP exam achievement.
[4] Based on Michigan State University's estimated cost of attendance.

Predictors of AP Success

Relatively little research has studied the factors that predict student success in AP classes and much of this work has been conducted by researchers at the College Board, which oversees the AP program. Perhaps unsurprisingly, these studies have identified prior achievement as the strongest predictor of AP success. An early study by Camara & Millsap (1998) used data on sophomores and juniors in the U.S. who took an AP test and the PSAT/NMSQT to determine that these measures showed moderate to high correlations depending on the AP subject and the PSAT measure used. The authors found correlations to be highest between AP subjects and PSAT subsections that are conceptually related, such as AP English and PSAT Verbal (correlation .654), but with many correlations between PSAT composite score and AP exam score in the .4 to .5 range. They also conducted regression analyses that included PSAT scores and self-reported data on achievement and coursework for a subsample of students to predict AP exam scores but determined that these factors explained little variation in AP exam outcomes. A follow-up to this study conducted by Ewing, Camara, & Millsap (2006), found largely similar results but that in some cases the inclusion of course grades added predictive power for some subjects, with these two factors sometimes explaining over 50% of the variation in AP exam scores.

More recent studies by researchers at the College Board have revisited this subject in light of changes in assessments and the population of AP students (e.g. Ewing & Wyatt, 2017; Zhang et al., 2014). Zhang et al. (2014) used the most recent data available to them and, interestingly, found higher correlations between PSAT and AP exam scores higher than what was found in earlier studies, many over .6. However, they also found that PSAT scores and PSAT scores combined with grades explained less than 50% of the variation in AP exam scores.

Why these changes occurred is unclear, but potential reasons include changes in the PSAT and AP exams over time and/or the larger group of students that participated in both assessments.

While these studies shed light on the factors that predict AP success, they nevertheless have important limitations. One such limitation is that the data they use on student grades are self-reported and therefore may be biased if students cannot accurately recall their grades or report grades that are higher (or lower) than they actually earned. Another is that they consider only one definition of AP success: earning a high score on an AP exam. While this confers the most benefit to students, other outcomes such as course grades in their AP classes are also important and merit examination. Lastly, these studies only include students who took both the PSAT exam and an AP exam, which may not be representative of the population of AP students.

Patterns in AP Enrollment

In the 2016-2017 school year, over 2.7 million students across the United States took one of the 38 courses offered as part of the College Board's Advanced Placement (AP) program. This represents a growth in AP participation of over 300% from the 2000-2001 school year (College Board, 2017a). Given the larger volume of content covered in AP classes, the AP program has traditionally been thought of as for the most academically talented students who are best prepared for the rigors of AP. Assuming that academic talent (i.e. intelligence) is evenly distributed across students from all subgroups within the population, one would expect students from all subgroups to be equally likely to enroll in AP classes (Ford, 2010; Southworth & Mickelson, 2007). Regrettably, significant gaps in AP enrollment have been identified, with students from some demographic groups being far less likely to enroll in AP classes than their peers.

Students of color, namely Black and Latino/a students, enroll in AP classes at rates far lower than their white counterparts.[5] Analyzing AP enrollment in Texas, Klopfenstein (2004) found that students of color are only half as likely as White students to take an AP course. A later study by Moore & Slate (2008) found similar enrollment gaps between White students and students of color. More recently, Theokas & Saaris (2013) analyzed data that included information on the U.S. student population overall as well as all students who took an AP exam[6] in the U.S. in 2010 and determined that while 25.1% of Asian and 11.9% of White students took an AP exam, just 9% of Hispanic, 6.3% of American Indian, and 6% of Black students took an AP exam (pp. 4). If these gaps were addressed such that students of color enroll in AP at the same rate as White students, AP participation among Black, Hispanic, and American Indian students would increase by over 89,000; over 54,000; and over 3300 students, respectively.

Socioeconomic status is also strongly related to AP enrollment as just 5.5% of low-income students took an AP exam in 2010 while 15.6% of students who were not low-income took an AP exam. Modelling AP enrollment, Klopfenstein (2004) found that low-income status was the strongest factor producing AP enrollment gaps. If low-income students enrolled in AP classes at the same rate as students not identified as low-income, AP participation would increase by over 460,000 students nationwide (Theokas & Saaris, 2013). In short, equitable enrollment in AP classes along the lines of race/ethnicity and socioeconomic status would result in AP

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[5] Here, I use the term "students of color" to refer to students who identify as Black and/or Hispanic because these groups' history of marginalization. Though Asian students are sometimes included in this term, I do not include them here because Asian students participate in AP courses at higher rates than do Black, Hispanic, and White students (Theokas & Saaris, 2013), which could mask under-enrollment in AP by Black and Hispanic students.

[6] AP exam-taking is used was an indicator of AP participation because College Board tracks exams rather than individual student enrollment in AP classes. Thus, the estimates calculated by the authors may overstate the size of enrollment gaps if students from underrepresented groups who take AP classes are less likely to also take the corresponding AP exam. Conversely, these estimates could understate the size of enrollment gaps if students from under-represented groups who take AP classes are in fact more likely to take AP exams.

participation increasing by over 600,000 students, an increase of over 20% above the current AP participation rate. Needless to say, recognition that many students of color and low-income students are not able to obtain the benefits of AP classes has alarmed and motivated educators, researchers, and policymakers to seek ways of addressing this important issue.

A third dimension of AP inequity is along the lines of urbanicity. After studies documented that many urban schools offered few or no AP courses (Klopfenstein, 2004; Solorzano & Ornelas, 2002; Zarate & Pachon, 2006), efforts have been made to make AP classes more readily available to all students, with some success. Mann et al. (2017) found that, as of the 2014-2015 school year, 92% of high school seniors in urban schools, and 95% of seniors in suburban schools, have AP courses offered at their school. However, just 73% of seniors attending rural schools have access to AP classes, though this has increased significantly since the 2000-2001 school year when 56% of rural seniors attend a school that offered AP. At the same time, AP participation among high school seniors has roughly doubled in rural, urban, and suburban schools, though urban and suburban seniors are over 50% more likely to take AP classes.

Perceptions That Shape AP Enrollment

A fourth area of research on AP enrollment considers the relationship between students' perceptions of the AP program and their participation in it. Relevant perceptions include how students view the AP program's benefits, students' perceptions of the climate in AP classes, their relationships with adults and peers in the school, and perceptions formed from prior educational experiences. Perhaps the most important perception related to students' AP enrollment is the benefits they associate with the program. Recall from an earlier section that by participating in the AP program, students may acquire greater knowledge and skills, improve the quality of their

college application, and/or waive college courses if they perform well on an AP exam. These rewards are significant, and students find them appealing. In interviews with several hundred AP students in nearly two dozen high schools, Hertberg-Davis & Callahan (2008) found that the vast majority of the students they interviewed reported that their AP class was the first setting in which they felt academically challenged and that their AP class provided a space for them to grow intellectually. The authors also found that students considered AP classes as important to their postsecondary plans in terms of signaling their work ethic and ability to colleges, seeing AP courses as almost essential to having a reasonable chance of acceptance at selective colleges.

Students' perceptions of the AP program vary along demographic lines. Hertberg-Davis & Callahan (2008) also observed that AP students from disadvantaged backgrounds see an especially strong sense of opportunity in AP classes, viewing the program as a way to break from the paths that others in their family had chosen. Interestingly, these students are from demographic groups that are underrepresented in AP classes. Other research has probed the perceptions of underrepresented students and found that, for students of color, a lack of diversity in AP classes may be self-reinforcing in that the absence of diversity can discourage participation, though the extent to which this may impact students' AP enrollment decisions is unclear (Havis, 2015; Hertberg-Davis & Callahan, 2008; Solórzano & Ornelas, 2009; Taliaferro & DeCuir-Gunby, 2008; Venzant Chambers et al., 2014; Welton & Martinez, 2014; Yonezawa et al., 2002).

Students' relationships are strongly related to their AP perceptions (Bryan, Glynn, & Kittleson, 2011; Mason, 1995; McDonald, 2014). In a study of students already in AP classes, McDonald (2014) found that all students felt invited into AP classes, but the strength of this feeling varied by demographic characteristics in a way that mirrors patterns in AP enrollment

with White students, Asian students, and wealthier students reporting a greater sense of invitation and encouragement to take AP classes than their peers. Other research by Taliaferro & DeCuir-Gunby (2008) similarly found that economically disadvantaged, Black, and Hispanic students were less likely to be encouraged by their teachers or administrators to take AP classes. The institutional knowledge students have, or are able to access, also plays a role in AP participation, especially since some schools may involve an application process or require a teacher endorsement to register for an AP course. Students, or their parents, who have greater knowledge of the rules and/or procedures, as well as their flexibility, are better able to access advanced courses, which may disadvantage already underrepresented students (Taliaferro & DeCuir-Gunby, 2008; Welton & Martinez, 2014; Yonezawa et al., 2002).

Lastly, students who take an AP course draw on their experience to reinforce or update their perceptions. Students who perceive their AP teacher to be high-quality and enthusiastic view AP more favorable and plan to take additional AP courses in the future (Hertberg-Davis & Callahan, 2008). On the other hand, students who experience an AP course with a teacher who is disorganized or of lower-quality exhibit decreased interest in advanced classes and are discouraged from taking future AP classes (Hallett & Venegas, 2011). Interestingly, little is known about how students gauge instructional quality, making it difficult to determine the elements of students' AP experiences that encourage or discourage future enrollment in AP classes. Students of color have unique experiences in advanced classes that shape their perceptions. Some research suggests that students of color may feel racially isolated in AP classes that have little diversity (Havis, 2015; Hertberg-Davis & Callahan, 2008; Solórzano & Ornelas, 2009; Taliaferro & DeCuir-Gunby, 2008; Venzant Chambers et al., 2014; Welton & Martinez, 2014; Yonezawa et al., 2002). However, this may not be a strong factor in later AP

participation as Havis (2015) found that while students of color are highly aware of their underrepresentation in AP classes, this did not impact their intent to take an AP class in the future.

The Question of Increasing AP Enrollment

The normative question of whether efforts should be made to enroll more students in AP classes involves different sets of values and thus remains a hotly debated topic. In recognition of the potential benefits of the AP program (see the above section on the Benefits of AP Classes), some have some called for policies and programs to increase participation in AP classes, especially for students from historically marginalized groups and in urban schools, as a way of promoting equity. One result of such efforts are state-level policies that provide a mandate or encouragement for schools to offer AP classes. High schools or districts are required to offer AP courses in eight states and the District of Columbia.[7] Additionally, thirteen other states have policies that require districts and high schools to offer advanced courses or courses that can lead to college credit, a requirement that can be fulfilled by AP courses (Education Commission of the States, 2016).[8] Another approach to expanding AP enrollment that has been advocated is to make AP classes part of the general curriculum rather than a specialized program only for students identified as gifted and talented (Flores & Gomez, 2011). Doing so, the thinking goes, would significantly increase exposure to AP for students from under-represented groups and therefore help them obtain the benefits of AP classes.

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[7] These are: the District of Columbia, Arkansas, Connecticut, Indiana, Iowa, Louisiana, Mississippi, South Carolina, and West Virginia.

[8] These states include: Florida, Idaho, Kentucky, Maine, New Hampshire, New Jersey, New Mexico, North Carolina, Ohio, Oregon, Rhode Island, Texas, and Virginia.

While some champion greater AP participation, some cast doubt on the espoused academic benefits of AP courses generally and others question the benefit of expanded participation in AP. For instance, in a study of 28,000 high school seniors in Texas, Klopfenstein & Thomas (2009) find limited to no evidence that taking an AP course in high school improved students' postsecondary outcomes. Using logistic regression that controls for student achievement, AP and non-AP courses taken, demographic characteristics, and family characteristics to predict whether a student returns to college in their sophomore year, the authors determine that after accounting for these factors, taking an AP course is not a significant predictor of college retention. In the same study, Klopfenstein & Thomas also examine the relationship between AP participation and students' first-year GPA using linear regression with the same controls and conclude that any apparent differences in the outcomes for students who did and did not take an AP course are attributable to factors outside their AP experience. Others caution that attempts to broaden AP participation may set some students up for failure if they are not adequately prepared for AP-level work, a concern that is shared by teachers (Finn & Winkler, 2009) and is supported by some research and journalistic accounts. Hallett & Venegas (2011) found that while expansion of AP programs in low-income urban schools did lead more students to take AP classes, they did not perform well on their AP exams, citing their academic preparation as the reason why. Similarly, Tugend (2017) documents that though students in urban schools were enthusiastic about taking AP classes and had dedicated teachers, they were rarely successful on AP exams due to being underprepared.

In confronting the question of whether AP participation should be increased, it is important to consider the different outcomes and values at play. Regarding the relationship between AP courses and learning/human capital development, it is unclear whether taking AP

classes is related to these outcomes. However, many universities consider students' AP participation in admissions decisions and allow students to earn college credit for earning a high score on an AP exam. Thus, it is important to support students' access to AP courses, especially for students from historically marginalized groups, as a means of promoting equity in postsecondary outcomes, though this should be done carefully considering a range of factors.

Extant literature paints a complex picture of AP enrollment that examines the espoused benefits of the program, enrollment patterns, student experiences and perceptions, and normative questions about AP enrollment. Consistent across studies is that students' academic ability and demographics are important considerations in evaluating students' AP enrollment decisions. In the following chapter, I draw on this and discuss the conceptual frameworks I use to study students' AP enrollment decisions.

CHAPTER 3: CONCEPTUAL FRAMEWORK

A review of the research on AP participation amongst high school students shows that the current rate of AP participation is sub-optimal. As noted in the previous chapter, students of color and economically disadvantaged students participate in the AP program at lower rates than what would be expected given their representation in the overall student population (e.g. Theokas & Saaris, 2013). This signals dimensions of inequity in how the AP program is administered in the nation's high schools. Also of concern, but less well understood, is the subject of AP enrollment by academically talented students, which may signal inefficiency in the administration of the AP program if a significant share of academically talented students do not participate in AP classes. In short, under-enrollment in AP courses, whether by race/ethnicity, socioeconomic status, or academic ability, disadvantages students who may otherwise benefit from a rigorous academic setting, the signal sent by taking an AP course on college applications, and/or the ability to earn college credit by passing an AP examination.

To understand these patterns of AP enrollment, it is important to understand students' decision-making. Importantly, high school students typically have significant agency in selecting the courses they take. In the typical process through which high school students are enrolled in courses, schools first distribute a catalogue of courses to students that describes the range of course offerings provided by the school. From these, students select the courses they wish to take by submitting course requests to the school, which the school administration then uses to put together a master schedule of classes. This gives students significant control over the classes they take in high school. From a rational perspective, giving students choice in their course schedule allows them to take the courses that are most relevant to their interests, best suited to their ability, and that align with their preferences (Becker, 1993). However, this does not explain why

students from traditionally underserved groups are systematically less likely to enroll in AP classes as students from these groups are not systematically less able (Theokas & Sarris, 2013) and it is unlikely that students from underserved groups have systematically different interests and preferences related to educational opportunity and the AP program. Thus, this dissertation focuses on high school students' decision-making around course selection and how this contributes to patterns in AP participation.

This study employs three conceptual frameworks to understand students' decision-making around course selection and how that in turn shapes AP participation: judgment and decision-making, social-emotional skills, and identity. In the following sections of this chapter, I describe each of these frameworks and their relevance to high school students' decision-making around AP courses.

Judgment and Decision-Making

The framework of judgment and decision-making (JDM) views the future as stochastic and examines how people behave in this context (Fischhoff & Kadvany, 2011; Knight, 1921). For instance, whether it will rain tomorrow, which dish from a restaurant's menu would be most satisfying, and the career in which one will be most successful are all probabilistic in nature. To make decisions, JDM holds, one uses information about the probabilities of possible events and the benefit or harm associated with each event to make a decision that then guides behavior. To make decisions in this way, one may obtain information about potential events and their associated probabilities from external sources, such as a meteorologist who provides the forecasted probability of rain for each day, experience, such as one's previous meals at a restaurant to gauge the taste of different dishes, or from one's environment, such as the feedback one receives about their strengths and weaknesses from peers or mentors. In this process, the

benefit or harm of different events depends on one's preferences for (or against) different outcomes. For instance, when selecting a career, one's preferences for money, job security, different types of work, time demands, location, and others factor into that career's degree of desirability. Importantly, JDM does not hypothesize that one deliberately estimates the probability and benefit/harm for each decision they make, simply that acts as though these processes are employed to maximize one's pleasure or benefit (Friedman & Savage, 1948). A key structure of JDM is that judgments and decisions occur in separate phases. In the judgment phase, one draws on available information to estimate the probabilities of relevant outcomes. Probability estimates are then used in the decision-making phase to reach conclusions that then guide actions. To use a simple example, Julie receives a weather alert on her phone that there is a 30% chance of rain in the area for the day but upon seeing dark clouds out of the window, decides that rain is more likely than not and, not liking the clammy feeling that rain jackets can sometimes cause, decides to pick up an umbrella before going out the door.

One popular theory within JDM is expected utility theory, also sometimes called rational choice theory (Fox & Simkin, 2015; Von Neumann & Morgenstern, 1944). At its core, the rational model of decision-making assumes that people have well-defined preferences and can accurately estimate the probabilities that different events will occur. With these relatively simple assumptions, rational choice theory predicts that people are able to make decisions that will best satisfy their wants and needs, which has made this theory appealing in the policy-making sphere (Marschak, 1950). Applying this to students' AP enrollment decisions suggests that giving students choice in the courses they take allows them to consider the range of courses available, their educational aspirations, career goals, probability of success in AP, and preferences for how to spend their time (balancing studying, work, extracurriculars, and relationships) and, after

weighing each of these considerations, the student would then make the decision that is optimal for them. In the aggregate, this would lead to a pattern of AP enrollment in which all students got what they wanted from their schooling and were best off in the long-run

Newer research in JDM challenges the usefulness of the rational model as an accurate depiction of behavior. Rather than presenting an alternative complete theory of behavior, JDM research has identified several ways in which real-world behavior deviates from the predictions of a rational model that leads to inaccurate predictions and sub-optimal outcomes. One such challenge is that intuition, rather than evaluation, can sometimes exert a significant influence on decisions. Stanovich & West (2000) explain this with a two-system process model of decision-making. According to the authors, System 1 processes are intuitive and executed without much attention or effort. For instance, high school students, upon hearing a bell in school, may automatically stand and begin moving toward their next class without consciously thinking of the time or which class follows their current one. System 2 processes, on the other hand, require motivation, concentration, and/or the application of what may be complex rules. As an example of a System 2 process, consider a student completing a homework assignment that requires her to follow directions, recall relevant information, and muster focus to solve a series of problems. System 1 processes are useful as they conserve mental bandwidth that one may employ on more complicated tasks. However, one may be led astray by intuition in some instances that are facially simple but fundamentally complex and people have varying ability to recognize such situations. In research by Frederick (2005), the ability to recognize complicated scenarios and switch from System 1 to System 2 processes, thus more fully engaging one's cognitive faculties, is termed cognitive reflection. In this study, Frederick found that cognitive reflection varies significantly across the population and that this trait is also moderately correlated (.43-.46) with

common measures of achievement and intelligence such as the ACT, SAT, and Wonderlic assessments.

A second phenomenon that conflicts with the rational view of decision-making is that people tend to employ heuristics, mental rules of thumb, when forming judgments (Tversky & Kahneman, 1974). One way to frame heuristic judgment is that it involves replacing a difficult question with one that is easier to answer but is sufficiently different that a different judgment results (Kahneman, 2011). Two of the most well-documented heuristics are availability and representativeness. The availability heuristic involves forming probability judgments based on the information that is most salient (Tversky & Kahneman, 1973, 1974) such that one replaces the question "what is the probability of X?" with "how easily or readily can I recall X (Kahneman, 2011)?" Say that a student faces an upcoming test and needs to earn an A on it to earn her desired final course grade. Here, the relevant question pertains to the likelihood that she will earn a desired score on the test, which would depend on mastery of the relevant content, preparation for the test, attentiveness in class, etc. However, in thinking about her potential for success on this test, her assessment may be swayed by the ease with which she can recall earning an A on a previous test even though it may have covered different content or that she may have been less prepared for it. Another well-established heuristic is representativeness, which involves judging the probability of something specific based on the degree to which it resembles the main characteristics of its larger group (Kahneman & Tversky, 1972; Tversky & Kahneman, 1974). In other words, instead of answering the question "how likely is X to be of group/type Y?" one instead thinks of the question "to what extent does X resemble Y?" (Kahneman, 2011). Especially relevant to the representativeness heuristic is that the features defining the archetype against which one compares a new case may be based on a personally held conception or schema

as opposed to a commonly shared conception. For example, in the process of deciding which students to recommend into an advanced course, one might say that the teacher ought to consider each student's academic talent, work ethic, disposition towards school, and ability to seek out support when needed. However, due to the cognitive demand of considering these factors for each student, the teacher may instead evaluate each of her students against a student who was highly successful in an advanced course and recommend only those who compare most favorably. In this example, the teacher would be likely to overlook students who are capable rather than exceptional. In short, using heuristics leads people to form faulty judgments.

A third consistent finding across research on JDM is that people tend to exhibit inconsistent preferences across time that may negatively impact themselves in the future. One example of this is referred to as hyperbolic discounting or present bias, which occurs when one discounts the near future more heavily than the distant future (de Water, Cillessen, & Scheres, 2014; Ersner-Hershfield, Tess Garton, Ballard, Samanez-Larkin, & Knutson, 2009; Ersner-Hershfield, Wimmer, & Knutson, 2009; Koch, Nafziger, & Nielsen, 2015; Read & Read, 2004). To illustrate this concept, imagine a person who stays up late at night to watch television but as a result only gets approximately five hours of sleep each night. Waking up tired and groggy each morning, he regrets staying up so late and vows to retire earlier that evening. Yet, as each evening rolls around he finds himself staying up to watch more television yet again and the cycle repeats. In this example, the subject showcases an inconsistent preference for sleep by discounting it at night (meaning he values sleep less) relative to the value of sleep in the morning. Present biasedness can apply to many situations in which costs must be borne in the near-term for the sake of one's long-term benefit and has been used to study behavior such as procrastination, retirement planning, and diet and exercise (O'Donoghue & Rabin, 1998, 2001;

Scharff, 2009). Studies of this phenomenon have also found that the scarcity of resources and uncertainty about the future associated with poverty leads people to more heavily prefer present rewards and thus exacerbates present bias (Bertrand, Mullainathan, & Shafir, 2004; Bertrand, Mullainathan, & Shafir, 2006; Mullainathan & Shafir, 2013). For instance, an student experiencing poverty could hypothetically be tempted to drop out of school to work full-time as an appealing means of alleviating their present scarcity and in doing so place themselves at greater long-term risk.

Students' cognitive development is also related to temporally inconsistent preferences. Tasks such as planning, strategizing, and problem solving are all parts of what is called executive functioning in psychology. These processes are important to decision making because they pertain to defining one's preferences as well as processing information and making decisions to satisfy those preferences, but they develop over time. Research in neuroscience has identified the prefrontal cortex as the region of the brain that controls and also established that this region is not fully developed until a person reaches their early 20s (Fuster, 2002; Romine & Reynolds, 2005; Teffer & Semendeferi, 2012). At the same time, the limbic system, an area of the brain that is associated with social rewards, immediate gratification, and is enhanced by conflict and emotion, develops much sooner (Galvan et al., 2012; Giedd et al., 2012). The differential rates of development between the prefrontal cortex and the limbic system predisposes young people, particularly adolescents, to base decisions on emotion, seek social benefits at the expense of other outcomes, and potentially engage in risky behavior, which exhibit preferences that are likely to change significantly as adolescents mature but that nevertheless may significantly impact their adult selves (Atkins, Bunting, Bolger & Dougherty, 2012; Schneider & Caffrey, 2012).

The framework of JDM has important implications for the study of students' decision-making around AP enrollment. The course enrollment procedures common in many high schools can be said to assume that students are able to employ a rational process to select the classes for which they are the best match. However, there are strong reasons why students may not adhere to rationality when choosing courses and these could contribute to under-enrollment in AP classes. First, students' level of cognitive reflection likely plays a role in the extent to which students deliberate over their choices rather than making quick, intuitive selections, meaning that students who are less cognitively reflective may not consider all the relevant factors in their course selections. Second, reliance on heuristics may impact the judgments that students use to form their conception(s) of AP classes and their potential for success in that environment, which could lead some students to underestimate their likelihood of success and thus be less likely to take an AP class. Finally, high school-age students are especially likely to hold preferences that are inconsistent with their future selves. Due to cognitive development during adolescence, high school students are likely to value social rewards over material ones and are also likely to exhibit present bias, especially students from economically disadvantaged backgrounds. Because many of the important benefits of AP classes are material in nature, namely improving the quality of college applications and the potential to reduce the cost of earning a degree, and not realized until sometimes years into the future, students may significantly undervalue AP classes and as a result not enroll in one. This study will therefore draw on these insights from JDM to understand students' AP enrollment decisions.

Social-Emotional Skills

The term social-emotional skills refers to a set of cognitive characteristics that differ from traditional academic skills that are nevertheless important in life outcomes. Sometimes called

"soft skills" or "non-cognitive skills," social-emotional skills have received significant attention in recent years from researchers, practitioners, and policymakers owing to research demonstrating that these competencies are equally important for adult outcomes and are also related to educational outcomes (Heckman, 2008; Heckman & Rubenstein, 2001; Heckman, Stixrud & Urzua, 2006; Kautz, Heckman, Diris, Weel, & Borghans, 2014). There is not a universally agreed upon inventory of specific social-emotional skills (OECD, 2014), but this framework commonly includes skills such as the ability to regulate one's own behavior, a belief in one's agency and ability, and one's disposition toward learning and personal growth. In this section, I discuss three social-emotional skills I hypothesize to be related to students' AP enrollment decisions: self-management, self-efficacy, and growth/fixed mindset and how these factors influence students' decision-making and behavior.

Self-management refers to one's ability to be aware of and control their thoughts, actions, and feelings in different contexts. Due to variation in thoughts, actions, and feelings across contexts, self-management has a number of subcomponents that are related in that they all pertain to self-regulation. Subcomponents of self-management include intrinsic motivation, dealing with stress, the ability to direct and sustain efforts over longer periods of time, and the ability to delay gratification. A high degree of self-management helps one to become and remain motivated to reach their goals, persevere through difficult tasks, and to manage stress and frustrations that arise in the pursuit of goals. This concept of self-management has been seen as an important social-emotional skill for school-age children (CASEL, 2005) and research has shown it to be positively correlated with academic achievement as measured by GPA and test scores and negatively correlated with a student being disciplines (West, Buckley, Bartolino Krachman & Bookman, 2018).

Self-efficacy refers to a sense of confidence that, through the application of skill and effort, one is able to achieve their goals. This concept is rooted in a large body of research by psychologist Albert Bandura (1982; 1997) on individuals' self-perceptions of their own knowledge and ability. An important element of self-efficacy is that it is reflective, requiring one to appraise and evaluate their faculties. In doing so, people can develop an imperfect sense of their ability and so ability and self-efficacy may not be perfectly aligned. Ideally, encountering and mastering new tasks allows one to revise their sense of self-efficacy, but this requires the ability to manage one's thoughts and emotions during what may be a tumultuous learning process (Bandura, 1982; 1997). In a study that examined the relationship between self-efficacy and academic outcomes, West et al. (2018) found a strong a positive correlation with achievement, but that this was strongest for younger children and much less so for older students.

Growth mindset is a psychological disposition that one's abilities are malleable (Dweck, 2006). Often, the concept of a growth mindset is contrasted with a fixed mindset, a belief that one's knowledge and/or skills are static and cannot be improved. Individuals with a growth orientation are more likely to seek out ways of developing themselves through effort and engaging with challenges while those with a fixed view tend to shy away from tasks that may test the limits of their ability, which can make these outlooks self-reinforcing (Dweck, 2006). By undertaking tasks that require the acquisition of new knowledge and skills, those with a growth mindset are likely to become more knowledgeable and skilled. Conversely, the concern with failure or focus on deficits inherent in a fixed mindset can lead to intellectual stagnation. Recent research has shown that a growth mindset can be imparted through modeling and interventions that encourage one to seek out opportunities for growth, thus making individuals more psychologically resilient.

Self-management, self-efficacy, and growth/fixed mindset are highly relevant to students' decision-making processes around whether to take an AP class. AP courses are billed as rigorous college-level experiences designed to challenge academically talented students. To be successful in such an environment, students must believe that they are capable of performing well and be able to manage their thoughts, emotions. Additionally, students who approach challenges as chances to improve themselves, rather than as something to be avoided, would be more likely to accept the challenge of an AP class. In this study, I will examine the relationships between these social-emotional skills and AP enrollment.

Identity

Students' sense of identity, their self-perceptions that guide how they interpret and navigate the world, is also strongly related to their decision-making process(es). Put simply, one's identity can be said to be their answer to the question "Who am I?" (LaGuardia, 2009). Erik Erikson, who pioneered the study of identity, viewed identity formation as the defining struggle of the adolescent phase through which young people develop a sense of their place in the world, a sense of their relation to others, and also develop or adopt a set of values (1968). Identity is a fluid concept that is multidimensional in nature as well as contextual, meaning that, depending on the situation at hand, identity may varyingly draw on gender, region, language, race/ethnicity, religion, socioeconomic status, or a host of other factors (Eccles, 2009; Elmore & Oyserman, 2012; Faircloth, 2012). In this study, I draw on three facets of identity that are related to students' AP enrollment decisions: academic identity, racial identity, and the concept of future identity.

Students' academic identity, the role they see education having in their life, serves to inform the school-related decisions they make, such as how much time to invest in homework

and which classes to take. Students with a strong academic identity are likely to be more engaged with their education and to have higher educational aspirations and achievement relative to students with a weaker academic identity (Akerlof & Kranton, 2002; Brotman & Moore, 2008). A strong sense of academic identity can be a positive and motivating force, encouraging students to pursue educational opportunities and success (Hejazi, Lavasani, Amani, & Was, 2012; Hertberg-Davis & Callahan, 2008). While the identity to which a student subscribes can pull students towards academic achievement and a value of learning on one hand, some identities may also encourage them to devalue or even reject academics on the other depending on the norms and value systems of those who share those identities (Akerlof & Kranton, 2002). Academic identity is also fluid, allowing students to develop an increasingly positive identification with school and achievement over time. In a study of identity-based interventions for high school students, Faircloth (2012) found that a stronger academic identity can be fostered over a period as short as one semester.

In research on the underrepresentation of students of color in AP classes and gifted programs, racial identity emerges as an important factor in how academically talented students of color experience and engage with school. In one famous study, Fordham & Ogbu (1986) argue that Black students' racial identity is at odds with their academic identity and that this causes Black students to underachieve in school and to underinvest in their education to avoid being accused of "acting White." Subsequent studies have found support for the "acting White hypothesis" in which students of color experience downward-leveling norms relating to achievement (Havis, 2005; Tyson, Darity, & Castellino, 2005). However, the assertion that students' racial identity is at odds with academic achievement and success has also faced significant criticism. While Havis (2005) found that some Black students reported being

discouraged from taking advanced courses by their racial peers, this did not impact their course selections. Also, Tyson and coauthors (2005) found that identities that de-emphasize academics were rooted in the culture of the local school or community as opposed to students' race. Others have found that racial identity can encourage achievement amongst students of color. Examining the relationship between identity and academic achievement among Black students, Chavous et al. (2003) determined that both racial identity and academic identity were associated with academic achievement, but that a stronger racial identity actually facilitated high levels of achievement and attainment for Black students.

Racial identity also appears to interact with what students of color observe and encounter in advanced courses. Numerous studies have found that students of color are very aware of their underrepresentation in advanced classes like AP and that this can impose social and psychological costs on these students who may be made to feel as though they must represent their racial groups or interpret the lack of students of color in advanced classes as a message that those classes are not "for them" (Solórzano & Ornelas, 2009; Welton & Martinez, 2014; Venzant Chambers, et al., 2014; Yonezawa, Wells, & Serna, 2002). This may then create a vicious cycle in which a lack of diversity in AP classes discourages students of color from enrolling in AP classes, which perpetuates a lack of diversity in AP classes, and so on. One potential solution to this that has been advocated is teachers and counselors working to help students of color develop a stronger racial identity by directly confronting issues around race and students' racial experiences to serve as a source of strength for academically talented students of color (Ford, Harris & Schuerger, 1993; Ford & Whiting, 2011).

Lastly, identity changes over time and these changes are often the product of one's intentions as much as they are of one's self-perceptions and experiences. In other words, along

with the question "who am I?" identity is related to how one approaches the question "who/what do I wish to be?" (Eccles, 2009; LaGuardia, 2009; Yeager, Bundick & Johnson, 2012). One thing adolescents may draw on as they craft their identity over time is their career aspirations. In a longitudinal study of adolescents' identity formation and development, Yeager, Bundick & Johnson (2012) found that more developed vocational identities reported a greater sense of purpose and that reflecting on future goals increased students' motivation to achieve those goals. What students see as possible for them also shapes long-term identity formation, especially for students who may see their opportunities as constrained, though this is subject to change. Eccles (2009) argued that adolescents conceive of their future identities by considering their skills, strengths, goals, and values to estimate the future(s) they are more likely to observe. Other studies suggest that identity formation over time can be supported. In a study of an intervention focused on disadvantaged students, Oyserman, Terry & Bybee (2002) found that working with youth to help them see connections between their present identity, new skills, and a wider range of successful outcomes, students experienced an increased sense of belonging in school and began to emphasize academics. Lastly, along with imagining how the future may be different, a related component of temporal identity formation is the degree to which one expects the future to resemble the present. Research on the concept of future-self similarity concluded, believing that one's future will generally resemble their present situation, is associated with decisions that are more optimal over the long-term, such as a higher rate of savings (Ersner-Hershfield, Tess Garton, et al., 2009; Ersner-Hershfield, Wimmer, et al., 2009).

Students' sense of identity is a powerful force on the decisions they make regarding their schooling in general and has implications for how students decide whether to take an AP class. Students with a stronger academic identity are more likely to see taking an AP class as an

expression of this identity and engage with the coursework to maintain it. Racial identity is also a factor, though the role played by race is complicated as a strong racial identity can encourage some students to enroll in AP, though in some situations students may experience conflict between their racial identity and academics. Finally, identity can help students to forge a connection to their future, meaning that taking an AP class linked to a student's future goals may be a way for them to begin realizing those goals.

In this chapter, I discussed the three conceptual frameworks I used in this study to examine students' decision-making around AP courses: judgment and decision-making, social-emotional skills, and identity. While each of these bears on a different element of students' decision-making, there are some areas of similarity that will allow me to consider competing frameworks to explain students' AP enrollment decisions. In the next chapter, I outline the mixed-methods design of this study.

CHAPTER 4: DESIGN AND METHODS

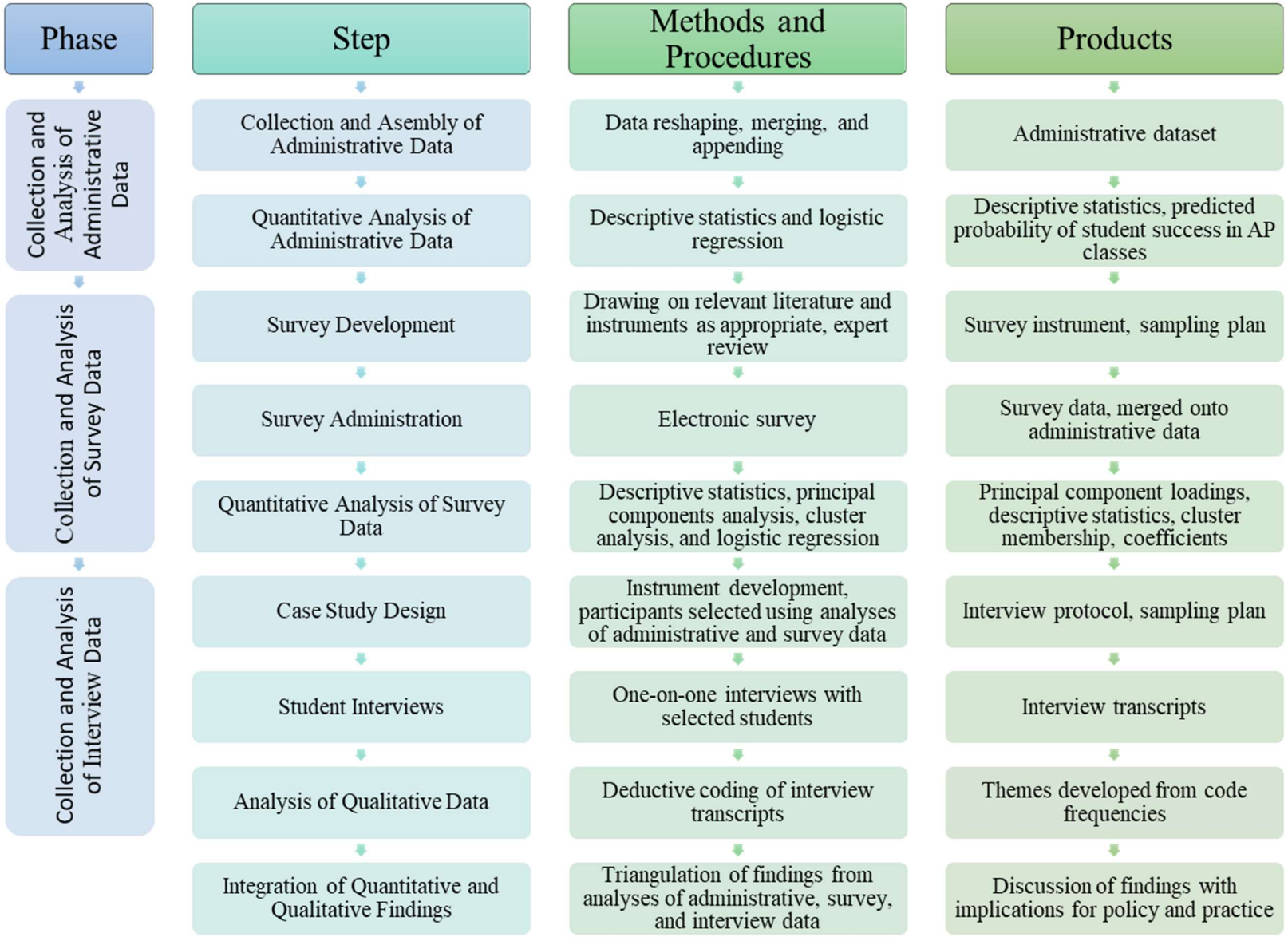
In this chapter, I outline the design of, and methods used in, this study to understand students' AP enrollment decisions. Given the research questions noted earlier and the extant literature on AP enrollment and students' decisions regarding AP enrollment, I argue that a mixed-methods approach is ideal for generating an understanding of high school students' AP enrollment decisions. As noted in the review of relevant literature, there is a significant body of quantitatively-oriented research using mainly administrative data that documents the presence and extent of different AP enrollment patterns by students from different groups. However, this research does not identify the mechanism(s) that produce the observed patterns. At the same time, qualitative studies on the subject, often drawing on interviews with students from underrepresented groups, explore the causes of AP enrollment gaps, but the degree to which these findings generalize to the population is unclear. Separately, these bodies of literature contribute to our collective understanding of AP enrollment, yet it is difficult to connect these two strands of research on AP enrollment. In other words, the degree to which the findings of extant qualitative literature account for what has been found in quantitative studies remains unclear. Importantly, this limits the ability of educators and policymakers to identify ways to both increase AP enrollment and to make AP access and enrollment more equitable. The present study aims to overcome the limits of a purely quantitative or qualitative approach by drawing on both types of data to investigate students' AP enrollment decisions.

To guide this mixed-methods investigation of students' AP enrollment decisions, I use a multi-stage sequential explanatory design. According to Ivankova, Creswell, & Stick (2006), an explanatory design differs from a concurrent design, in which quantitative and qualitative data are collected and analyzed at roughly the same time, in that an explanatory design begins with

the collection and analysis of one type of data and uses those analyses to inform instrumentation, sampling, and the collection of additional forms of data. Importantly, subsequent stages of data collection and analysis are done purposively to probe deeper into findings from the initial stage of data analysis. A strength of explanatory designs is that they present opportunities to explore preliminary results in greater detail and adapt to new findings as the research continues (Creswell & Plano Clark, 2007; Ivankova et al., 2006).

As the aim of this study is to investigate how students' decisions contribute to under-enrollment in AP classes and the factors that shape those decisions, it is important to first be able to describe under-enrollment in AP classes. Thus, an explanatory research design that begins with quantitative data is more appropriate as this can be used to identify broad patterns in AP participation and inform a qualitative sampling plan that maximizes the representation and generalizability of qualitative findings. The overall structure of the multi-stage explanatory design used in this study is shown Figure 4.1. As this figure illustrates, the first phase of this research involved the collection, assembly, and analysis of administrative data, which was subsequently used in the design and administration of a student survey, the results of which were in turn used to identify a sample of students and create a protocol for qualitative interviews that were analyzed in a multiple case study framework (Yin, 2003; 2018). In the following sections I describe how research sites for this study were identified outline the phases and steps of this research in greater detail.

Figure 4.1 Study Design



Site Selection and Characteristics

The design of this study considers contextual factors that shape students' AP enrollment decisions and requires collecting a significant amount of data from students who could potentially enroll in an AP class. To better examine the environment in which students make decisions and out of practical considerations for collecting a large volume of data, the recruitment of participants began at the school level. Recruiting schools as partners in this research facilitated access to administrative data as well as access to collect survey and interview data. Situating this study within schools also permits a deeper exploration of the academic and social environment in which students make their AP enrollment decisions.

Selecting and recruiting research sites began by setting criteria for inclusion and exclusion in this study. A review of the existing research on AP enrollment and AP enrollment gaps suggests the following considerations for selecting research sites: urbanicity; racial/ethnic diversity within the student body; socioeconomic diversity; school size in terms of population; and capacity within the school's AP program, defined here as a school offering AP classes in multiple subject areas, suggesting that the school could expand AP enrollment. Though AP enrollment at rural schools has been identified as an issue, rural schools are excluded from this study because they are less likely to offer AP classes due to capacity (Mann et al., 2017) and because their smaller size reduces the statistical power of quantitative analyses. Additionally, only comprehensive high schools, those that offer a traditional academic program, were considered for this study to ensure greater generalizability of findings. Magnet schools, which offer specialized academic programs, were excluded 1) because they often involve an application process, meaning that magnet schools ostensibly serve different types of students than comprehensive high schools and 2) because magnet schools are less common than

comprehensive schools. Thus, findings generated from a study that includes magnet schools may be less generalizable to the overall population of high schools and high school students. Other specialized schools, such as schools that focus on students with special needs or alternative schools, were excluded from this study because significant contextual differences between these and comprehensive schools would likewise limit the generalizability of findings. Thus, I focused recruitment on medium- to large-sized comprehensive urban and suburban high schools with diverse student bodies along the dimensions of race and socioeconomic status and an existing AP program they aim to expand.

To identify sites for this study, a sampling frame of potential partner schools was created using publicly available data. To increase the efficiency of conducting this study, the initial sampling frame included schools in the Mid-Michigan region, radiating further away as schools were excluded. Information on schools' student body composition and diversity was obtained from MISchoolData.org, a website maintained by the Michigan Department of Education (MDE) that houses data on student demographics and achievement for each public school in Michigan. Information on urbanicity (urban, suburban, and rural), was retrieved from the Common Core of Data and merged with data on student composition and achievement at each school. After reviewing these sources of information, a list of schools was created using the inclusion criteria discussed above, from which candidate schools were selected. After identifying candidate schools, I retrieved the Annual Education Report (AER) that schools are required to distribute to the school community and public, typically via the school's website. AERs are written by building principals to communicate information to the community about the school's performance, whether the school has been rewarded or sanctioned by MDE, and to highlight points of pride for the school. Since high schools often tout their AP participation, data on AP

Table 4.1. Student Characteristics of Pooled Sample by Year and Overall

Year	n	% Female	%American Indian/Native AK	% Asian	% Black	% Hawaiin/Other Pacific Islander	% White	% Hispanic	% Multiracial[4]	% Enrolled Through Schools of Choice	% Free/reduced Lunch Eligible	% Receives Special Education Services	% English Language Learners	Absences	% Who Took an AP Course	% Who Took an AP Exam	Mean GPA	Maximum SAT Composite Score[1]
2013	2911	51.2	0.9	3.4	11.1	0.0	79.0	9.3	15.3	22.2	14.0	4.1	1.8	13.3	14.4	7.8	2.69	1261[2]
2014	2845	50.7	1.0	3.7	11.5	0.1	77.7	9.6	15.0	23.6	16.1	4.5	2.1	9.7	14.4	6.7	2.64	1243[2]
2015	2825	50.2	1.1	4.1	11.2	0.2	76.9	10.3	15.1	24.8	20.1	7.0	2.4	7.9	14.0	7.9	2.57	1207[2]
2016	2840	48.7	0.8	4.4	11.2	0.3	76.0	10.6	16.1	24.6	24.2	9.6	2.7	8.0	15.4	8.4	2.57	962
2017	2702	47.7	0.9	4.2	11.1	0.4	76.3	11.0	15.1	24.4	28.2	12.2	2.4	7.1	19.5	10.5	2.59	970
2018	2816	46.9	0.8	4.6	10.5	0.4	76.8	11.1	14.2	24.8	32.9	14.2	2.5	--[3]	17.7	--[3]	--[3]	--[3]
Overall Sample		**49.3**	**0.9**	**4.1**	**11.1**	**0.3**	**77.1**	**10.3**	**15.1**	**24.1**	**22.5**	**8.6**	**2.3**	**9.2**	**15.8**	**6.9**	**2.62**	**972**
MI H.S. (2017)		**48.5**	**0.62**	**3.4**	**18**	**.1**	**66.2**	**7.9**	**3.9**	**--**	**50.7**	**13.1**	**6.4**	**--**	**--**	**--**	**--**	**1007**

[1] Since students could voluntarily take SAT assessments in addition to their required test, some students took more than one SAT test (e.g. both the PSAT10 and the SAT) or took the SAT multiple times in the same year. In those instances, their highest SAT composite score (their critical reading plus their math score) was used for analysis.

[2] Scores for these years are based on significantly fewer students as an SAT assessment was not required during those years. However, students were able to take an SAT assessment voluntarily, which likely resulted in only the students who were most interested in attending college doing so. As a result, average SAT composite scores for these years are not representative of the sample.

[3] End-of-year data for the 2017-2018 school year were not available at the time of this writing.

[4] Students at Lindor High school were able to identify as multiracial while students at James High School identified as one of the six commonly used racial/ethnic groups.

Table 4.2. Descriptive Statistics for Partner Schools in the 2016-2017 School Year

Partner School	Size	Female	White	Black	Hispanic/ Latino	Asian	Two or More Races	American Indian or Alaska Native	Native Hawaiian or Other Pacific Islander	Economically Disadvantaged	English Language Learners	Students With Special Needs	GPA	SAT Composite
James High School	900	45%	80%	5%	5%	5%	5%	0%	0%	20%	0%	10%	3.03	1043
Lindor High School	1800	50%	65%	10%	15%	5%	10%	0%	0%	30%	0%	10%	2.37	932

Percentages may be rounded to protect the identity of partner schools.
Sources: Administrative data, mischooldata.org

participation and outcomes is often included in their AER. AERs therefore provided information on whether the school has an AP program, its size, and sometimes AP outcomes, which was used to form an assessment of the school's AP capacity. After identifying candidate high schools that appeared to have AP capacity, building administrators were recruited via email about participating in this study.

This process yielded two high schools, each in a different district, that agreed to participate in this study as partner schools. Partner schools, and their districts, agreed to participate in the following ways: by providing administrative data from their learning management system (LMS) for all students from the 2012-2013 school year through the 2017-2018 school year, by agreeing to provide access to a sample of their current students for a survey, and by agreeing to facilitate interviews with selected students. To learn about the AP program at each partner school, I interviewed the principal and a counselor at each site about the history and context of their AP program, their AP offerings and the role of AP in their academic program, and whether there are any prerequisites or requirements for a student to participate in the AP program. Permission to conduct this research was obtained through each district's approval process and was done under the supervision of Michigan State University's Human Research Protection Program.

James and Lindor High Schools are both representative of high schools that offer AP courses. Both partner schools are situated in suburban districts near an urban center and both schools are the only high school in their district. Descriptive statistics for each partner school from the 2016-2017 school year are presented in Table 4.2. As this table shows, most students at both Lindor and James High School identify as White and both schools serve a significantly smaller proportion of economically disadvantaged students than Michigan students overall.

James and Lindor provide similar AP course offerings focused on the core subjects of English/Language Arts, Science, Math, and Social Studies though AP courses are also sometimes offered in elective areas. In both schools, students at any grade level are technically eligible to enroll in AP classes and without required prerequisites, but the principal and counselor at each site noted that students in grades 10-12 are best prepared for the rigors of an AP environment. At both schools, the principal and counselor stated that they believe their AP courses provide opportunities for students to challenge themselves in preparation for college, that their AP program is popular amongst higher-achieving and ambitious students, and that upper classmen – juniors and seniors – participate in AP at a higher rate than do sophomores. Additionally, leaders at both schools stated that their AP program is open to all students and wished that more students would take advantage of the opportunity to take AP classes.

However, there are some differences between the student characteristics of, and the AP program in, these schools. In terms of their student composition, Lindor High School enrolls roughly twice as many students as does James High School and Lindor High School also has comparatively more diversity along the lines of race/ethnicity and economic disadvantage. Additionally, students at James High School are higher-achieving on average compared to students at Lindor by six-tenths of a grade point on average and by over 110 points in terms of SAT achievement. Along with these differences in student characteristics between James and Lindor High Schools, there are also some differences between their AP programs. As Table 4.1 shows, a higher proportion of students at James High School participate in its AP program. The policies and procedures around AP enrollment and participation vary somewhat between, as well as within, these schools. During the course registration process, administration at James High School convenes class-level meetings about course registration where information about AP

courses is shared along with information about other courses. Additionally, James High School hosts an AP fair during students' lunch periods for which the teachers of AP courses make posters advertising their class(es) so that students can learn more about the AP courses that are offered. During course registration at Lindor High School, most of a day is devoted to teachers sharing information with students about the different courses and programs that are offered. The principal at James described an effort in previous years to "limit unintended hurdles, unintended criteria for students to enter into AP" and that students can participate in AP classes by simply enrolling in one during the regular course registration process. Students generally have autonomy in their course selection at Lindor as well, but a minority of AP courses and subject areas have prerequisites or an application process that is determined and enforced by each AP teacher.

As noted above, James and Lindor High Schools are typical of the high schools that offer AP courses. Their student bodies are demographically similar to each other and to the population of students in Michigan. Student achievement at Lindor is also comparable to the statewide average in terms of SAT scores while students at James are higher-achieving. In terms of their AP programs, administrators and counselors at both schools are committed to students having broad access to AP courses, though prerequisites and an application process exist(s) for some AP courses at Lindor. In the following sections, I describe the methods used to collect and analyze data for this study.

Phase One: Collection and Analysis of Administrative Data

The first phase of this study involved collecting various administrative data from partner schools; merging, appending, and reshaping that data into a format that can be used for analysis; and analyzing the relationships between a range of variables and AP enrollment. Analyses from phase one then inform the second phase of this study by providing initial insights into the drivers

of AP enrollment and identifying comparison groups for subsequent phases. In this section, I discuss how these steps were conducted.

Assembly of Administrative Data

Administrative data was provided to the researcher by partner schools and consists of descriptive data, enrollment data, and achievement data for all students enrolled between the 2012-2012 school year and the fall of the 2017-2018 school year. Descriptive data includes student race/ethnicity, gender, and a set of indicators for whether the student qualifies for free and/or reduced lunch; is enrolled in their school through Michigan's Schools of Choice[9] policy; receives special education services; and is classified as an English Language Learner. Enrollment data includes the number of absences a student has in a given year, the grade level in which the student is classified that year, the classes taken during that year, and the AP exams for which the student sat that year. Achievement data includes course letter grades for each semester, semester exam letter grades for each course, end-of year GPA, scores for any AP exam the student took that year, and scores the student received for the SAT assessment they took that year. Since the 2015-2016 school year, all high school students in Michigan from grades 9-11 sit for an assessment from the SAT suite of assessments based on their grade level.[10] Additional detail on the variables in this administrative data can be found in Appendix A. After receiving these data, they were merged, appended, and reshaped to create a dataset in which each observation is one student-year. To ensure the accuracy of this data prior to analysis, it was verified against summary data provided by the Michigan Department of Education for each school and by an

[9] Schools of Choice involves both school funding and school choice. Rather than using local property taxes to fund education, school districts in Michigan receive most of their funding from the State in the form of a per-pupil foundation allowance, a set amount of funding for each student enrolled. If a district allows non-resident students to enroll, the enrolling district also receives the foundation allowance for those students.

[10] Each spring, freshmen take the PSAT9, sophomores the PSAT10, and juniors the SAT.

administrator at each partner school. The data also contain a unique identifier for each student, which allows data relating to a student in one year to be linked to data in future years as students progress through high school. Importantly, the longitudinal nature of this data allows patterns in AP enrollment and outcomes to be examined over time for individual students as well as in the sample overall.

In total, this data contains observations on 6,589 unique students, with each student observed one to five times. Descriptive statistics for the overall sample, by year and overall, are shown in Table 4.1. This shows that the sample is approximately evenly divided between males and females, though the percentage of females enrolled declined over time, and that the largest racial/ethnic group is White students, who comprise roughly 77% of the total. Table 1 shows a slight decline in the percentage of students who identify as Black and Multiracial while enrollment by Asian, Hispanic, and Native Hawaiian students has increased slightly over the years examined in this dissertation. During this period, enrollment in partner schools through Schools of Choice, through which a student can enroll in a school located within a district in which that student does not reside, has also increased somewhat. At the same time, the percentage of students eligible for free/reduced lunch and who receive special education services have increased greatly, with the representation of students classified as English Language Learners also showing sizeable growth. Regarding student enrollment and outcomes, student absences declined during the years examined here and while AP participation, as measured by the percentage of students enrolled in at least one AP course and the percentage of students who took at least one AP exam, has increased while mean GPA has decreased slightly. Interestingly, this has been accompanied by a slight decrease in average GPA, though achievement as

measured by SAT composite score increased during the years when students were required to take an SAT assessment.

Estimating Students' Academic Ability

Since an important feature of the AP program is the academic rigor it offers to students, students' academic ability can be considered an important factor in students' AP enrollment decisions. However, academic ability can be difficult to measure due to its multidimensional nature which involves aptitude, prior knowledge, and other factors. As it pertains to AP enrollment, academic ability can be operationalized as the predicted probability of being successful in an AP class, which can be estimated using administrative data. The first step in estimating the probability of success in an AP class is selecting the most appropriate definition of success. Existing work on this subject has been done by the CollegeBoard using data gathered from the SAT and AP assessments it administers and defines success as earning a 3 or higher, out of a possible 5, on an AP exam. However, other definitions of success beyond AP exam outcomes may also be useful, especially since not all students who take an AP course take the associated AP exam. Earning a grade of A or B for either semester or exam grade may indicate success by demonstrating that a student can meet the expectations of an AP class. Earning a high final grade may be another measure of success by demonstrating that a student consistently meets the expectations of an AP class over the duration of the school year. Next, I examine these outcomes to determine the definition of AP success best suited to this study.

The distributions of grades earned in AP classes, in terms of highest grade earned for either semester or exam, are shown in Figures 4.2 and 4.3. Here, grades that were coded in letter form, with plus and minus grades, were converted into grades on a 4-point scale using partner

Figure 4.2 Distribution of Highest Grade Earned in AP Classes

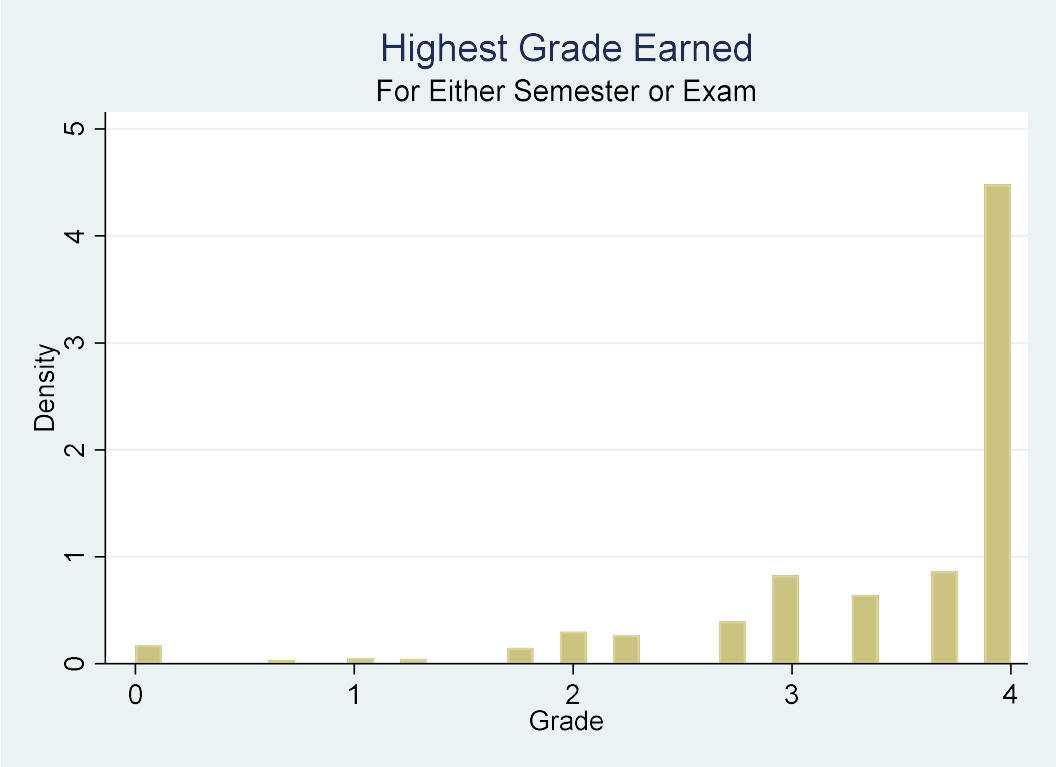
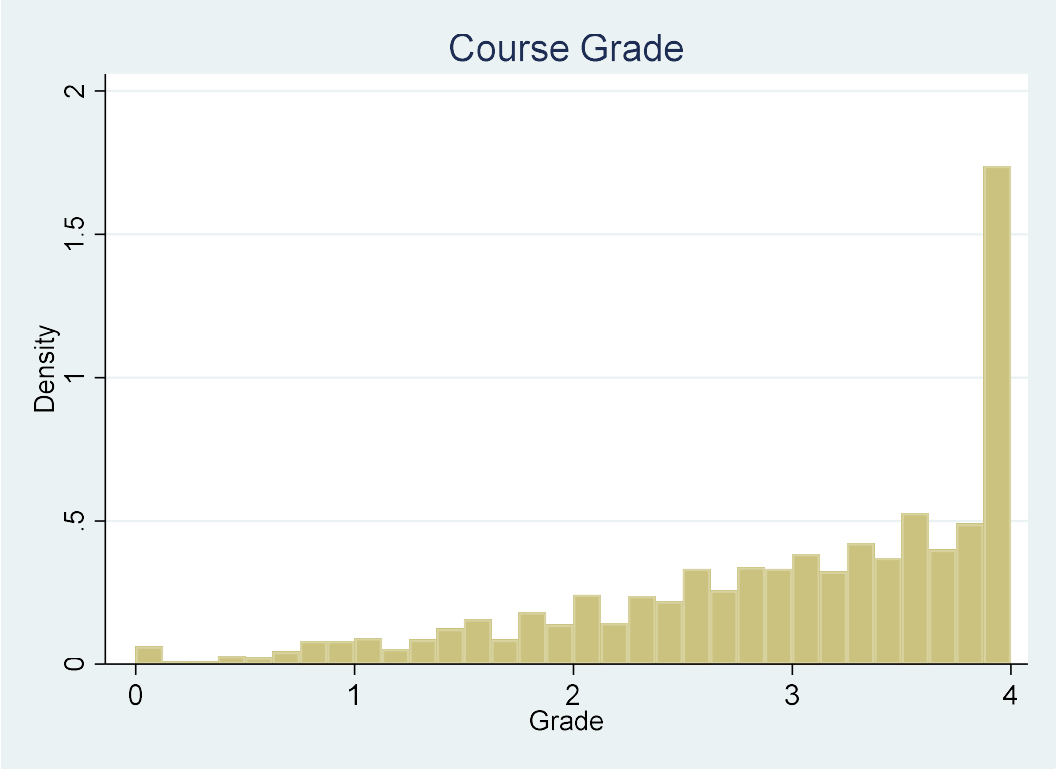


Figure 4.3 Histogram: End-of-Course Grades in AP Classes



schools' grade policies. Figure 4.2 shows that the most common high grade earned in AP classes is an A, with nearly 45% of students who take an AP class earning an A for either semester or on either their midterm or final exam. Further, 68.7% of students who enroll in an AP class earn at least a B in one semester or on one exam. The limited variation in this variable suggests that defining AP success as earning at least a grade of B at one point during the year is not very useful as the vast majority of students who take AP classes meet that definition. End of course grades, calculated from letter with plus/minus grades for each semester and exam according to partner schools' grading policies, shown in Figure 4.3, exhibit greater variation but are also significantly skewed, with a final grade of A being the most common. However, less than half (46.4%) of students who take an AP course earn a final grade of B or higher, meaning that final grades may be a useful indicator of AP success. Examining the third potential definition of AP success, earning at least a 3 out of 5 on an AP exam, shows that this may also be a meaningful indicator of success as 42.6% of AP enrolled students earn at least a 3 on an AP exam. Given the similar frequency with which students meet the second and third potential definitions of AP success, it may be that these definitions capture similar information. The correlation coefficient between these two outcomes, earning a final grade of B or higher in an AP class and earning a 3 or higher on an AP exam, is .73, which indicates that this appears to be the case. As such, I adopt the definition of AP success as earning a 3 or higher on an AP exam and use this definition in subsequent analyses

Being that the definition of AP success used here is binary in nature, the probability a given student will be successful can be estimated using logistic regression. This approach has been used by the College Board, the AP program's parent organization, to identify students as having "AP Potential." Examining the relationship between PSAT/NMSQT scores in one year

and AP exam scores in the following year, Zhang et al. (2014) find strong correlations between these variables, with coefficients between .47 (AP Physics C: Electricity and Magnetism) and .76 (AP English Language). Using simple logistic regression to predict the probability of earning a 3 or higher on an AP exam with prior-year PSAT/NMSQT scores, Zhang et al. (2014) observed a pseudo R-squared, the proportion of variation in the outcome variable that can be explained with the predictor(s) used in the model, between .149 (AP Physics C: Electricity and Magnetism) and .418 (AP English Language). The authors found that including students' self-reported high school GPA as a predictor in addition to PSAT/NMSQT score had a mixed effect on pseudo R-squared, with changes in pseudo-R-squared ranging from -.03 to .02. Given this, only exam scores were used to estimate students' AP Potential (Ewing & Wyatt, 2017; Zhang et al., 2014).

To estimate students' academic ability, defined in this study as the probability a given student would earn at least a 3 on an AP exam conditional on taking an AP exam, I adopt the general approach used by Ewing & Wyatt (2017) and Zhang et al. (2014) in which logistic regression is used to model the probability of future success in AP, earning a 3 or higher the following year, using prior achievement. However, there are three relevant differences between the approach I use here and that used by Ewing & Wyatt (2017) and Zhang et al. (2014). First, while those authors estimated the relationship between prior achievement and each individual AP exam, I use whether a student was successful on any AP exam as the outcome of interest. The factors driving this choice are statistical power and interpretability. The above referenced studies examined data with over 1.8 million observations and included students who took exams from every AP subject. The sample used in the present study is comparatively smaller and AP course offerings varied slightly between partner schools and years, meaning that examining success on each exam discretely would result in reduced statistical power and "noisier" estimates. At the

same time, an approach examining success on any AP exam may also contain noise as the true probability of success may vary across AP subjects. An important advantage of examining success on any AP exam, however, is that this permits a more straightforward interpretation as it does not require one to consider different probabilities of success across AP Government and Politics, AP Statistics, AP Biology, etc. Given these tradeoffs and this study's focus on the AP program generally, rather than individual AP subjects, I use an indicator for whether a student earned a 3 or higher on any AP exam as the outcome of interest.

A second difference between the approach I use to estimate students' probability of success in AP and that used in the studies discussed above is in the assessment scores that are analyzed. I use scores from the PSAT9, PSAT10, PSAT/NMSQT and SAT assessments whereas those above use only scores from the PSAT/NMSQT and the SAT. Since all PSAT and SAT assessments use a common scale (College Board, 2017c), scores across these various assessments are comparable. In other words, the assessments are designed so that a student who earns a composite score of 1200 on the PSAT9 would have received that same score if she had taken the PSAT10, PSAT/NMSQT, or SAT. Including scores for all PSAT/SAT assessments expands the sample in the present study significantly given the assessment policy in Michigan during a portion of this study. Since the 2015-2016 school year, all high school students in Michigan from grades 9-11 sit for an assessment from the SAT suite of assessments based on their grade level[11]. Comparatively, Ewing & Wyatt (2017) and Zhang et al. (2014) use only scores from the PSAT/NMSQT and SAT, leading to a sample that is roughly evenly split between 10th and 11th grade students. Including additional assessments significantly expands the sample in this study. Further, the requirement that all Michigan high school students take a

[11] Each spring, freshmen take the PSAT9, sophomores the PSAT10, and juniors the SAT.

PSAT or SAT assessment means that the sample analyzed in this study likely includes a wider range of student ability. In many states, taking a PSAT or SAT assessment is voluntary and has associated costs in the form of an exam fee and having to take an exam outside of regular school hours. This may result in an overall population of exam takers that is of higher ability and/or more ambitious since these assessments are often used for college and scholarship applications, which may impact findings. This issue is greatly reduced by the assessment context in Michigan. The final difference in how assessment scores are used in this study compared to previous research examining the link between academic ability and AP success is that this study uses the highest composite score a student earned in a given year while other have simply used the score from the first exam a student took in a given year. Though many students only take one PSAT or SAT exam in a given year, some may take the PSAT/NMSQT and the SAT or may take the SAT multiple times to improve their score as a means of making themselves more attractive candidates for scholarships and college admissions. In these instances, the highest composite score is retained for analysis.

The third difference between the data used here to predict AP success and that used in prior studies is that the data analyzed in the present study contains GPA from students' transcripts rather than self-reported GPA. Self-reported GPA may be biased if students systematically report their GPA as being higher or lower than their actual GPA, which could be the case if students believe that the information they provide about their GPA could be transmitted with their exam scores to colleges and universities. Self-reported GPA may also simply be inaccurate if students either do not know their GPA or know it with imprecision – believing they have a "3 point something" rather than a 3.41. Either, or both, of these could cause the relationship between students' grades and AP success to be inaccurately estimated.

I estimate academic ability, the probability that a given student earns a 3 or higher on an AP exam in the following academic year, using logistic regression as shown in Equations 1, 2, and 3. In these models, the outcome $APSuccess$ indicates whether a student earned a 3 or higher for any AP exam, β_0 represents the baseline likelihood of earning a 3 or higher on an AP exam, π represents the highest composite score a student earned on a PSAT or SAT exam, τ represents whether the students' end-of-year GPA is an "A," Φ represents a vector of other student-level performance characteristics, such as the number of school days missed, that may be associated with AP success, ε represents a random error term clustered at the student level, and *i* and *t* index students and years, respectively. In each of these models, variables from one year are used to

$$APSuccess_{it+1} = \beta_0 + \pi_{it} + \varepsilon_{it} \quad (1)$$

$$APSuccess_{it+1} = \beta_0 + \pi_{it} + \tau_{it} + \varepsilon_{it} \quad (2)$$

$$APSuccess_{it+1} = \beta_0 + \pi_{it} + \tau_{it} + \Phi_{it} + \varepsilon_{it} \quad (3)$$

predict AP success in the following year because this structure aligns with how students make course enrollment decisions – using information from one year to inform course selections for the following year – and because this approach is consistent with existing studies of AP enrollment. Equations 2 and 3 include a dichotomized form of GPA due to the distribution of that variable. As Figure 4.5 illustrates, the distribution of GPA is not approximately normal as it is extremely positively skewed and has a high kurtosis. As a normally distributed is preferable, I considered a series of transformations of the variable GPA, but none had an approximately normal distribution, as shown in Figure 4.4. Due to this, the variable GPA was recoded to indicate simply whether the student's GPA is classified as an "A."[12]

[12] Using raw GPA in these models as opposed to the dichotomized version discussed here had little impact on their fit.

Figure 4.4 Distribution of GPA After Various Transformations

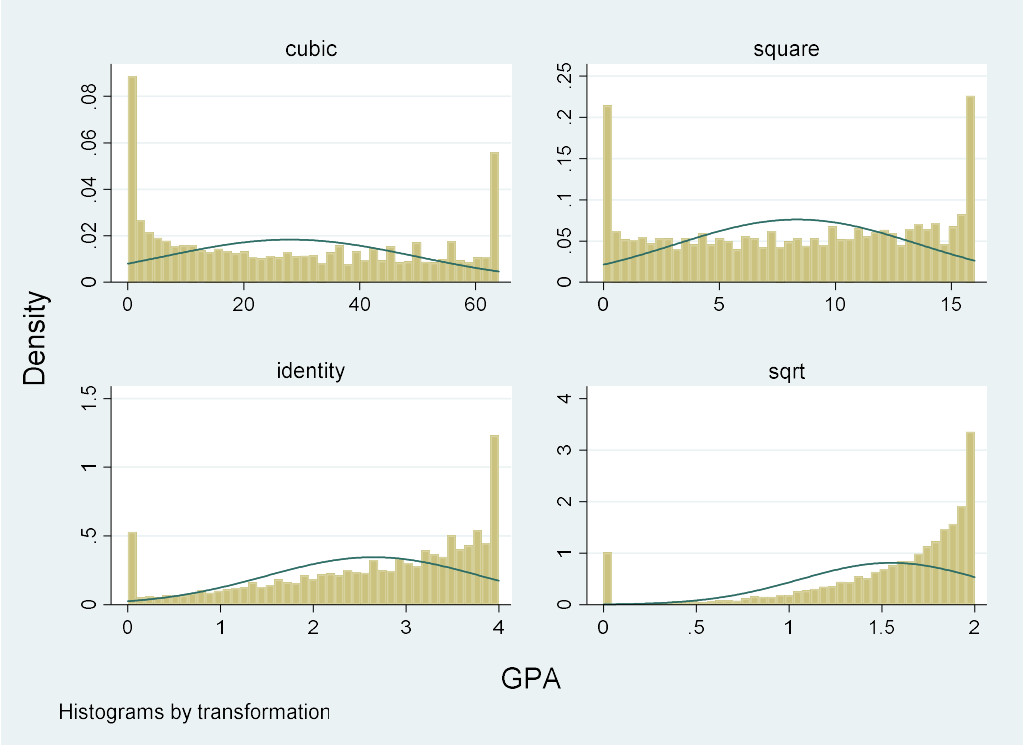


Figure 4.5 Density of End-of-Year GPA Compared to a Normal Distribution

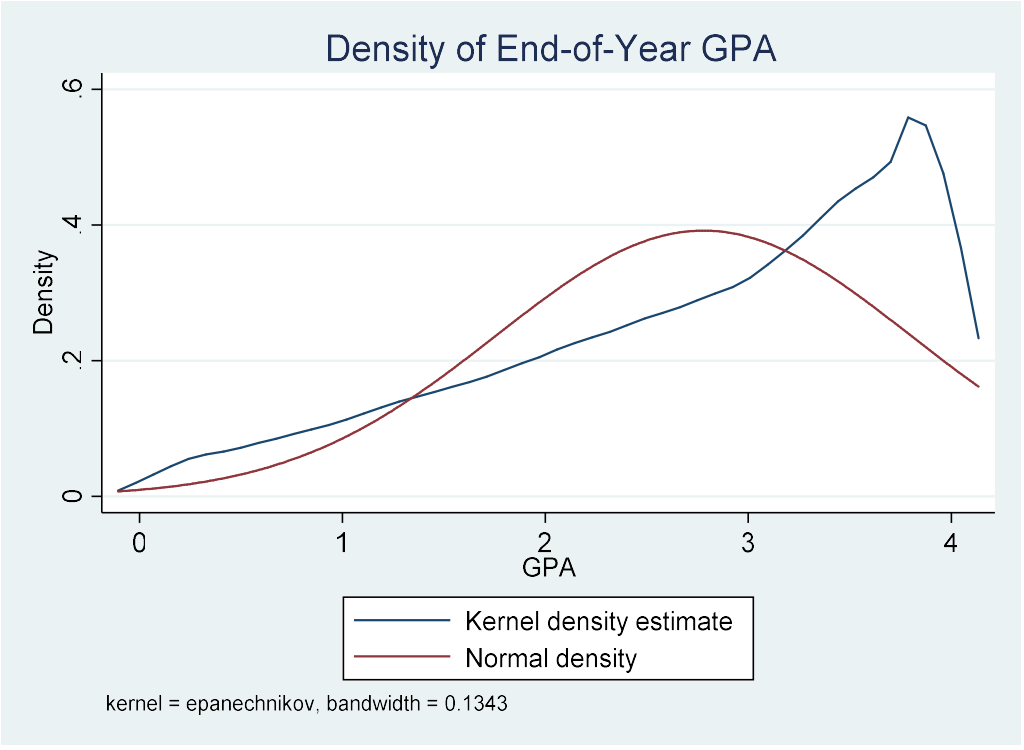
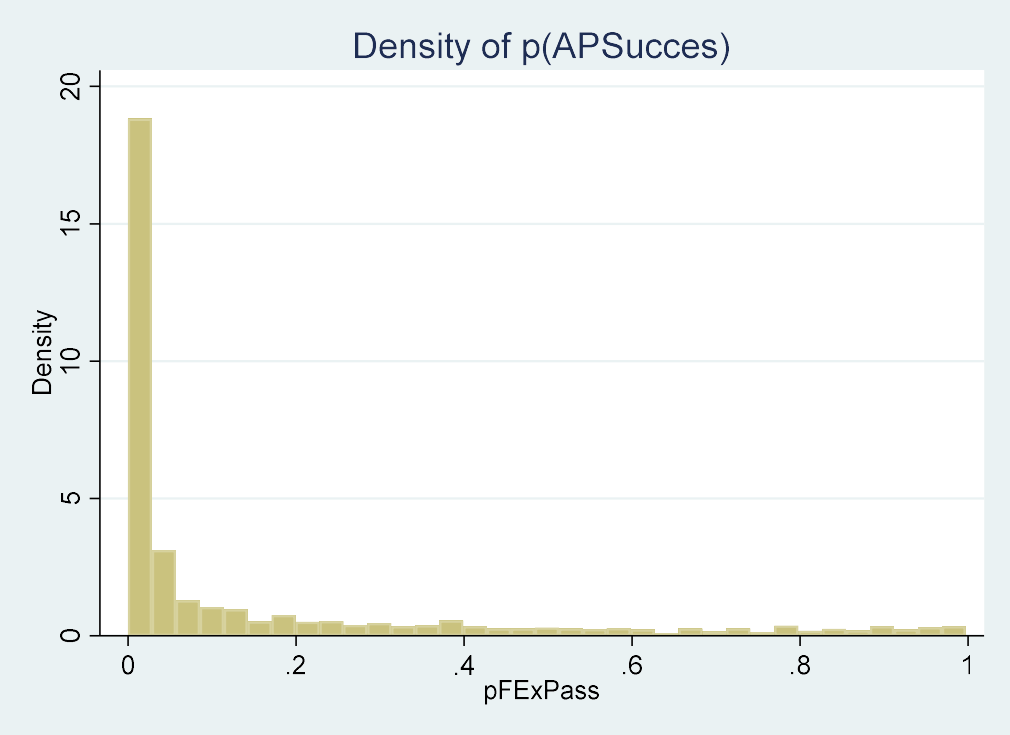


Figure 4.6 Histogram: Probability of AP Success



Results from analyses using Equations 1, 2, and 3, are presented in Table 4.3. As this indicates, I find that, perhaps unsurprisingly, SAT scores and GPA from one year are statistically significant predictors of AP success the following year. Additionally, the inclusion of grades results improves the explanatory power of the model, increasing the proportion of variation in AP success explained by the model from 0.414 to 0.463, though the increase in classification accuracy was marginal. These strong relationships are consistent with results from Zhang et al. (2014), who found pseudo-R^2 of 0.149-0.418 and classification accuracy between 74.2% and 89.6% using only SAT scores as a predictor of AP success. Moving from model 2 to model 3, the number of school days missed is not a statistically significant predictor of AP success and has a negligible impact on the model's explanatory power. Based on these results, model 2 was used to predict students' probability of AP success. A histogram of the probability of AP success is

Table 4.3. Results from Logistic Regressions Predicting AP Success

	(1) SAT Only	(2) SAT+GPA	(3) SAT+GPA+Absences
maxSAT	0.0125***	0.00999***	0.0103***
	(0.000776)	(0.000843)	(0.000861)
GPAA		1.862***	1.783***
		(0.234)	(0.238)
Absences			-0.0318
			(0.0176)
_cons	-14.98***	-13.56***	-13.62***
	(0.855)	(0.894)	(0.9)
N	1893	1891	1891
Pseudo-R2	0.414	0.463	0.465
Classification Accuracy	89.86%	90.06%	90.01%

*p<.05 **p<.01 *** p<.001

illustrated in Figure 4.6. This shows that, based on end-of year GPA and SAT scores, most students have a relatively low probability of being successful in AP, which is what would be expected based on the AP program's reputation of providing a highly rigorous environment. At the same time, there are also many students with a high likelihood of being successful in AP. While the probability of success in AP gives insight into students' academic ability, it also presents a question as to the threshold above which a student should be considered to have sufficient academic talent that an AP class could be considered the appropriate environment for them, a topic to which I turn next.

Identifying Academically Talented Students

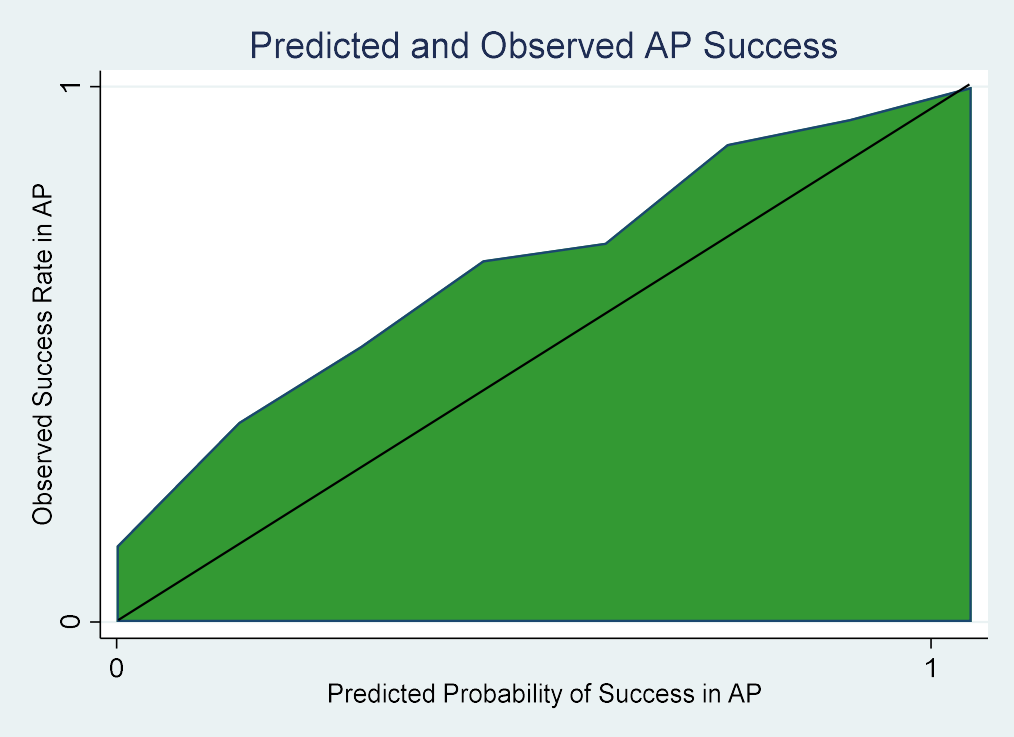
Identifying a method for classifying students as AP-caliber can provide a normative standard against which AP enrollment can be compared. As discussed in the review of relevant literature, many studies of AP enrollment focus on student demographics. While this is important as it bears on the commonly held educational value of equity, the fact that rigor is so central to the AP program implies that academic ability is also an important dimension of AP enrollment, a topic that is underexamined in research. A difficulty in studying this issue is the complexity of

identifying a means of identifying AP-caliber students, which involves students' academic ability along with a range of other factors, many of which are difficult to measure, as well as the values at work in addressing the topic of which students *should* be in AP classes. In what follows, I draw on analyses of administrative data from this study and input from stakeholders at partner schools to establish a method for identifying AP-caliber students.

I begin the process of identifying AP-caliber students using students' probability of AP success estimated in the previous section. Relevant to this process is an acknowledgement that identifying AP-caliber students takes place under the condition of uncertainty. The domain of uncertainty involves decision-making contexts in which outcomes are known, or can be estimated, probabilistically rather than with certainty. This is important because it means that even highly talented students may not be successful in an AP environment while, at the same time, less academically talented students may experience success in an AP setting. This is demonstrated in Figure 4.7, which plots estimated probability of AP success in one year and the observed rates of AP success for students who took an AP exam the following year. This shows that, as one would expect, students with a higher predicted probability of AP success are in fact successful at higher rates and vice versa. However, this does not present a means of using students' probability of AP success to determine which students are AP-caliber and should therefore be enrolled in an AP class.

I argue that a method of identifying AP-caliber students should consider students' estimated probability of success in AP along with the benefits and rigor associated with AP courses to classify students in a manner that maximizes their expected long-term benefit. Classification thresholds could be designed to be more inclusive and expand the pool of AP students, but may run the risk of having a high number of false positives, which would lead to

Figure 4.7 Predicted vs. Observed AP Success



AP enrollment by students who may not be adequately prepared for that setting. On the other hand, a more conservative classification threshold may fail to identify a number of students who would be successful in an AP class, which could result in some students missing out on the benefits afforded by the AP program. This is not to say that a classification system should be the basis of requiring or denying AP enrollment for students, only that such a system has heuristic value for research, and potentially interventions, on AP enrollment.

The tradeoffs between higher and lower thresholds for identifying AP-caliber students can be analyzed statistically and by considering the values of stakeholders. Different thresholds can be evaluated statistically by examining relative rates of false positives and false negatives between thresholds with the aim of selecting one that minimizes both. Information on the classification rates for different thresholds of predicted success in AP is in shown in Table 4.4, which displays information on predicted and observed AP success based on the subsample of

Table 4.4. Characteristics of Different Classification Thresholds

Probability Threshold for Classification	.3	.4	.5.	.6	.7
Accurately Classified Positive	41.8%	35.8%	29.8%	24.4%	20.6%
False Positive	12.6%	8.2%	5.2%	2.8%	1.6%
Accurately Classified Negative	33.6%	38.0%	24.0%	43.4%	33.2%
False Negative	12.0%	18.0%	41.0%	29.4%	44.6%
Classification Rate	75.4%	73.8%	53.8%	67.8%	53.8%

students who took an AP exam[13]. For these analyses, five different probability thresholds were used to classify students as AP-caliber, being likely to succeed in AP, ranging from a probability of .3 to .7. Students were categorized as being likely to succeed in AP if their predicted probability of doing so met or exceeded the relevant threshold. For the first column of Table 4.4, this means that students with a predicted probability of AP success greater than or equal to .3 were classified as AP caliber. This was then repeated for each threshold. Next, this binary prediction was cross-tabulated with whether the student was indeed successful in AP, conditional on taking an AP exam. The first row of Table 4.4 represents the group of students who were classified as likely to succeed in AP and later succeeded. The second row refers to students who were classified as likely to succeed in AP but did not. The third row refers to students who were not classified as likely to succeed in AP and did not. The fourth row represents the group of students who were not classified as likely to succeed in but were successful in AP. Finally, the last row of Table 4.4 displays the total percent of predictions that were accurate based on that threshold, which is the sum of rows 1 and 3. Table 4.4 shows that, in general, lower thresholds have lower combined rates of false positives and false negatives. Further, the ratio of false negatives to false positives is lower at lower probability thresholds. Together, this suggests that using a predicted probability of AP success of around .3 or .4 would have a high degree of

[13] The subsample of AP exam-taking students was used because the data suggest that virtually all students who take an AP exam do so after taking the associated AP class. This meant that predictions for students who did not take an AP class could not be examined as these students did not take and AP class or test.

predictive power. Interestingly, this finding differs from recommendations made by the College Board, which identifies students as having "AP Potential" if their predicted probability of success meets or exceeds .6 (College Board, 2015).

Deciding between the probability thresholds of .3 and .4, which have a similar degree of explanatory power, involves a tradeoff between a more even ratio of false positives and negatives and a lower rate of false positives. I argue that this choice depends significantly on one's belief or value as to whether students should be encouraged to rise to a challenge or whether classification should be approached more cautiously. Data regarding these beliefs and values was collected as part of a set of interviews that were conducted with administrators and counselors at both partner schools regarding the structure and functioning of their AP program. The interview protocol for these interviews is included as Appendix B. In these interviews, both administrators and counselors tended to favor a broader approach to AP classes, believing that AP provides opportunity for many students. When asked about the types of students who should take AP classes, the principal of James High School opined:

> I think, like I said before, anybody that wants to take an AP class can take an AP class, especially when our data will support 85 to 90 plus percent of our kids on any given year going to go to a two or four-year institution. For the very reasons that we've discussed, and I've shared, anybody should be able to take one.

The principal of Lindor High School expressed a similar sentiment but stated more firmly that AP classes should aim to enroll a broader range of students. To the same prompt, he responded:

> I think the wider the net the better. I would be more inclusive than exclusive because there are, there's all kind of mitigating factors… You know, it's okay. Colleges look at those things, and so whether they will get a 3 or higher on the AP exam, I still think it's good for a kid to experience that level of rigor and expectation for them so that they're prepared for that when actually have to at other times whether that's colleges or careers or whatever. Bigger net that's possible of making sure people can access those things.

While counselors' views generally aligned with those expressed by principals, they also spoke about the students who could be served by the AP program in a slightly different manner. The counselor at Lindor High School suggested that expanding AP enrollment to include new students could help challenge high-achieving students who may not seek out challenges for themselves. Discussing the students who may be well suited for AP classes, but don't enroll, she mentioned:

> I see kids all the time looking at their transcripts. I'm the one that sends them to college. I'm the final say on all of these and I say, 'You have all As. You have a 4.0, and you have never even taken an honors class,' and that alarms me because they sit there and—okay, your GPA is flawless. Your class selection is great, but when a college looks at that, you're—just average.

In a separate question, this counselor showed greater hesitation than did either principal on the question of setting criteria to determine whether should be in an AP class, but at several points in the interview she referred to experiences like that described above in which she encountered students who did not seek out challenges for themselves. The counselor at James High School also referred to conversations with students, both in her role as a counselor and in her prior role as an AP teacher, about the level of rigor in the classes they take, stating:

> It gives our students the opportunity to—I think the—I think the group we need to push a little bit, the group that maybe isn't trying as many AP classes, is that group that doesn't quite believe that they're academically capable… I think the super academically-motivated, high-achieving students should definitely be in the AP classes. I think that they are, here. I don't think we miss too many of those… I do think that there are a group of kids that don't see themselves as scholarly enough to do an AP class. I think that they would really see a benefit, even if they—to me, even if they didn't score a four or five on the test and get college credit. If they were able to have experienced that, so when they're sitting in that college classroom, like most of them will be, they've experienced that kind of thing before.

A consistent theme from responses across each of these interviews is a view that their respective AP programs could serve more students that they currently do and that this is due to students'

undervaluing the challenge of AP classes or underestimating their own academic ability. In referring to those students who may benefit from AP classes but do not enroll in them, principals and counselors often referred to the benefits of AP classes in terms of helping students gain prepare for their post-high school careers. Their focus on developing knowledge and skills suggests that a more permissive threshold for identifying AP-caliber students is desirable since students would receive important benefits even if they are not successful on an AP exam. Given the characteristics of the different classifications contained in Table 4.4 and input from stakeholders, in partner schools, in future analyses I identify students as AP-caliber if their predicted probability of AP success is greater than or equal to .3.

AP Enrollment Among AP-Caliber Students

After developing a process for identifying the group of students who are likely to be successful in AP classes, I now turn to the issue of AP enrollment by academic ability. As noted earlier, an important aim of this study is to add to the research on high school students' AP enrollment decision-making by studying similar students who do and do not enroll in AP classes. Classifying students according to AP ability and then examining AP enrollment between them, illustrated in Figure 4.8, provides a set of contrasts that can be explored to generate important insight into students' AP enrollment decisions. As shown in Figure 4.8, students who are likely to succeed in an AP class and do enroll are referred to as positively matched since their course enrollment corresponds to their ability while students who are likely to succeed but do not enroll in an AP class are considered under-enrolled as it could be considered that they should be in an AP class. Students who are not likely to succeed in an AP class and do not enroll are labeled negative matches, though this should not be taken to suggest that these students do not belong in an AP class. Rather, negatively matched students' decision to not enroll in an AP class can be

Figure 4.8 Classification Using Predicted Success and AP Enrollment

		Enrolled in an AP Class? Y	Enrolled in an AP Class? N
AP-Caliber	Y	**Positive Match**	**Under-enrolled**
AP-Caliber	N	**Ambitious**	**Negative Match**

understood as students from this group may be less well-prepared for the demands of that environment. However, some students who are not likely to succeed in an AP class do enroll in one, a group of students I refer to in this study as ambitious as they have admirably set out a challenge for themselves. With knowledge of how students fall into these categories, it is then possible to make comparisons between them to investigate questions such as why some AP-caliber students do not enroll in an AP course while other students with a lower probability of success do opt to enroll in an AP class.

The relative size of the four enrollment groups examined in this study: positive match; under-enrolled; ambitious; and negative match; is shown in Table 4.5. The largest group, by a significant margin, is negatively matched students, which comprises slightly more than two-thirds of the students in this study for whom the probability of success in AP could be estimated. The next largest group is positively matched students at 14%, followed by ambitious and under-

Table 4.5 AP Enrollment by Academic Ability

	Enrolled in AP	Not Enrolled in AP	Total
AP Caliber	14%	5.4%	19.4%
Not AP-Caliber	12%	68.6%	80.6%
Total	26%	74%	100%

enrolled students at 12% and 5.4%, respectively. Comparing across these groups, slightly less that half of the students who take AP classes are classified as ambitious while over 25% of the students who are likely to be successful in AP classes do not enroll in one. While these patterns are intriguing, administrative data has a very limited ability to explain them and how they are related to, or a product of, students' decision-making. To provide a more complete and wholistic view of students' AP enrollment decisions, it is important to examine additional factors that bear on, and shape, these decisions. Recognition of this motivates the second phase of this study: a student survey to measure students' attitudes, preferences, beliefs, and thinking and use this information to explain patterns in AP enrollment.

Phase Two: Student Survey

The first phase of this study was aimed and collecting and using a range of administrative data to identify four groups of students based on whether they are highly likely to be successful, defined as earning a 3 or higher on an AP exam, in an AP class and whether they enroll in an AP class. I find that a logistic regression model using dichotomized GPA and PSAT/SAT scores explains a significant proportion of variation in AP success. Analyses of different classification thresholds and input from principals and counselors at partner schools suggests that students can

be considered AP-caliber if they have at least a .3 probability of being successful in an AP class. Cross-tabulating this classification with AP enrollment shows a significant number of ambitious students, who enroll in an AP class despite a lower predicted probability of success, and of under-enrolled students, who are likely to succeed in an AP class but nevertheless do not enroll. While the administrative data collected and analyzed in phase one of this study is indeed rich, it is difficult to draw inferences about students' AP enrollment decisions from this data beyond observing that students appear to have a general sense of their academic ability given that higher-ability students are more likely to enroll in AP classes. To overcome this, phase two of this study builds on phase one by drawing on the classifications in Figure 4.8, patterns observed in initial analyses of the data, and relevant literature on AP enrollment and adolescent decision-making to develop a student survey. This survey captures data on a range of factors hypothesized to influence students' AP enrollment decisions. In this section, I discuss the process of developing the instrument for this study, survey sampling, and initial analyses used to guide the third and final phase of this study.

Measures and Constructs

The survey administered in phase two of this study is designed to measure a range of constructs that I hypothesize to have a relationship with students' course enrollment decisions. These constructs include students' sense of academic identity, their preferences relevant to course enrollment decisions, the degree to which students' preferences align with a rational view of decision-making, social-emotional skills, and information about students' background that is not captured in administrative data. A full list of these constructs is provided in Table 4.6.

The first group of constructs that were added to the survey focus on students' academic identity, which refers to how they see themselves within the context of education and schooling

Table 4.6. Survey Constructs

Construct Category	Construct	Relevant Elements	Relevant Sections from Survey
Academic Identity	Academic Identity	Educational aspirations, educational values, plans for after high school	I (1), III (1)
	AP Identity	Belief that similar students take AP classes, a student believing that they are welcomed in AP classes	III (1)
	AP Recruiting	Whether the student was encouraged to take an AP class by different people	I (2)
Educational Preferences	Course Preferences	The impact of perceived course difficulty, course enrollment with friends, and the commitment/workload of courses on students' decisions	I (1)
Rational Decision-Making	Future Discount Rate	Rate at which the future is discounted relative to the present	II (1, 2), V (1, 2)
	Future-Self Similarity	The degree to which one believes their future will be similar to, or different from, their present life	V (8)
	Cognitive Reflection	Intuitive vs. reflective decision-making	IV (3, 4, 5)
Social-Emotional Competencies	Self-Management	Students' preparedness and engagement in class.	III (2)
	Growth Mindset	A belief that experiencing challenge leads to growth	III (3)
	Self-Efficacy	A belief that one's ability and work ethic can lead to success	III (4)
Student Background	Socioeconomic Status	Parental education, parental occupation, possessions,	V (9-22)
	Extracurricular Commitments	Involvement in sports, clubs, arts, or other activities outside of school	V (3-6, 15)

or the role they see education having in their future. Given that one of the defining characteristics of the AP program is its academic rigor, students' general academic identity may impact whether they see AP classes as being a good fit for them. An important part of academic identity is students' perception of their achievement, but other factors may also be sources of students' academic identity. For instance, students from different socioeconomic backgrounds have different patterns of interaction with their teachers and school (Lareau, 1987) and also have qualitatively different school experiences (Anyon, 1981). Gender identity has also been

associated with course decisions, especially around the issue of females in science, technology, engineering, and math (STEM) subjects (Brotman & Moore, 2008). Students' racial identity may also shape their decisions in school. Fordham & Ogbu (1986) argue that students of color who enroll in advanced courses and programs are sometimes accused of "acting White," which may impact participation in AP programs by students of color, though other studies cast doubt on the "acting White" hypothesis as an explanation for educational decisions (Havis, 2015; Venzant Chambers, Huggins, Locke & Fowler, 2014) or find that the role of oppositional culture in educational behavior is rooted in the school and community context rather than racial identity (Tyson, Darrity & Castellino, 2005).

Along with generalized academic identity, I hypothesize AP identity to be a distinct construct that influences students' AP enrollment decisions. In interviews with principals and counselors at partner schools, discussed in an earlier section, interviewees talked about academically talented students and "AP students" as overlapping, but discrete groups. This is perhaps best illustrated by comments from a counselor at James High School, who talked about one group of students who identify as "AP students," saying "I think, also, some students who are 'AP students,' and think of themselves that way" and another "group of kids that don't see themselves as scholarly enough to do an AP class. I think that they would really see a benefit…" This may help to explain the significant proportion of AP-caliber students who are under-enrolled. Further, existing research has found that there are sometimes perceptions around AP students and culture that are rooted in non-academic factors such as demographics (Havis, 2005; Tyson, Darity, & Castellino, 2005). These sources of information was used to draft several items to measure students' AP identity.

The construct of AP recruitment refers to whether students were ever encouraged to take an AP course by a friend, teacher, parent, counselor, or other adult. In interviews with principals and counselors at partner schools, one set of questions asked interviewees about the course enrollment process in general, and for AP courses specifically, at their school. In both schools, the enrollment process specifically involves teachers and counselors giving advice to students about their course selection. Research by McDonald (2014) found that being encouraged to take AP classes by teachers and counselors was associated with a perception of AP classes as being more inviting. For this survey, parents and students were added to the list of potential AP recruiters on the assumption that they may also communicate normative messages to students about AP enrollment.

Educational preferences refer to the characteristics of courses that a student wishes to maximize in their course selection. One preference that students have for GPA came through during interviews with counselors in partner schools. A statement from a counselor at Lindor High School illustrates this preference: "I know a lot of kids worry, 'I'm not going to take AP classes because that's going to ruin my high GPA." A counselor at James High School similarly noted the role of GPA in students' course enrollment decisions in her response:

> There are also some students that, they'll take enough classes to, I feel like, have a 'good transcript' to send to college, but they don't want to tank their GPA, so they don't want to step too far off the diving board or anything there.

Studies of adolescent psychology and neurological development suggest that teenagers tend to have a strong preference for social rewards (Akerlof & Kranton, 2002; Atkins, Bunting, Bolger & Dougherty, 2012; Schneider & Caffrey, 2012), which may lead students to favor time with friends or participation in extracurricular activities over developing their knowledge and skills. In other cases, preferences related to AP enrollment decisions were identified using knowledge

of the AP program. For instance, some students may prefer to take courses that require the least amount of work, and thus wish to avoid the commitment of an AP class, while others may opt to take AP classes to further develop their knowledge and skills.

Rational decision-making encompasses a set of domains that can be used to evaluate decisions one makes using the rational actor model as a normative standard. Generally speaking, a rational actor is assumed to use known information about the present and probabilistic information about the future to maximize their utility, or benefit (Friedman & Savage, 1948; von Neumann & Morgenstern, 1944). Applying this to education suggests that students should make decisions that optimize long-term outcomes (Becker, 1993). One domain of rational decision-making is temporal discounting, the rate at which one discounts the future relative to the present. To manage the challenge of taking an AP course, students ostensibly need to invest more time and effort to be successful in AP classes relative to regular courses, meaning that a student would need to assign greater value to the future rewards from an AP class than to the present cost associated with taking it. Unfortunately, due to the way that humans develop neurologically, adolescents are predisposed to place higher values on the present relative to the future (Atkins, Bunting, Bolger & Dougherty, 2012; Schneider & Caffrey, 2012) and this may be especially the case for students from impoverished backgrounds (Bertrand, Mullainathan, & Shafir, 2006; Mullainathan & Shafir, 2013). Since the material benefits a student receives from taking AP classes are in the form of having greater appeal on college applications or in needing fewer courses to earn a degree (and potentially a lower cost of earning a bachelor's degree), temporal discounting may play a significant role in students' AP course enrollment decisions. Thus this survey draws on item-types that are commonly used in experimental economics and judgment and decision-making to estimate future discount rates.

Future-self similarity (FSS), the degree to which one believes their future will resemble their present, is another facet of rational decision-making. Research on this concept has found that a higher degree of FSS, believing that one's future will generally resemble their present situation, is associated with decision-making that benefits oneself in the long-term, such as increased savings (Ersner-Hershfield, Tess Garton, et al., 2009; Ersner-Hershfield, Wimmer, et al., 2009). These outcomes are related to temporal discounting, with greater future-self similarity predicting a lower discount rate (Ersner-Hershfield, Tess Garton, et al., 2009; Ersner-Hershfield, Wimmer, et al., 2009), but FSS does not appear to simply be a subcomponent of temporal discounting and so is examined separately here using an item developed by Ersner-Hershfield, Tess Garton, et al. (2009).

The cognitive reflection test (CRT), developed by Frederick (2005), is a set of three items that measure whether one is an intuitive decision-maker, who is more likely to make decisions based on a "gut reaction" or initial assessment, or a reflective decision-maker, who reflects on decisions and updates initial assessments. The CRT does this by phrasing items in a way that elicits an intuitive, but incorrect, answer to a mathematical word problem. An example of one item from the CRT is provided here:

> A bat and a ball together cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost? ____ cents

Importantly, the correct answer does not require sophisticated or complicated math, just that one recognize the inaccuracy of the intuitive answer and use simple math to arrive at the correct answer. In the above example, 10 cents is the intuitive, and most common, answer. However, to answer correctly one must recognize the relevance of the word "more" and calculate appropriately by solving the equation b+(b+$1.00)=$1.10 to reach the correct answer of 5 cents. The CRT has been used widely in judgment and decision-making research, higher performance

on the CRT has been associated with a lower rate of future discounting and more rational preferences for risk – a greater willingness to take risks when there is a potential for benefit and greater tendency to avoid unnecessary risks when faced with a potential loss (Frederick, 2005). Given that students' AP enrollment decisions require them to confront risk (uncertainty) and weight present and future costs and benefits, the CRT is included on this survey instrument.

Social-emotional skills or competencies, sometimes referred to as noncognitive skills, are a group of abilities that relate to one's ability to regulate their behavior, persevere through challenges or setbacks, and a belief in one's capability and that performance can be improved through continued effort. In recent years, social-emotional skills have received significant attention in education research and practice in response to findings that social-emotional skills may be as predictive of long-term success as traditional measures of cognitive ability (Duckworth, Peterson, Matthews, & Kelly, 2007; Dweck, 2006; Heckman & Rubinstein, 2001; Heckman, Stixrud, & Urzua, 2006; Kautz, Heckman, Diris, Weel, & Borghans, 2014; West et al., 2016; Yeager & Dweck, 2012). While there is no universally recognized inventory of social-emotional skills, self-management, growth mindset, and self-efficacy are well-researched. In relationship to schooling, self-management refers to behaviors such as participating in class, paying attention in class, and following directions. Growth mindset is a belief that intelligence and ability are malleable, as opposed to fixed, traits and that focused effort can meaningfully increase knowledge and improve skill. Self-efficacy is a sense of confidence in one's abilities. This is somewhat related to growth mindset in that it involves the perceived relationship between effort and outcomes, but self-efficacy is gauged relative to achieving success whereas growth mindset is concerned more with expanding one's capabilities. Being that these three social-emotional competencies relate to students' confidence about being successful in a challenging

environment, ability to manage their work, and that challenge provides an opportunity to develop and hone one's knowledge and skills, these three constructs are included in the instrument for this survey. Items for these three constructs are drawn from an existing instrument developed to measure students' social-emotional skills (CORE Districts, 2017).

The final construct measured in this survey is students' socioeconomic status (SES). SES is multidimensional in nature and involves a range of resources to which one has access, including human, financial, and social capital. While the administrative data used in this study contains an indicator for whether a student qualifies for free or reduced price lunches (FRL), this is a problematic measure of socioeconomic status. One issue with using FRL status is that it is based solely on household income and does not include other types of resources. A second is that FRL is binary and therefore makes only a broad or general distinction between students' backgrounds. A third is that FRL may be underreported, especially at the high school level, because completing the appropriate paperwork may discourage some from applying and because of a stigma sometimes associated with FRL status. An approach to SES advocated by many well-regarded student surveys such as the National Assessment of Educational Progress (NAEP) and the International Programme for Student Assessment (PISA) involves a combination of parental education, parental occupational status, and parental income (Cowan et al., 2012; OECD, 2017). This survey collects information on parental education and occupation by asking students for the highest level of education completed by either parent and by asking students to describe or name the occupation of each parent. Responses to parental occupation were assigned a prestige score using the occupational classification system (OCS) developed as part of the General Social Survey (GSS), a national survey that collects information on a range of characteristics and perceptions of the population of the United States. Briefly, the methodology used by the GSS to

create the OCS involved gathering perceptions from many respondents about the prestige associated with a range of job types used by the Census Bureau to classify occupations. Examples of job types include occupations such as lawyer, plumber/pipefitter, dental assistant, and childcare worker. Using ratings of perceived prestige, the GSS computes prestige scores for each occupation, with a higher number indicating greater prestige (General Social Survey, 2010). Occupational prestige for each parent was coded using students' reported parental occupation in this survey and ratings for the 2010 census occupational categories from the GSS.[14] For the purpose of analysis, only the highest parental occupation and education level were used. Directly collecting parental income from students is problematic because students may not know their parents' income or may be uncomfortable sharing that information. Thus, items that ask about the possessions a student has or that are in their home are used as a proxy for wealth. Items about possessions on the present survey draw on, and adapt as necessary, items that have been used on the NAEP, PISA, and the Trends in International Mathematics and Science Study (TIMMS) (OECD, 2012; NAEP, 2015; TIMMS, 2015)[15].

Response Formats and Item Scaling

The items in this survey use several different response formats. To reduce response burden, options were provided whenever possible. For several items, respondents simply selected yes or no as appropriate. One set of items intended to measure temporal discounting also involved only two choices, but rather than yes/no, respondents chose between one of two

[14] In a small number of cases, prestige scores could not be assigned due to the absence or ambiguity of responses (e.g. "a good job"). In these cases, occupational prestige was imputed using the mean occupational prestige for each parent's highest education level.

[15] One item about home possessions, whether the student has a smart speaker such as a Google Home or Amazon Echo, was created as part of this survey. According to marketing research, ownership of these devices is positively associated with income (Snook, 2018) and thus this item seemed appropriate.

options. On most items, the survey recorded responses using a 5-point Likert scale, which has a good balance in terms of variety of choices but without creating undue response burden. Four items: father's education level, mother's education level, future-self similarity, and the number of books in the home, used a categorical response format. Finally, some items, which include the cognitive reflection test and the occupation of each parent, have an open response format being that the number of potential responses is large.

Instrument Development and Feedback

Because the instrument used in this survey is composed of items from other instruments, items based on existing research on students' decision-making, and factors that were identified from interviews with principals and counselors at partner schools, it was necessary to solicit input and feedback to ensure readability and clarity of items and to verify that items activate the desired memories and thought processes to capture the intended information. Feedback was obtained in three ways: by soliciting input from other researchers with experience conducting survey research, by conducting a small-scale pilot of the instrument, and through cognitive interviews with students from the target population. Feedback from experts was used to refine the wording and ordering of items prior to the pilot and cognitive interviews. Data from a pilot administration of the survey was compared to results from other research (when the same or similar items were used) to determine whether the items performed similarly. Finally, cognitive interviews were used to examine students' thinking during the survey to identify items that were confusing or ambiguous. These different forms of feedback identified some areas where phrasing could be improved as well as some items that were eventually deleted from the final instrument.

Survey Sampling and Administration

Because this survey was conducted with students during regular school hours, the sampling plan for this survey was developed in consultation with partner schools to accommodate their schedules and needs. A goal of this survey was collect a sample that could be used to describe and compare the four enrollment groups identified in phase one of this study (positive match, ambitious, under-enrolled, and negative match), which could be accomplished through a simple random sampling (SRS) strategy. At James High School, a SRS approach could be accommodated. At this school, the sampling process unfolded as follows: consent forms were first distributed to students in grades 9-12[16] via their English classes. Students who consented to participate in this survey then took the survey online via Qualtrics software.

Unfortunately, Lindor High School could not accommodate a sampling design in which all students were initially recruited. Sampling at Lindor High School was then conducted using a cluster sampling strategy (CS) by focusing on a subset of teachers who taught students in multiple enrollment groups that were identified in phase one of this study. Because all positively matched and ambitious students are enrolled in an AP class by definition, AP teachers dominated the subset of teachers included in the sampling plan at Lindor HS. However, no AP teachers taught AP classes exclusively and therefore they taught negatively matched students as well. At the same time, it was desirable to include teachers beyond the relatively small group of AP teachers to capture a wider swath of the student body in this survey and so some non-AP teachers were selected to have their students recruited. To reduce the burden on teachers, approximately half of their classes were consented for participation in the survey. One limitation of this

[16] Freshmen were not included in the sample because they very rarely take AP classes and thus there is almost no variation in AP enrollment among this group.

sampling approach was in drawing an adequate number of under-enrolled students since this group is smaller than the other three. Also, under-enrolled students took classes from many teachers throughout the school, meaning that a cluster sampling design that focused on teachers may not result in a large enough number of responses for under-enrolled students. Because of this, all under-enrolled students at Lindor High School were given consent forms to ensure adequate representation. Students who agreed to participate in this survey completed the survey using Qualtrics software.

In total, roughly 950 consent forms were distributed to request participation in this survey. From this group, 452 students returned consent forms, 402 began completing the instrument, and 389 completed the instrument, producing a response rate of 41%. After the survey window ended, survey responses were matched to administrative data using student identifiers. Prior to analyzing data from the survey, it is first important to analyze whether the different sampling designs that were required in partner schools lead to differences in their portion of the sample that must be accounted for. For instance, if the characteristics of students who are assigned to AP teachers, even if they are not in one of the teacher's AP classes, are systematically different, this may introduce sampling bias into the data. Comparing the sample of survey respondents to the student body in grades 9-12 in each school shows that these groups have generally similar characteristics. As a result, all survey responses are treated as a random sample. Characteristics of the survey sample and the overall sample are presented in Table 4.7, which shows that survey respondents are slightly more likely to be female, White, to not qualify for free/reduced lunch, and are higher achieving in terms of GPA and PSAT/SAT scores, which appears to be driven by a higher response rate among positively matched students.

Table 4.7. Descriptive Statistics of Survey and Overall Sample

	n	Positive Match	Ambitious	Under-Enrolled	Negative Match	Grade	% Female	% White	% Black	% Hispanic	% Asian	% American Indian or Alaskan Native	%Hawaiian or Other Pacific Islander	% Multiracial	% SOC	% FRL	Lagged GPA	Lagged SAT
Survey Sample	389	127	86	30	144	11	54	82	7	6	5	1	.7	10	25	19	3.32	1060
Overall Sample for the 2018 School Year	1850*	281	203	107	1255	10.4	47	77	10	11	5	.8	.4	14	25	33	2.62	967

*The n given here may be rounded to protect the identities of participating schools

Dimension Reduction of Survey Variables

Due to the large number of variables generated by the survey and because many constructs of interest were assessed using multiple items, it was necessary to reduce the number of variables to be used in analyses of survey data. Dimension reduction was conducted using principal components analysis (PCA), which examines the correlation between variables to identify variables that appear to measure similar constructs (Jolliffe, 2002). In the case of this survey, principal components analysis was used to confirm that the different groups of items within the survey indeed show the desired relationships with one another. That is, to confirm that the items intended to measure, say, AP identity are correlated with one another. After using PCA to confirm the structure of the instrument, many variables were compiled into composite variables using the relevant items. In most cases, this was done by adding together the values of responses to each item associated with a construct. For instance, there are 4 items that measure growth mindset, each of which collects responses using a 5-point Likert scale. To calculate each respondents' score for this construct, the response-values for each item were added together.[17] In the case of some constructs, such as the items in Section II that measure temporal discounting, a different approach was used to reduce the number of variables that were used for analysis. For these items, the discount rate was estimated by identifying the midpoint between when respondents stopped preferring an outcome immediately and expressed a preference for a greater amount in the future and used this to calculate the implied annual percentage rate. For example, if responses to item 1 in Section II show a preference for $80 now instead of $100 in one year but a preference for $100 in one year over $70 now, $75 was identified as the net present value

[17] For the construct growth mindset, items are reverse coded, meaning that higher numbers on the scale correspond to a lower degree of growth mindset. For this reason, the composite variable for this construct is named "fixed mindset" for ease of interpretation.

of $100 in one year (the point at which the preference for present vs future outcomes changed). The net present value was then used to calculate the implied discount rate expressed as an annual percentage rate (in terms of net present value). For this example, valuing $100 in one year at $75 today suggests a 33.3% discount rate (($100-$75)/$75=$25/$75=1/3 or 33.3%). To compute a composite score for SES, principal components analysis was used to calculate a component score using variables on the highest level of occupational prestige from both parents, the highest level of educational attainment from both parents, and the possessions in the student's household. Additional information on the synthetic variables that were created using survey items is shown in Table 4.8. With a reduced set of variables from survey responses, subsequent analyses that use survey data can be done more efficiently and interpreted more easily. In the next section, I discuss how administrative and survey data were used to select a sample of students for interviews and to support the development of an interview protocol and how those interviews were conducted and the resulting data analyzed.

Phase Three: Student Interviews

In the third and final phase of this study, interviews were conducted with 19 students from both partner schools. The first two phases of this research yielded rich and useful data about students' demographics, AP enrollment, and psychological constructs that are related to their AP enrollment decisions, but do not identify or suggest the mechanisms or processes that connect student characteristics with their AP enrollment decisions. A strength of qualitative approaches to research is their ability to identify and explain the mechanisms that drive observed phenomena and phase three of the present study draws on that strength by conducting individual student interviews. However, qualitative research can have limited generalizability due to the small samples that are often involved and uncertainty about the degree to which the sample, or

Table 4.8. Construct Composition and Dimension Reduction Approach

Variable/Construct	Calculated/Derived By
Fixed Mindset	Sum of items a-d in Section III, 3.
Self-Efficacy	Sum of items a-e in Section III, 4.
Self-Management	Sum of items a-f in Section III, 2.
Academic Identity	Sum of items a, d, f in Section III, 1.
AP Identity	Sum of items g, k, l m in Section III, 1.
Adult AP Recruiting	Sum of items b-e in Section I, 2.
Weight of Adult Input in Decisions	Sum of items d-f in Section I, 1.
Grade-Maximizing Preferences	Sum of items a & b in Section I, 1
Weight of Social Factors in Decisions	Sum of item c in Section I, 1 and item a in Section II, 2.
School Extracurricular Involvement	Sum of items 3-5 in Section V.
SES	Principal component score using the maximum value of parent occupational prestige (coded from open response), parent educational attainment (coded from open response), and the sum of possessions (items 18-22 in Section V).
Present Value (week)	Present value of $10 determined by using the midpoints between the highest value the respondent would take now and the next highest value.
Discount Rate (year)	Present value of $100 determined by using the midpoints between the highest value the respondent would take now and the next highest value. Present value then used to calculate annual percentage rate using the formula $r = \frac{FV}{PV} - 1$ where PV represents present value, FV represents future value, and r represents the discount rate.
Cognitive Reflection	Sum of the number of correct responses to items 3-5 in Section IV.
Time Spent on Homework (daily)	Sum of responses in item 7, Section V.
Single-Parent Household	Coded as a 1 if the response to item 13, Section V is 1, coded as 0 otherwise.

cases, that is analyzed is representative of the population of interest. In this section, I discuss how case selection for phase three of this study was done to overcome many of these issues, the development of the interview protocol, and how data from these student interviews was analyzed.

Case Study Framework for Interviews

Students' decision-making around AP courses is a complex phenomenon to study given the many different factors that can shape students' decisions and the many ways those factors can be weighed or combine to make a decision. According to Yin (2003, 2018), case studies are well-suited to research that investigates decisions. Yin (2003, 2018) defines a case study as a line of empirical inquiry that investigates a phenomenon *in situ*, that confronts a difficult situation whereby the number of variables of interest exceeds the number of observations that can be collected, and that draws on multiple sources of data to triangulate findings and results. The third phase of this study uses a multiple-case design drawing on survey and interview data to examine the phenomenon of students' AP enrollment decisions. As Yin (2003, 2018) notes, an important part of multiple-case designs is the careful selection of cases designed to either yield similar results or to find disparate results for predictable reasons. The present study uses a multiple-case design to explain differences in the AP enrollment decisions of the four groups of students referenced in Figure 4.8: positively matched students, ambitious students, under-enrolled students, and negatively matched students. In what follows, I discuss the process used to select cases, develop the interview protocol, how interviews were conducted, and how interview data was analyzed.

Case Selection for Student Interviews

In this section, I outline how administrative and survey data were used to select cases for student interviews. The purpose of using administrative and survey data to select cases was to identify the students who are likely to provide the most insight into students' decision-making process around course selection and enrollment in general and for AP classes specifically. This was done by drawing a set of cases to interview based on student characteristics that are most

relevant to their AP enrollment decisions. One set of relevant characteristics include student demographics. As noted in the review of relevant literature, one strand of research on AP enrollment focuses on demographic enrollment gaps, the under-enrollment in AP of economically disadvantaged students and students of color relative to enrollment by non-economically disadvantaged students and White students. Purposively including students of color and economically disadvantaged students when selecting students to interview could provide insight into how those elements of students' background and identity are related to their course enrollment decisions. However, other student characteristics are related to their AP enrollment decisions and thus merit consideration. One of these is academic ability. To understand students' AP enrollment decisions, it is likely most helpful to interview students at or near the margin of deciding whether to take an AP class. As a result of exceptionally high or low academic ability, a student's AP enrollment decisions may require relatively little thought, limiting the insight that can be gleaned from them about what leads students to enroll, or not, in AP classes. The four-group classification developed using administrative data in phase one, illustrated in Figure 4.8, provides a useful way of considering academic ability in case selection. Using this, cross-comparisons could be made between positively matched, under-enrolled, ambitious, and negative matched students to learn how ability intersects with other factors to influence students' decision-making around AP classes. However, this may also mask important variation in students' thinking, perceptions, and experiences that could explain their AP enrollment decisions. One way to examine this type of variation is by using cluster analysis to identify different types of students based on their thinking, perceptions, and experiences related to AP classes.

Cluster analysis (CA) is a statistical technique used to identify latent groupings of observations that are similar along certain variables (Everitt, 2011; Kaufman & Rousseeuw, 2005; Wierzchon & Klopotek, 2018). CA accomplishes this by analyzing how variables are related to one another across cases. In the present study, cluster analysis is used to identify groups of students who have similar characteristics, views, and perceptions related to AP classes and employ similar thinking processes to make course enrollment decisions. For instance, it may be that the group of students classified as ambitious according to Figure 4.8 is not monolithic but comprised of several sub-groups. Hypothetically, one group could be predominantly students from higher socioeconomic status (SES) backgrounds whose parents push them into AP classes while another consists of students who have high degree of growth mindset and self-efficacy and set lofty goals for their future. If something like this were indeed the case, the decision-making processes used by students in these groups would be significantly different and therefore important to capture in this study of students' AP decision-making.

Cluster analysis is an exploratory approach to data analysis, meaning that the number, size, and characteristics of clusters need not be specified or hypothesized ahead of time. This makes it important to consider the variables that are used in cluster analysis. Also, clusters must be evaluated post-hoc to ensure that they represent meaningful groups or categories in the real-world (Kaufman & Rousseeuw, 2005). In the context of this study, variables that may be related to cluster membership include: gender, race/ethnicity, free/reduced lunch status, enrollment through Schools of Choice,[18] GPA, attendance, AP enrollment, PSAT/SAT scores, SES, self-management, self-efficacy, discount rate, growth mindset, academic identity, AP identity, AP recruiting, cognitive reflection, extracurricular involvement, time spent on schoolwork outside

[18] This indicates that the student is not a resident of the school district.

school, and future-self similarity. From this set of variables, demographic variables such as gender, race, or free/reduced lunch status may influence the clustering solution in undesirable ways by creating clusters that are strongly related to these characteristics, in which case it would be more straightforward to simply compare the characteristics of demographic groups. Another consideration in selecting the variables used for CA is the research question(s) at hand. Being that students' perceptions, experiences, decision-making processes, and resources are the primary focus of this research, a clustering approach aimed at identifying different types of decision-makers seems most appropriate as demographic factors can be considered alongside cluster membership. After considering these factors, I employ cluster analysis using the variables that measure prior-year GPA, Schools of Choice enrollment, lagged PSAT/SAT score, implied discount rate, growth mindset, self-efficacy, self-management, academic identity, AP identity, socioeconomic status, future-self similarity, cognitive reflection, whether the student lives in a single-parent household, the number of school-based extracurricular activities in which a student is involved, and whether the student is involved in non-school extracurricular activities.

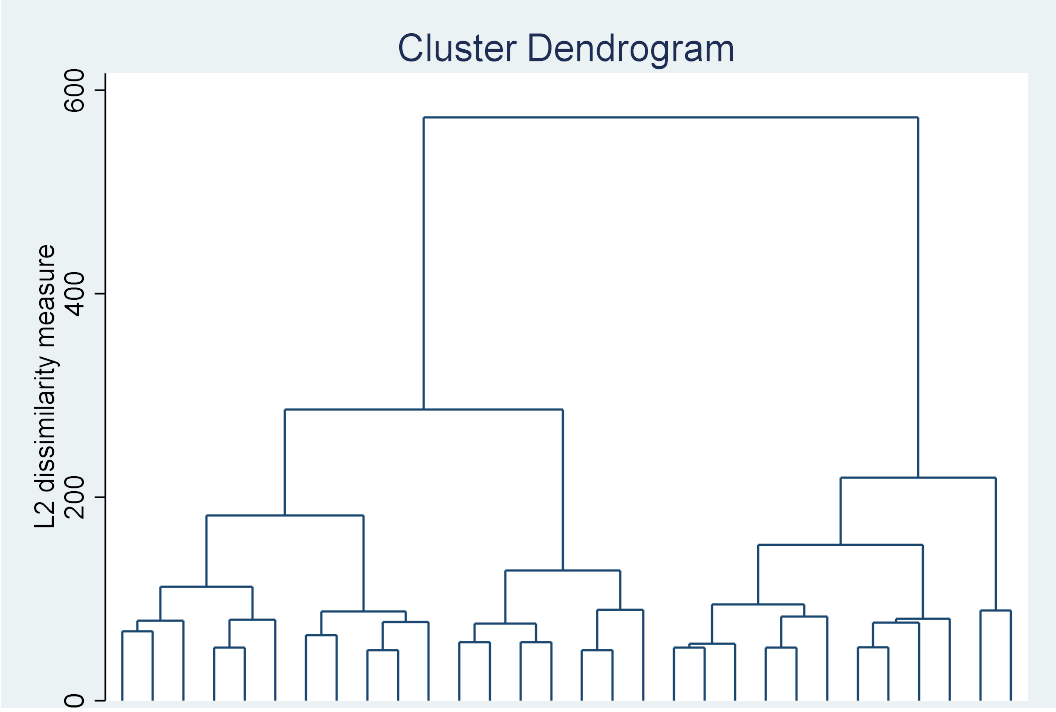
Cluster analysis was performed using a weighted average linkage. According to (Wierzchon & Klopotek, 2018), the weighted average linkage method is one form of agglomerative cluster analysis, in which clusters are formed by identifying the most similar cases first, then the next most similar, and so on to create hierarchical groupings. An advantage of a weighted average linkage is that it balances within-group similarity and between-group dissimilarity whereas other clustering algorithms emphasize one of these two characteristics at the expense of the other. Additionally, the weighted average linkage can accommodate clusters of different sizes more readily than other linkage methods. These features of a weighted average cluster linkage are desirable for this study by identifying a set of clusters in which students

within the same cluster share a similar thinking process, students from different clusters exhibit different thinking in relation to course enrollment, and some clusters may be larger while others are smaller.

In CA, identifying the number of clusters is typically done through visual inspection of a dendrogram, a diagram that shows the number of groupings and their level of dissimilarity. To identify the number of clusters to be retained, a cut point along the dimension of dissimilarity must be established, which involves considering the relative size of groupings that would be created, the dissimilarity between groups, and theoretical or practical considerations (Kaufman & Rousseeuw, 2005). For the present purpose, a desirable cluster solution would be parsimonious to aid in interpretation and would make meaningful distinctions between clusters. A dendrogram showing the 30 largest groupings of observations is shown in Figure 4.9. This dendrogram shows that these groups have a fair degree of similarity at lower levels (near the origin of the y-axis). Thus, it is necessary to reduce the number of clusters by combining similar clusters together.

A dendrogram showing 15 clusters, and the number of students contained in each, is presented in Figure 4.10. The horizontal red line in Figure 4.10 is a proposed threshold of dissimilarity for identifying clusters. Here, a cluster would be defined at each point this red line intersects a branch of the dendrogram, with groups below this point being combined. This means that group 1 would be retained as a cluster of 81 cases while groups 2 and 3 would be combined to form a cluster with a size of 106. Increasing the dissimilarity threshold to reduce the number of retained clusters would yield a few rather large clusters and several other small ones, which would give the appearance of 2-3 main clusters along with small groups of outliers. Reducing the dissimilarity threshold, on the other hand, would lead to additional small clusters, which would

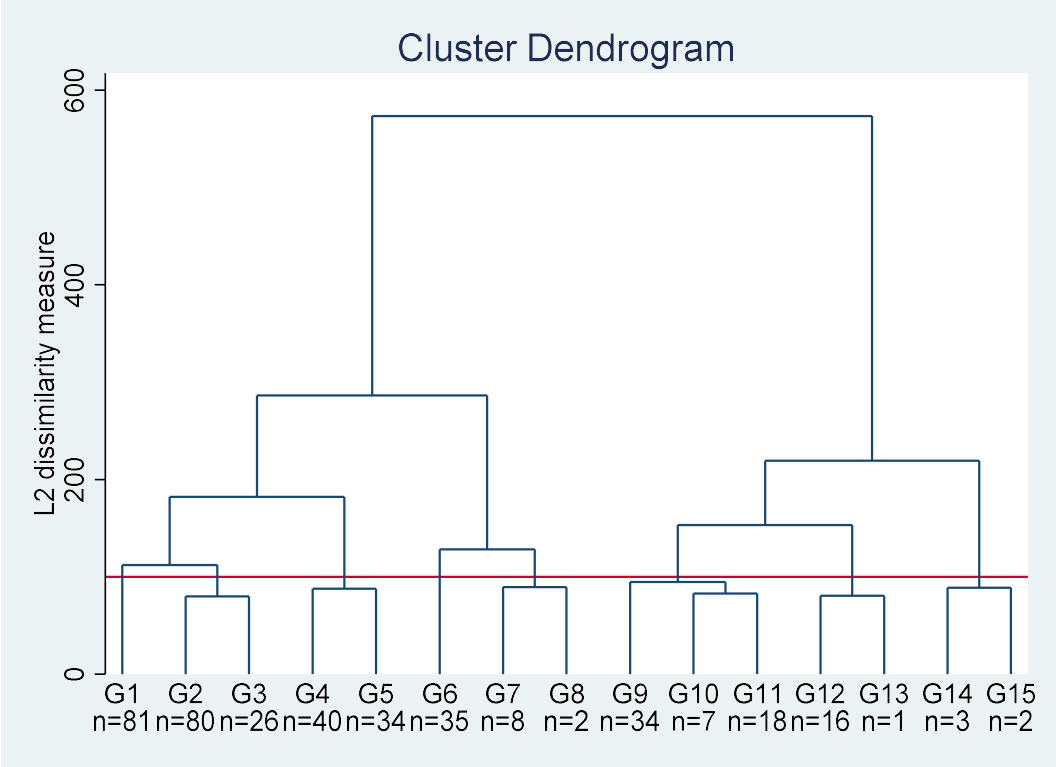
Figure 4.9 Dendogram of the 30 Largest Clusters



complicate analysis. Thus, the proposed cut point was used to identify 8 different clusters of students.

Information on the composition of these eight clusters is shown in Tables 4.9,4.10, and 4.11, which display demographics, achievement and AP enrollment, and standardized composite scores for survey constructs, respectively. Table 4.9 shows significant variation across clusters in terms of gender, race, free/reduced lunch status, and enrollment. For instance, just under 26% of students in cluster 4 are Black, but clusters 5, 6, 7, and 8 contain no Black students. Regarding gender, females are significantly under-represented in clusters 5 and 7. Additionally, less than 10% of students in clusters 6, 7, and 8 qualify for free/reduced lunch while 30% of students in cluster 5 and nearly half of the students in cluster 4 do. Table 4.10 shows significant differences in achievement and AP enrollment across clusters. Relative to cluster 5, students in cluster 8

Figure 4.10 Dendogram of the 15 Largest Clusters



have GPA and PSAT/SAT scores that are twice as high, which likely explains why all students from cluster 5 are negatively matched (did not enroll in an AP class, not likely to succeed in an AP class) while all students from cluster 8 are positively matched (likely to succeed in AP, enrolled in an AP class). There are also interesting patterns in achievement and enrollment aside from these two clusters. For instance, no students from cluster 3 are classified as AP-caliber (likely to succeed in an AP class), but nearly one-third of students from that cluster were enrolled in an AP class when the survey was taken. Table 4.10 also shows that under-enrolled students, those who are classified as AP-caliber but are not enrolled in an AP class, are only found in clusters 1, 2, and 6. Table 4.11 suggests that cluster membership is related to students' social-emotional skills, extracurricular participation, academic identity, SES, view of the future, and decision-making style. To take one example, comparing the traits of clusters 1 and 2 shows that,

Table 4.9. Demographic Characteristics of Clusters

Cluster	Cluster Size	Female	American Indian	Asian	Black	Hawaiian or Other Pacific Islander	White	Hispanic	Multiracial	FRL	SOC
1	81	59.3%	1.2%	6.2%	4.9%	1.2%	79.0%	1.2%	6.2%	13.6%	25.9%
2	106	59.4%	1.9%	6.6%	6.6%	0.0%	79.2%	0.9%	4.7%	16.0%	21.7%
3	74	50.0%	0.0%	1.4%	8.1%	0.0%	74.3%	6.8%	8.1%	27.0%	20.3%
4	35	62.9%	0.0%	0.0%	25.7%	0.0%	51.4%	17.1%	5.7%	48.6%	31.4%
5	10	20.0%	0.0%	0.0%	0.0%	0.0%	80.0%	10.0%	10.0%	30.0%	30.0%
6	59	49.2%	0.0%	3.4%	0.0%	0.0%	93.2%	1.7%	1.7%	8.5%	23.7%
7	17	35.3%	0.0%	5.1%	0.0%	0.0%	20.3%	1.7%	1.7%	5.9%	23.5%
8	5	60.0%	0.0%	0.0%	0.0%	0.0%	29.4%	0.0%	0.0%	0.0%	40.0%

Table 4.10. Achievement and AP Enrollment Across Clusters

Cluster	Lagged GPA	Lagged PSAT/SAT Score	Taking an AP Class	Positive Match	Ambitious	Under-Enrolled	Negative Match
1	3.60	1133	73.8%	51.9%	23.5%	13.6%	11.1%
2	3.39	1037	53.9%	14.2%	38.7%	8.5%	38.7%
3	2.97	922	35.2%	0.0%	31.1%	0.0%	68.9%
4	2.23	786	3.4%	0.0%	5.7%	0.0%	94.3%
5	1.99	674	0.0%	0.0%	0.0%	0.0%	100.0%
6	3.80	1260	82.2%	81.4%	1.7%	16.9%	0.0%
7	3.90	1404	100.0%	100.0%	0.0%	0.0%	0.0%
8	3.99	1545	100.0%	100.0%	0.0%	0.0%	0.0%

Table 4.11. Standardized Survey Constructs Across Clusters

Cluster	School Extracurriculars	Non-school Extracurriculars	Fixed Mindset	Self-Efficacy	Self-Management	Academic Identity	AP Identity	Influence of Adults in Course Decisions	Grade-maximizing preferences	Weight of Social Factors in Course Decisions	SES	Future-Self Similarity	Cognitive Reflection	Discount Rate	Mean Time Spent on Homework (min)
1	1.38	0.72	-0.22	0.11	-0.15	-0.16	-0.05	-0.04	-0.11	0.03	0.25	-0.04	0.74	151%	124
2	1.44	0.67	0.07	-0.04	0.06	0.15	0.09	-0.04	0.07	0.07	-0.01	-0.03	0.63	327%	118
3	1.00	0.60	0.09	-0.24	-0.06	0.00	0.03	0.06	0.24	0.11	-0.26	-0.06	0.28	244%	112
4	0.70	0.35	0.62	-0.68	-0.20	-0.09	-0.22	0.47	0.14	-0.12	-0.92	-0.22	0.07	848%	70
5	1.06	0.56	0.55	-0.88	-0.37	-0.12	-1.30	-0.07	-0.44	0.28	-0.67	-0.00	0.00	776%	85
6	1.66	0.79	-0.31	0.66	0.19	0.18	0.16	-0.27	-0.30	-0.22	0.64	0.17	1.40	103%	122
7	2.01	0.80	-0.14	1.01	0.34	0.54	0.28	0.00	-0.33	-0.12	0.81	0.58	2.21	141%	159
8	1.52	0.83	0.03	0.49	-0.05	-0.21	0.68	-0.25	-0.72	0.49	1.34	-0.39	2.76	29%	88

despite sharing similar demographics and achievement, students in cluster 2 discount the future at a higher rate, have a higher degree of growth mindset and self-management, and have a stronger academic identity, but have a lower sense of self-efficacy. These, and other, differences between clusters indicate that the retained clusters capture meaningful differences in students' characteristics, perceptions, and decision-making processes. Next, I explain how clusters were used to select cases for the third phase of this study.

The human and financial resources available for this research allowed for interviews with 20 students, making it important to select cases that could provide the most insight into students' AP enrollment decisions. Since clusters 5 and 8 are comparatively small and have little variation in AP enrollment, I infer that interviews with these students would provide rather limited insight into students' AP enrollment decisions given that their defining characteristics are having very high achievement and taking AP classes (cluster 8) and very low achievement and not taking AP classes (cluster 5). As such, students from these clusters were excluded from case selection. This left 6 clusters from which to select 20 students to interview. Case selection proceeded by determining the number of students to interview from each cluster, which was done using the relative size of each cluster. Based on this, four interview slots each were reserved for students from clusters 1, 2, and 6; three interview slots for clusters 3 and 4; and two slots for cluster 7. After this, cases were selected by considering students' gender, race, enrollment group, grade level, and the degree to which their survey responses aligned with the mean for their cluster with the aim of selecting a set of students to interview that is representative of the overall sample in terms of demographics, achievement, and survey responses and who can be thought of at least considering taking an AP class so that meaningful comparisons can be made between students

Table 4.12. Characteristics of Interviewees

Category	Characteristic	#
School	James	10
	Lindor	9
Gender	Female	10
	Male	9
Grade	10	2
	11	10
	12	7
Cluster	1	4
	2	4
	3	2
	4	3
	6	4
	7	2
Race/ethnicity	Asian	2
	Black	3
	Hispanic	2
	Multiracial	3
	White	9
Enrollment Group	Positive Match	5
	Under-Enrolled	6
	Ambitious	5
	Negative Match	3

Total Number of Interviews: 19

who do and do not take AP classes.[19] Characteristics of the students selected for interviews are shown in Table 4.12.

Instrument Development

As noted earlier, the constructs of interest in this study were identified primarily based on the relevant literature, but also drew on relevant factors that emerged in interviews with principals and counselors at partner schools about their school context and AP program. As such,

[19] Consent to participate in interviews was obtained at the same time as consent to participate in the student survey. Any student who did not consent to participate in the interview was thus dropped from the pool of potential interviewees.

a draft interview protocol was developed based on these constructs. After a draft was developed, expert feedback was solicited to improve the wording, framing, and ordering of items. Next, initial analyses of survey results were used to refine the instrument by identifying patterns in the survey data that appeared to contradict what was initially hypothesized. For instance, prior research by Mason (1995) found that teachers have an important role in promoting AP courses to their students and see doing so as part of their job, suggesting that students who place greater weight on input from teachers and other adults within the school would be more likely to enroll in AP classes. Yet, students who place the most weight on input from adults in their course enrollment decisions actually appear to be less likely to enroll in an AP class. At the same time, the relationship between academic and AP identity and AP enrollment appears to be as one would expect, with students who have a stronger sense of academic and/or AP identity having a higher likelihood of taking an AP class. In response to these, and similar, observations, the instrument was edited to focus on constructs that may disconfirm hypotheses or that need greater elucidation so that data from interviews could be used to explain patterns in the administrative and survey data. After making these adjustments, a final round of cognitive interviews was conducted to suggest any final revisions. The instrument that was used in student interviews is included as Appendix C.

Interview Process

One interview was conducted with each interviewee. Students selected to participate in individual interviews were given letters informing them of their selection and inviting them to participate in an interview. Of the 20 students who were selected, one withdrew the day of the scheduled interview and a replacement could not be identified. Thus, a total of 19 students were interviewed. Interviews were conducted between the researcher and subject during regular school

hours and lasted approximately 45 minutes each. Interviews were audio-recorded and later transcribed.

Analysis of Interview Data

Prior to analysis, interview transcripts were imported into Dedoose software and linked with descriptive characteristics of the interviewee. Interview data was analyzed in two stages. In stage one, descriptive coding as described by Saldana (2016) was used to code interview transcripts. According to Saldana (2016), descriptive coding is one type of qualitative data analysis in which the researcher uses a coding scheme to identify the major topics or themes that appear in qualitative data. A strength of this approach is that it can summarize qualitative data and serve as the basis for follow-up analyses. Interview transcripts were coded using the coding scheme included as Appendix D, which was developed using existing research on enrollment in AP classes or relevant gifted/talented programs and also informed by interviews conducted with principals and counselors at partner schools during the first phase of this study which suggested additional factors that may be related to student achievement. Interviews were coded at the response level, meaning that a response to a question from the protocol was simultaneously coded for each construct that was mentioned. Coded interviews were then used to compare and contrast the decision-making processes of students from the four enrollment groups identified in Figure 4.8 and other categorizations, such as race/ethnicity. In the second stage of analyzing interview data, selected themes and constructs were reexamined. Some of these were selected to help the researcher understand why they did not show the hypothesized relationship with students' AP decisions. Other constructs that appeared to be particularly strong were studied more closely to suggest the reason(s) for this. Findings from these stages of analysis were then

used alongside data collected in earlier phases to answer the research questions that motivate this study, which are presented in the following chapters.

CHAPTER 5: RESULTS FOR RESEARCH QUESTIONS 1, 2, AND 3

As discussed in the introduction to this study, Advanced Placement (AP) classes play an important role in many American high schools by providing students with a more rigorous curriculum than traditional high school offerings. Billed as college-level courses, AP classes are reputed to prepare students for a postsecondary career and can also help students waive college credits for earning high scores on an AP exam. Given these links to postsecondary outcomes, the topic of participation and enrollment in AP classes has received heightened attention in recent years. Despite this, it appears that AP classes continue to be undersubscribed for reasons not well understood. Addressing this knowledge gap motivates the present study which aims to shed light on students' AP enrollment decisions by studying students in two Michigan high schools. In this chapter, I present results for the first three questions that guide this research: What are the patterns in AP participation among demographic groups and for the sub-population of students who are most likely to succeed in AP? How do student characteristics, including demographics, achievement, and psychological constructs, vary by AP enrollment status? and What student-level factors or characteristics predict enrollment in AP classes?

To answer these questions, I analyze administrative and survey data collected during phases one and two of this study using descriptive and inferential statistics. As described in the earlier chapter on design and methods of this study, administrative data includes a panel of student demographic characteristics, course enrollment, and achievement for all students from each high school for the six-year period from the 2012-2013 school year to the 2017-2018 school year. In total, administrative data contains 16,939 observations for 6,589 unique students, with each student observed one to five times. Descriptive statistics for the overall sample are shown in

Table 5.1. Descriptive Statistics for Administrative Data

Year	n	% Female	%American Indian/Native AK	% Asian	% Black	% Hawaiian/Other Pacific Islander	% White	% Hispanic	% Multiracial[2]	% Free/reduced Lunch Eligible	% Receives Special Education Services	% English Language Learners	Absences	Mean GPA	SAT Composite Score[1]
Overall Sample	16,939	49.3	0.9	4.1	11.1	0.3	77.1	10.3	15.1	22.5	8.6	2.3	9.2	2.62	972

[1] Since students could voluntarily take SAT assessments in addition to their required test, some students took more than one SAT test (e.g. both the PSAT10 and the SAT) or took the SAT multiple times in the same year. In those instances, their highest SAT composite score (their critical reading plus their math score) was used for analysis.

[2] Students at Lindor High school were able to identify as multiracial while students at James High School identified as one of the six commonly used racial/ethnic groups.

Table 5.2. Descriptive Statistics for Survey Data

	n	% Female	%American Indian/Native AK	% Asian	% Black	% Hawaiian/Other Pacific Islander	% White	% Hispanic	% Multiracial[2]	% Free/reduced Lunch Eligible	% Receives Special Education Services	% English Language Learners	Absences (previous year)	Mean GPA	SAT Composite Score[13]
Overall Sample	389	54	1	5	7	1	82	6	10	19	8	1.5	5.4	3.32	1060
Administrative Sample	16,939	49.3	0.9	4.1	11.1	0.3	77.1	10.3	15.1	22.5	8.6	2.3	9.2	2.62	972

[1] Since students could voluntarily take SAT assessments in addition to their required test, some students took more than one SAT test (e.g. both the PSAT10 and the SAT) or took the SAT multiple times in the same year. In those instances, their highest SAT composite score (their critical reading plus their math score) was used for analysis.
[2] Students at Lindor High school were able to identify as multiracial while students at James High School identified as one of the six commonly used racial/ethnic groups.

Table 5.1. This shows that the sample is approximately evenly divided between males and females and that the largest racial/ethnic group is White students, who comprise roughly 77% of the total though Asian, Hispanic, and Multiracial students also represent a significant proportion of the sample. Just under one-fourth of students in the administrative sample qualify for free/reduced lunch while 8.6% of students receive special education services. Regarding achievement, the typical student in this sample is absent for fewer than 10 days per year, has a GPA in the B-/C+ range (2.62), and has a composite PSAT/SAT score slightly under 1000.

Survey responses were collected from 389 students in partner schools during the 2017-2018 school year. Survey responses were then matched to students' administrative data. Instrumentation, sampling, and administration of this survey are discussed in an earlier chapter on the design and methods used in this study. Descriptive statistics for the survey sample, and how this sample compares to the administrative sample, is shown in Table 5.2, which shows that the survey sample is slightly more White, higher achieving, and less likely to qualify for free/reduced price lunch compared to the overall sample.

Addressing this study's research questions, I find that AP participation in the schools included in this study has varied significantly over the school years ending 2013-2018, both overall and for academically talented students. I also document differences in the demographic, achievement, and psychological characteristics of AP and non-AP students. Finally, I find that different demographic characteristics, academic ability, and psychological factors are associated with AP enrollment. In the sections that follow, I describe the procedures, and interpretations that support these conclusions.

RQ1: What are the patterns in AP participation among demographic groups and for the sub-population of AP-caliber students?

To analyze AP participation, it is first important to define it. Initially, I consider two different definitions of AP participation: enrolling in an AP class and taking an AP exam. The relevance of selecting from these definitions is that how AP participation is defined may influence the conclusions that are drawn about AP participation. Students can earn the most benefits from taking an AP exam by earning college credit for high performance. Additionally, AP exam-taking has been used to define AP participation in other research, though this has been mainly for practical purposes as the College Board collects AP exam records but not rosters of students in AP classes. Though it is possible to take an AP exam without taking the corresponding course and vice versa, in examining administrative data I find that less than 0.2% of AP exam-takers did not first take the AP class. Thus, defining AP participation as taking an AP exam complicated the framing of this study that focuses on understanding students' AP enrollment decisions as the data suggest that a student's decision about whether to take an AP exam is dependent on their earlier decision to enroll in an AP class. Moreover, a definition of participation that excludes students who take an AP class but not an exam may lead to different inferences about AP participation. Looking at exam-taking among students who took an AP class, illustrated in Figure 5.1, I find that approximately 1/3 of students who take an AP class do not take an AP exam. If the groups of exam takers and non-exam takers have different characteristics, how AP participation is defined may lead to different inferences about AP participation. Using t-tests to compare exam takers and non-takers, I find statistically significant differences between them along some variables, with students of color and students who receive free/reduced price lunch being less likely to take an AP exam conditional on taking an AP class.

Table 5.3. Comparing Demographics of AP Students Under Different Definitions of AP Participation

	% Female	%American Indian/Native AK	% Asian	% Black	% Hawaiin/Other Pacific Islander	% White	% Hispanic	% Multiracial[1]	% Free/reduced Lunch Eligible	% Receives Special Education Services	% English Language Learners
AP Course Only	54.5	1.1	6.3	6.2	0.3	82.2	8.2	14.9	14.2	2.4	1.5
AP Course + Exam	54.1	0.4	7.9	3.9	0.1	84.6	4.3	10.4	8.1	2.0	1.2
Difference	-0.35	-0.73*	1.65	-2.27**	-0.13	2.49	-3.92***	-4.51*	-6.09***	-0.38	-0.28

* p<.05 ** p<.01 ***p<.001

[1] Students at Lindor High school were able to identify as multiracial while students at James High School identified as one of the six commonly used racial/ethnic groups.

These and other results are presented in Table 5.3. To focus on students' decisions about whether to participate in AP, which begins with a choice to enroll in an AP class, and to capture the broader range of students who have an AP experience, I define AP participation as a student taking any AP class in a given year.

Changes in AP participation over time are shown in Figure 5.1 using administrative data. Here, I observe a relatively stable trend in participation from the 2013-2015 school years, followed by a significant increase, peaking in 2017, after which the rate of AP participation fell. During this period, changes in AP course-taking parallel changes in AP exam-taking and success on AP exams, defined as earning a 3 or higher out of a possible 5, indicating that increasing enrollment in AP classes did not lead to lower average AP outcomes in terms of exam participation and exam success. To shed light on changes in AP participation, I examine variation in AP participation by subject area and by student characteristics, presented in Figures 5.2, 5.3, and 5.4.[20] Looking at the four main AP subject areas (science, math, social studies, and

[20] See Appendix D for a list of AP courses and their associated subject areas.

Figure 5.1 AP Participation and Success by Year

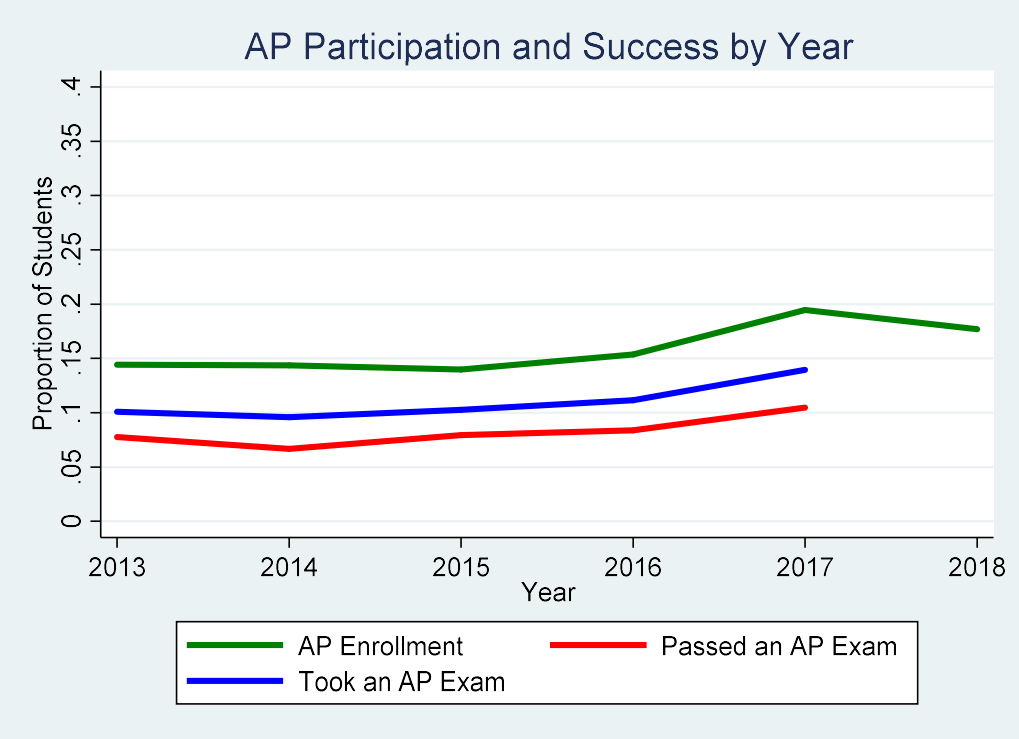
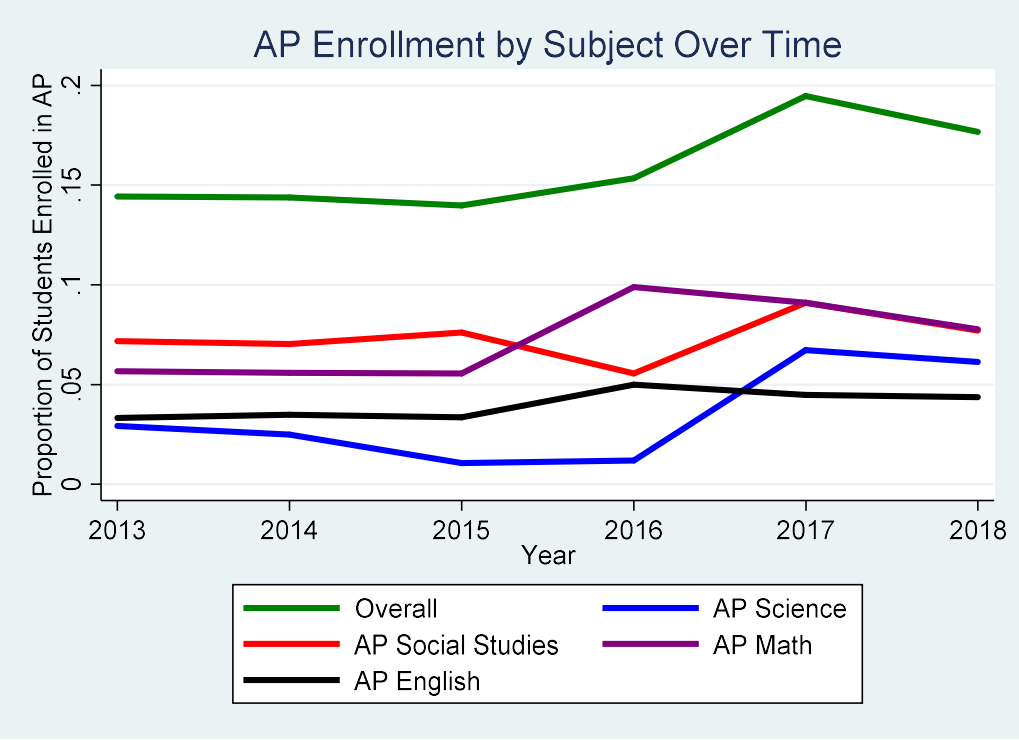


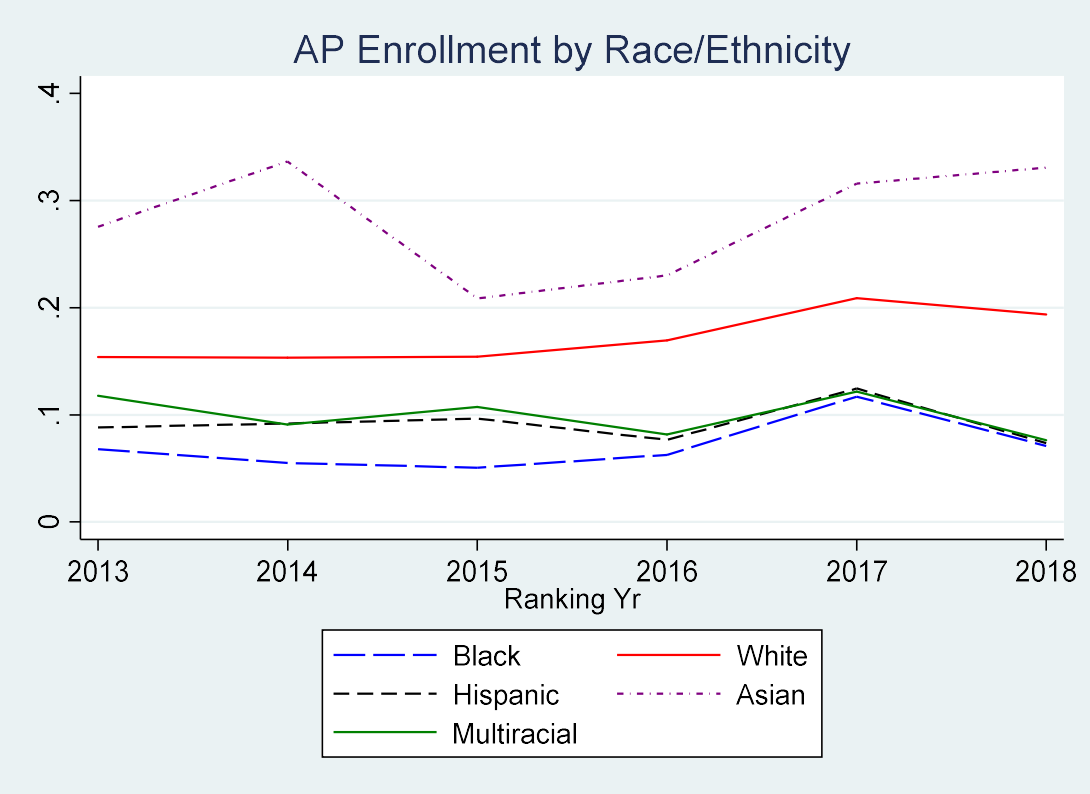
Figure 5.2 AP Enrollment by Subject Area Over Time



English), I find that enrollment was relatively stable until the 2014-2015 school year, after which the popularity of different AP subject areas changed, in some cases markedly, from year to year. Interestingly, it appears that change in AP Science enrollment is negatively related to changes in AP Math enrollment and that a negative relationship in enrollment also exists between AP Social Studies and AP English. It is unclear what drives this, but one potential explanation is that students are somewhat indifferent between AP courses within the STEM subjects and within the humanities subjects. Overall, I find no clear pattern in AP subject-area participation that accounts for the variation in AP participation overall, which I interpret as suggesting that interest in the AP program is more generalized rather than subject-area specific.

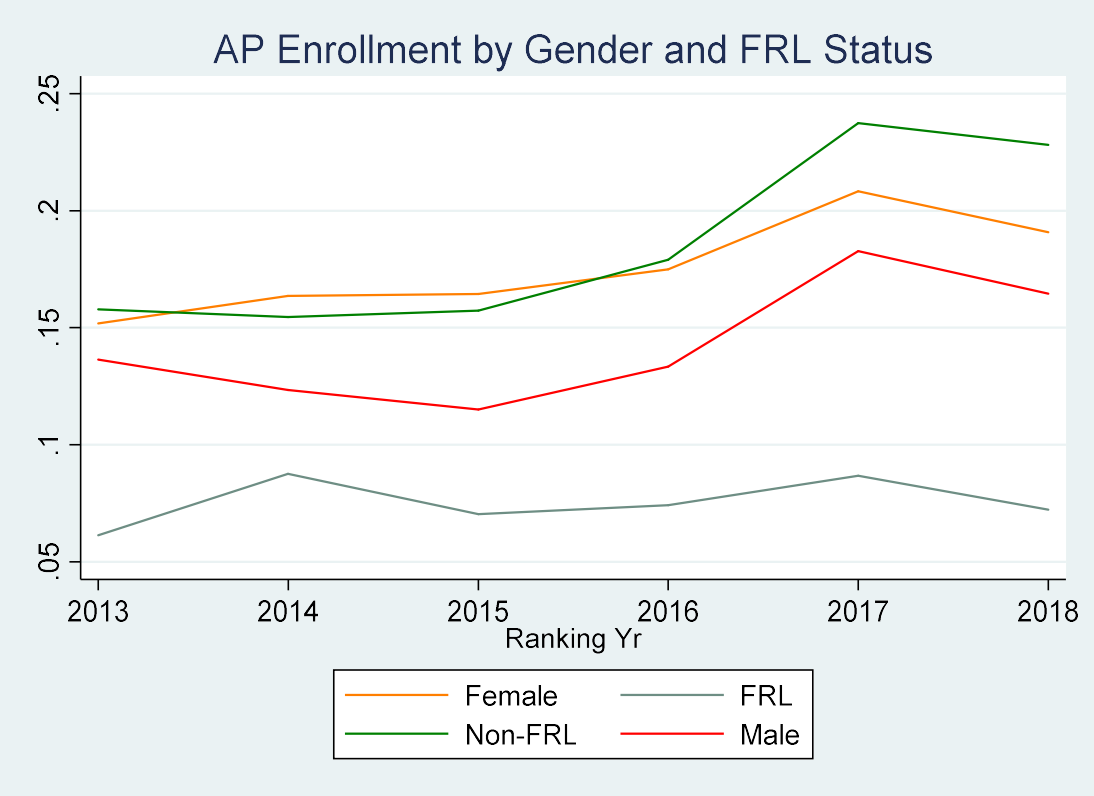
Examining AP participation by race/ethnicity over time, I find a slight increase in AP enrollment among White students and an uneven, but overall positive trend in AP enrollment among Asian students from 2013 through 2018. However, the opposite trend is evident among students of color – students who identify as Black, Hispanic or Latino/a, or Multiracial. Through 2017, the AP enrollment among Hispanic and Multiracial students varied, but had a flat trajectory overall while AP enrollment among Black students increased meaningfully. As of 2017, the rate of AP enrollment among Black, Hispanic, and Multiracial students was approximately 12% for each group. Then, between the school years that ended in 2017 and 2018, AP enrollment among students of color decreased precipitously, with the enrollment rate of these three groups declining by roughly one-fourth relative to their 2017 participation rate. As of 2018 there exists significant AP enrollment gaps by race/ethnicity within the schools included in this study, with students of color enrolling in AP classes at roughly half the rate of White students and one-third the rate of Asian students.

Figure 5.3 AP Enrollment by Race/Ethnicity Over Time



Examining AP enrollment by gender shows a steady increase in AP participation amongst females through 2017. Participation by males, on the other hand, declined from 2013 to 2015, but increased through 2017, closing much of the gender enrollment gap. AP enrollment among both males and females then decreased between 2017 and 2018, reflecting an overall decline in AP participation. Interestingly, the trend in AP enrollment among free/reduced lunch (FRL) eligible students is relatively flat, oscillating between roughly 6-8% while enrollment by non-FRL students increased significantly, though the decrease in participation from 2017 to 2018 observed elsewhere is evident in this demographic group as well. As of the last year examined in this study, non-FRL students enrolled in AP classes at three times the rate of their FRL-eligible counterparts, indicating a sizable enrollment gap between economically disadvantaged students and students who are comparatively more affluent.

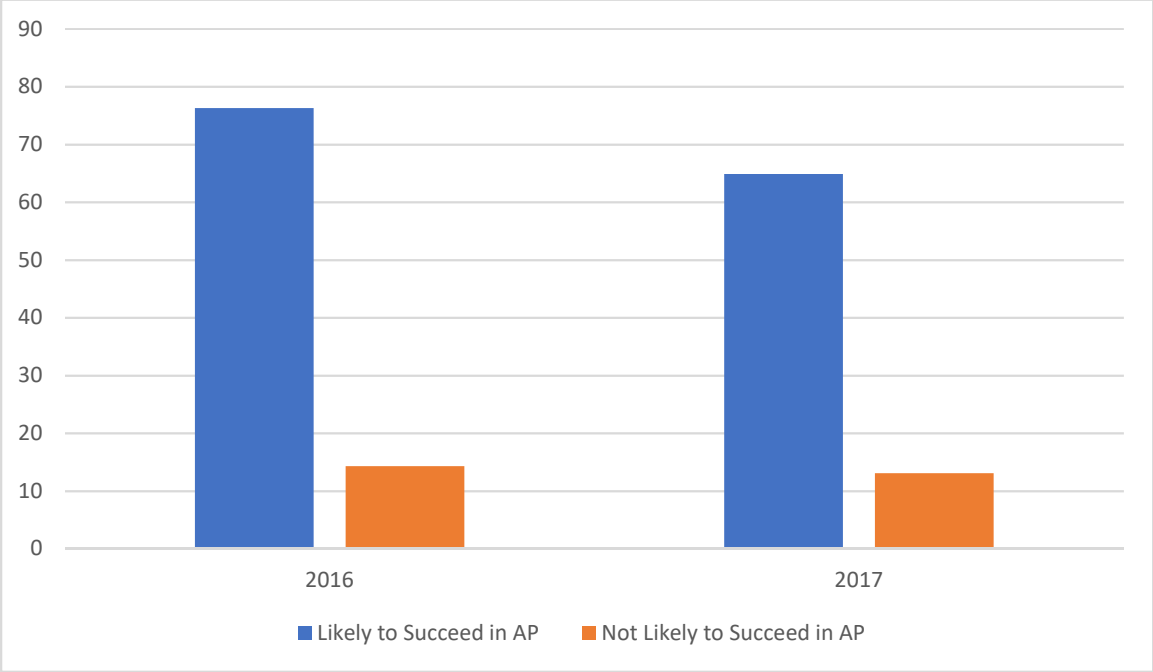
Figure 5.4 AP Enrollment by Gender and FRL Status Over Time



This study hypothesizes that academic ability is another important dimension of AP enrollment. As discussed in the earlier chapter on design and methods, achievement data was used to identify students who are most likely to be successful in an AP class.[21] Using that classification system, I analyze AP enrollment among students identified as AP-caliber and those who are not identified as AP-caliber (though not being identified as AP-caliber should not be taken to mean that a student should not be in an AP class). I do this by examining the proportion of each group who enroll in an AP class. For this analysis, I restrict the sample to the school years 2016-2018 because the PSAT/SAT assessments were not widely administered prior to that time. Looking at the AP participation rate for AP-caliber and non-AP-caliber students over time,

[21] Students whose predicted probability of earning a 3 or higher, out of 5, on an AP exam greater than, or equal to, .3 were classified as AP-caliber, or likely to be successful in an AP class.

Figure 5.5 Percent of Students Enrolled in AP by Academic Ability



shown in Figure 5.5, I find that participation among students who are not identified as AP-caliber decreased only slightly, from 14.3% to 13%, while the participation rate among AP-caliber students decreased significantly, from 76.3% to 64.8%.

The preceding analyses show that overall AP participation has varied over time and that variation in AP participation is mirrored in AP success. However, variation in AP enrollment is uneven across subject area, student demographics, and academic ability. Examining enrollment by subject area suggests that higher enrollment in some subject areas may be offset by lower enrollment in others. Demographic trends show the presence of significant AP enrollment gaps along race/ethnicity and FRL status and that these gaps have widened in recent years. Further, AP enrollment among academically talented students has also declined. The following section further explores these findings by analyzing the intersection of AP enrollment with student characteristics.

RQ2: How do student characteristics, including demographics, achievement, and psychological constructs, vary by AP enrollment?

Results from the preceding section show differential rates of AP enrollment across student groups, which are helpful in identifying large-scale trends and comparing the relative enrollment rates of different subgroups. However, those findings do not describe the composition of the group of students who participate in AP classes relative to those who do not take AP classes. Examining these characteristics provides insight into students' AP enrollment decisions as different characteristics may suggest factors that shape students' decision-making. In this section, I build on earlier analyses by comparing the characteristics of students who do and do not enroll in AP classes.

Demographic characteristics of the groups of students who do and do not enroll in AP classes across all years examined in this study are provided in Table 5.4 along with results of t-tests of the differences between students who do and do not enroll in AP classes. This shows that, with few exceptions, there are statistically significant differences in the demographic composition of the groups of students who do and do not take AP classes. Additionally, the differences between these two groups are also practically meaningful. Females represent 54% of all AP students but 48.4% of non-AP students. The representation of White students in AP classes is notably higher (6.6%) than in non-AP classes while the representation of Asian students in AP classes is twice that of non-AP classes. Black students, on the other hand, are represented in AP classes at less than half their representation in non-AP classes, which is 4.9% and 11.8%, respectively. Hispanic or Latino/a students also enjoy less representation in AP classes, accounting for 6% of AP students but 10.6% of non-AP students. Representation of students who identify as Multiracial also have significantly lower representation in AP classes

Table 5.4. Demographic Comparison of AP and Non-AP Students

	Non-AP Students	AP Students	Difference
Female	48.4%	54.3%	5.8%***
American Indian or Alaskan Native	1.0%	0.7%	-0.3%
Asian	3.5%	7.2%	3.7%***
Black	11.8%	4.9%	-6.9%***
Hawaiian or Other Pacific Islander	0.2%	0.2%	-0.1%
Hispanic	10.6%	6.0%	-4.7%**
Multiracial	15.5%	12.5%	-3.0%***
White	77.0%	83.6%	6.6%***
Free/reduced Lunch	24.5%	10.8%	-13.8%***
Socioeconomic Status Composite[1]	-0.295	0.369	0.664***
Prior Year GPA	2.49	3.59	1.10***
Highest PSAT/SAT Score	905	1140	236***

[1] This was computed using data from the student survey, which has an n of 186 non-AP students and 217 AP students.

(12.5%) than they do in non-AP classes (15%). Further, students who take AP classes also come from relatively more advantaged backgrounds than do non-AP students, as measured by free/reduced lunch status and the composite SES measure based on survey responses. For instance, 10.8% of the students who took an AP course were eligible for free or reduced-price lunch (FRL) while FRL eligibility among non-AP students is more than twice that at 24.5%. Students who take AP classes also have higher achievement in terms of GPA and PSAT/SAT scores, which may be expected given the academic rigor promoted by the AP program. Students who enroll in AP classes have a GPA 1.1 points higher than non-AP students, a difference of more than a full letter grade. Regarding achievement on standardized assessments, students who take AP classes have a PSAT/SAT composite score 236 points higher, a difference of over 1.3 standard deviations. These comparisons show that AP classes systematically have fewer students of color and economically disadvantaged students.

Examining responses to the study survey that was conducted in phase two of this study indicate that the differences between students who take AP classes and those who do not extend

beyond demographics. This survey was designed to measure AP-related perceptions and experiences, the sources of information students use to make enrollment decisions, commitments that may impact students' ability to take on the workload of rigorous courses (i.e. band, sports, job), social-emotional factors, and decision-making processes. See the prior chapter on the design and methods of this study for a discussion of how these constructs were measured and compiled. Comparisons of AP and non-AP students' responses to this survey are presented in Table 5.5,[22] which indicates significant differences between these groups along almost all dimensions. Students who took AP classes received more suggestions from adults (i.e. a teacher, counselor, or parent) to take AP classes. Interestingly, however, students who took AP classes place significantly less weight on adult input in their decisions than students who do not take AP classes. However, the weight AP and non-AP students give to social considerations (e.g. advice or suggestions from friends) appears to be similar as the difference in responses between them is not statistically significant at conventional levels. Non-AP students appear to show greater concern for their grades when selecting their courses as they display greater grade-maximizing preferences, meaning that students who do not take AP classes place greater importance on the perceived difficulty of a class and how it might impact their GPA when choosing their classes. Perhaps unsurprisingly, students who take AP classes display a stronger sense of academic identity, meaning that students who take AP classes see themselves as academically stronger students and have higher education aspirations; and AP identity, meaning that students who take AP classes view themselves as welcomed in, and suited to, AP classes. Students who take AP

[22]All but three of the measures presented in Table 5 are sum scores of the relevant constructs, these scores were calculated by adding together students' responses across multiple items. The exceptions to this are discount rate, which is inferred using responses to a series of forced choice items in Section II of the survey; time spent on homework each day, which was collected as an open response item; and future-self similarity, which is based on a single item using a 7-point Likert scale.

classes also have stronger social-emotional skills. Of these, the greatest difference between students who do and do not take AP classes is their sense of self-efficacy, a belief that they can be successful, accomplish goals, and master content; though AP students also report a greater degree of self-management, being prepared for class and focusing on one's work, and a lower degree of fixed mindset,[23] a belief that growth is the product of focused effort rather than an innate capability. Examining elements of students' decision-making, students enrolled in an AP class tend to discount the future at a lower rate than do students not enrolled in an AP class. Students in AP classes also score higher on the cognitive reflection test (Frederick, 2005), indicating a greater tendency to reflect on, and update one's decisions. Additionally, students in AP classes have a higher level of future-self similarity, which refers to the degree of similarity or dissimilarity one perceives between their future and present self. Finally, students who do not take an AP class report spending approximately one hour and twenty minutes on homework each day while students in AP classes, on average, report spending an additional hour on their schoolwork each day. Together, these differences show that relative to students who do not take AP classes, students who enroll in AP classes receive more encouragement to take an AP class; place less emphasis on grades and adult input in their decisions; participate in a wider variety of extracurricular activities; have a stronger sense of academic identity as well as a stronger identity as an AP student; higher levels of social-emotional skills; discount the future at a lower rate relative to the present; are more reflective thinkers; see their future as being more similar to their present lives; and spend more time on schoolwork outside of regular school hours.

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[23] This construct is often discussed in terms of growth mindset, a belief that intelligence and talent can be developed, as opposed to a fixed mindset in which one sees ability and intelligence as fixed. However, it is measured in this study using reverse coded responses. For instance, students could respond to the statement "My intelligence is something that I can't change very much." using a scale from 1 (not at all true) to 5 (completely true), meaning that a higher number refers to a greater degree of fixed mindset and a lower number a greater degree of growth mindset.

Table 5.5. Comparison of Social, Psychological, and Decision-Making Factors Between AP and Non-AP Students

	Non-AP Students	AP Students	Difference
N	186	217	
Recruited by an Adult to Take AP	1.78	2.46	0.68***
Weight of Adult Input in Course Enrollment	16.27	14.65	-1.62*
Grade Maximizing Preferences	13.48	12.08	-1.40***
Weight of Social Factors in Course Enrollment	4.42	4.17	-0.25
Participates in a School-Based Extracurricular Activity	1.05	1.53	0.49***
AP Identity	10.91	11.72	0.80***
Academic Identity	9.51	10.26	0.76***
Self-Management	23.12	24.53	1.41***
Self-Efficacy	15.10	18.64	3.54***
Fixed Mindset	7.62	6.49	-1.13***
Discount Rate	384%	221%	-164%**
Cognitive Reflection	0.42	0.96	0.53***
Total Time Spent on Homework Per Day	82	141	59***
Future-Self Similarity	4.29	4.60	0.31**

Some of these differences lend themselves to relatively straightforward interpretations using logic and existing research on decision-making. For example, one could expect students who see themselves as stronger students, seem comfortable in an AP environment, spend more time on their learning outside of school, and who receive more suggestions to enroll in an AP class to end up enrolling in AP classes at a higher rate. Similarly, being that many potential benefits of taking an AP class are delayed, namely receiving college credit, one could surmise that students best able to delay gratification and trade present costs, such as additional work and effort, for future gains, such as improving college applications and waiving college credits, are likewise more apt to choose to take an AP class. At the same time, some of these results are less transparent. Since students who take AP classes have higher average achievement in terms of GPA and standardized assessment scores, it makes sense that their ability would be recognized by the adults with whom they interact and that these adults would encourage high-ability students to take an AP class. One would expect these positive messages to lead high-ability

students to consider them when deciding on the courses they plan to take. However, despite this encouragement, students who take AP classes actually place less weight on the advice they receive from these same adults when making their course selections. A second interesting observation in these differences is how students factor their potential, or likely, grades into their course enrollment decisions. Given the higher level of rigor associated with AP classes, students who emphasize earning higher marks may steer themselves toward non-AP classes where, ostensibly, higher grades can be earned with less effort; but it is curious why high-ability students, who seem themselves as stronger academically, taking more rigorous courses, would give their grades less consideration in their enrollment decisions.

The comparisons presented in this section highlight important differences between the groups of students who do, and do not, take AP classes, but these differences may not explain why some students decide to enroll in an AP class while others do not. To determine how achievement, beliefs, social-emotional skills, and decision-making factors impact students' AP enrollment decisions, it is important to consider them simultaneously when comparing students who take AP and those who don't. In the next section, I discuss the relationships between these factors and AP enrollment and examine several models to predict students' AP enrollment decisions.

RQ3: What Student-Level Factors or Characteristics Predict Enrollment in AP Classes?

Though descriptive analyses identify significant differences between students who enroll in AP classes and those who do not, these differences do not automatically signal the factors that drive students' AP enrollment decisions. To determine those factors that influence students' enrollment, different analyses are needed to control for the relationships between a range of

variables and AP enrollment. One way to do so is with logistic regression, by modeling the outcome of interest, whether a student takes an AP class, as a function of a series of predictor variables, such as demographics, achievement, and psychological constructs. This approach allows for multiple explanatory, or control, variables to be considered simultaneously and accounted for. In this section, I use logistic regression to estimate the relationship between AP

$$Enroll_{it} = \beta_0 + \gamma_i + \theta_{it-1} + \pi_i + \varepsilon \qquad (1)$$

enrollment and student characteristics as shown in Equation 1 where $Enroll$ is a binary indicator for whether a student enrolls in any AP class; β_0 represents the baseline probability of any student taking an AP class; γ represents a vector of demographic characteristics such as gender, race/ethnicity, and free/reduced lunch status; θ refers to achievement (GPA and PSAT/SAT scores); π represents a vector of psychological constructs; ε represents a mean-zero error term, and *i* and *t* refer to students and school years, respectively.

To identify the set of variables that best explain students' AP enrollment decisions, different combinations of independent variables can be considered. Results from four different logistic regression models are shown in Table 5.6. In each model, coefficients are presented as log odds, meaning that a positive coefficient indicates a higher likelihood of AP enrollment while negative coefficients represent a lower probability of taking an AP class. Model 1, column (1) in Table 5.6, uses only end-of-year GPA and the highest PSAT/SAT score from the previous year to predict AP enrollment. This shows that achievement has a strong, positive, AP enrollment as the coefficients for lagged SAT score and GPA are positive and significant at the p<.001 level. Additionally, model 1 has a pseudo r-squared of 0.4, meaning that this model explains roughly 40% of the variation in AP enrollment. The second model uses only dummy variables representing student demographics – race, gender, and whether the student qualifies for

free/reduced lunch (FRL) - to predict AP enrollment. Model 2 identifies statistically significant relationships between AP enrollment and race, gender, and FRL status with females, Asian students, Native Hawaiian students, and White students having a higher estimated likelihood of taking an AP class while finding a lower estimated probability of AP enrollment for economically disadvantaged students (FRL) and Hispanic or Latino/a students. Interestingly, this model does not find a statistically significant relationship between Black students and AP enrollment, which differs from the descriptive analysis shown in Table 5.4, suggesting that a significant portion of Black students' under-enrollment in AP may stem from under-enrollment by Black males and by economically disadvantaged Black students. However, model 2 explains little of the variation in AP enrollment with a pseudo r-squared of .037. Overall, the results from models 1 & 2 align with the differences between AP and non-AP students observed in Table 5.4.

The third model uses only constructs from the student survey to predict AP enrollment and explains 20.6% of the variation in this outcome. Some estimates from this model align with the differences between AP-taking students and students who are not in an AP class observed in Table 4.5 in the previous section. One such alignment is around the role of adult input in students' decision-making in that that students who are recruited by more adults to take an AP class have a higher probability of taking an AP class and this coefficient is statistically significant while, at the same time, students who place greater weight on adults' recommendations have a lower likelihood of taking an AP class. Also, students who place greater emphasis on their grades have a lower predicted probability of taking an AP class. A positive relationship between extracurricular participation and AP enrollment is also found here. Additionally, some social-emotional factors also have a statistically significant relationship with

Table 5.6. Models of AP Enrollment Decisions Using Achievement, Demographics, and Survey Data

	(1)	(2)	(3)	(4)
GPA	1.163***			1.075***
	(0.000)			(0.000)
SAT	0.00830***			0.00726***
	(0.000)			(0.000)
Female		0.228***		
		(0.000)		
American Indian		-0.344		
		(0.309)		
Asian		0.679***		
		(0.000)		
Black		-0.934***		
		(0.000)		
Hawaiian		1.253*		
		(0.049)		
Hispanic		-0.758**		
		(0.000)		
Multiracial		-0.522***		
		(0.000)		
White		omitted		
FRL		-0.909***		
		(0.000)		
SES			0.169	0.0280
			(0.103)	(0.818)
Adult Recruiting			0.230*	-0.0359
			(0.022)	(0.769)
Adult Weight			-0.325*	-0.0413
			(0.010)	(0.781)
Grade Max Preference			-0.295*	-0.255
			(0.019)	(0.077)
Social Factors			0.0917	0.217
			(0.451)	(0.130)
School Extracurriculars			0.343*	0.175
			(0.022)	(0.293)
AP Identity			0.200	0.129
			(0.159)	(0.407)
Academic Identity			0.217	0.354*
			(0.146)	(0.033)
Self-Management			-0.0593	0.0283
			(0.700)	(0.867)
Self-Efficacy			0.386*	0.0527
			(0.012)	(0.768)
Fixed Mindset			-0.324*	-0.179
			(0.012)	(0.227)
Discount Rate			-0.00699	0.0271
			(0.721)	(0.274)
CRT_score			0.262*	-0.221
			(0.049)	(0.187)
Future-self Similarity			0.177	0.203
			(0.075)	(0.085)

Table 5.6 (cont'd)

Constant	-13.15***	-1.604***	-1.729**	-12.07***
	(0.000)	(0.000)	(0.001)	(0.000)
N	3598	18179	403	387
pseudo R-sq	0.400	0.0379	0.206	0.345

p-values contained in parentheses
* p<.05 ** p<.01 ***p<.001

AP enrollment after controlling for other variables, such as self-efficacy, which positively predicts taking an AP class, and fixed-mindset, which negatively predicts taking an AP class. Finally, students who score higher on the Cognitive Reflection Test, which indicates a greater tendency to revise one's initial judgments and decisions, also have a significantly higher probability of taking an AP course. However, several factors that appeared to be related to AP enrollment when using t-tests are not statistically significant after controlling for other variables. One such example is the relationship between students' socioeconomic status composite score. Others include students' academic identity and AP identity which have a positive, but not statistically significant, relationship with AP enrollment. The coefficient for students' self-management both changes sign compared to Table 5.5, becoming negative, and is not statistically significant. Finally, model 3 finds a weaker pattern of relationships between decision-making factors and AP enrollment in that it does not indicate a statistically significant relationship between AP enrollment and either the rate at which students discount the future and or students' future-self similarity, though the coefficient for future-self similarity is marginally significant.

The first three models of Table 5.6 separately estimate the relationship between students' decisions to enroll in an AP class and achievement, demographics, and psychological constructs. Though there are demographic differences between students who enroll in AP classes and students who do not, demographics explain very little of the variation in AP enrollment, suggesting that factors beyond demographics shape much of students' enrollment decisions.

Independent of achievement and demographics, psychological constructs such as a preference for higher grades, self-efficacy, and cognitive reflection meaningfully explain variation in students' AP enrollment decisions, but many coefficients are also not statistically significant. Finally, achievement is a powerful predictor of AP enrollment, which implies that students have at least a general awareness of their academic ability and factor this into their course selection, but achievement alone overlooks other relevant characteristics that appear to influence whether students choose to take an AP class. To understand students' decision-making around AP enrollment, it is important to consider a number of these factors together.

To overcome the limitations of models 1, 2, and 3, model 4 uses a combination of achievement and psychological factors to examine AP enrollment decisions. Interestingly, this explains slightly less of the variation in AP enrollment than model 1, which uses only achievement. However, an advantage of model 4 is that it suggests factors beyond achievement that appear to influence students' enrollment decisions. This model shows that after accounting for achievement (comparing model 3 to model 4), the coefficients for several psychological factors such as adult recruiting, the weight given to adult recommendations in course selection, extracurricular participation, consideration given to grades when choosing courses, self-efficacy, fixed mindset, and cognitive reflection, are no longer statistically significant. Academic identity, though, is statistically significant after accounting for achievement and a concern for GPA and future-self similarity are both marginally significant. While these factors provide some hints at how students decide whether to enroll in an AP class, much of students' decision-making processes remain opaque.

Though it is difficult to explain students' enrollment decisions in a general sense using administrative and survey data, analyses on subsamples of interest sheds light on why certain

students enroll in AP classes while others do not. In what follows, I use model 4 from Table 5.6 to analyze the AP enrollment decisions of four groups of students who are relevant to understanding important aspects of AP enrollment: students of color, economically disadvantaged students, students who are likely to succeed in an AP setting, and students who are less likely to be successful in an AP class. Results of these subsample analyses are shown in Table 5.7. Examining economically disadvantaged students, students who are eligible for free/reduced price lunch, prior-year PSAT/SAT scores are the only predictor that is significant at the .05 level, consistent with other models of AP enrollment. However, two factors are marginally significant: GPA and socioeconomic status. Thus, higher-achieving economically disadvantaged students are more likely to take an AP class. The relationship between SES and enrollment, though, is more difficult to interpret as the negative coefficient suggests that, among economically disadvantaged students, those with comparatively more resources are less likely to enroll in an AP class after controlling for factors such as ability and other preferences. Unfortunately, an explanation for this is not readily available.

To analyze AP enrollment among students of color (SOC), several demographic groups that have been historically marginalized or disadvantaged – students who identify as Black, Hispanic or Latino/a, Multiracial, or Native American - were combined. While students from each of these groups may have different experiences based on their racial/ethnic identity, examining each group individually would result in a sizable loss of statistical power to identify significant predictors of AP enrollment due to the lower representation of these groups in the survey sample. As Table 5.7 shows, the only predictor of AP enrollment among students of color that is significant at the .05 level is extracurricular participation, meaning that students of color who participate in, say, sports and band or band and theater are more likely to opt in to an AP

course. Additionally, the coefficient for GPA is fairly large, suggesting that students with a higher GPA are more likely to take an AP class, but is only marginally significant. The

Table 5.7. Logistic Regression Models Predicting AP Enrollment for Subgroups

	Economically Disadvantaged	Students of Color	AP Caliber	Not AP Caliber
SES	-1.689	-0.0768	0.215	0.0136
	(0.080)	(0.902)	(0.341)	(0.930)
Adult Recruiting	0.296	0.116	-0.143	0.0132
	(0.698)	(0.860)	(0.469)	(0.939)
Weight of Adult Input	-0.0722	0.626	0.142	-0.176
	(0.916)	(0.474)	(0.604)	(0.372)
Grade Maximizing Preference	-1.004	-1.256	-0.312	-0.302
	(0.107)	(0.109)	(0.183)	(0.133)
Social Factors	0.345	-0.0171	-0.0457	0.342
	(0.563)	(0.983)	(0.864)	(0.072)
Extracurricular Participation	-0.500	2.400*	0.134	0.175
	(0.540)	(0.042)	(0.651)	(0.444)
AP Identity	-0.429	0.716	-0.111	0.508*
	(0.552)	(0.415)	(0.685)	(0.027)
Academic Identity	-0.0362	-1.104	0.215	0.644**
	(0.968)	(0.362)	(0.487)	(0.006)
Self-Management	1.072	0.753	0.0501	0.186
	(0.216)	(0.508)	(0.853)	(0.465)
Self-Efficacy	-1.431	0.934	-0.201	0.251
	(0.161)	(0.310)	(0.545)	(0.281)
Fixed Mindset	-1.225	0.737	-0.253	-0.0365
	(0.163)	(0.401)	(0.374)	(0.842)
Discount Rate	0.200	-0.0896	0.0364	0.0271
	(0.195)	(0.428)	(0.481)	(0.390)
Cognitive Reflection	-0.653	-0.418	-0.182	-0.293
	(0.407)	(0.686)	(0.441)	(0.273)
Future-self Similarity	0.506	0.436	0.138	0.218
	(0.416)	(0.365)	(0.463)	(0.195)
GPA	4.038	3.162	1.748	1.028**
	(0.063)	(0.054)	(0.101)	(0.006)
SAT	0.0249*	0.00879	0.00807**	0.00977***
	(0.019)	(0.306)	(0.006)	(0.000)
Constant	-43.14**	-23.59*	-15.14**	-2.340**
	(0.010)	(0.015)	(0.004)	(0.002)
N	74	66	157	230
pseudo R-sq	0.634	0.691	0.144	0.343

p-values in parentheses
*p<.05 **p<.01 ***p<.001

coefficient for prior-year PSAT/SAT composite scores, on the other hand, has a p-value of .3, which implies that this form of achievement is less salient for students of color when deciding whether to take an AP course.

Restricting the sample to only AP-caliber students, students who are likely to be successful in an AP class, there is little to explain why some academically talented students do not take an AP class. For this group, lagged PSAT/SAT score is the only significant predictor, as shown in the third column of Table 5.7. This implies that students with higher achievement on the PSAT/SAT are more likely to enroll in an AP course, which seems intuitive initially since achievement is a strong predictor of AP success and enrollment. However, the defining characteristic of this group of students is that they are all likely to be successful in an AP environment. In other words, among the group of students whose prior achievement predicts a high likelihood of AP success, students with comparatively lower assessment scores, but not significantly lower GPA, are less likely to enroll in an AP class. This is puzzling and, perhaps, may be due to some students underestimating their ability to be successful in an AP class, though the data here cannot test this hypothesis.

Examining the group of students who are less likely to be successful in an AP class in column 4 of Table 5.7 identifies several factors that appear to lead some of these students to take an AP class. Importantly, this analysis is not to suggest that students from this group should not be allowed into an AP class, rather that it is important to understand the factors that lead ambitious students to take on the challenge of an AP class. For students who are less likely to be successful in an AP class, prior-year GPA and PSAT/SAT score are significant predictors of AP enrollment, which suggests that more academically talented students from this group are more likely to enroll in an AP class. In addition to achievement, academic identity and AP identity

positively predict AP enrollment, meaning that seeing oneself as a stronger student and as comfortable in an AP environment is associated with a higher probability of enrolling in an AP course for students in this subsample. Finally, the weight students give to social preferences in their course enrollment decisions – the degree to which they consider the advice and suggestions of friends when choosing their classes – is a positive, but marginally significant, predictor of AP enrollment for this group of students.

Looking across these groups (economically disadvantaged, students of color, AP-caliber students, and students who are less likely to be successful in an AP class), different factors, and different combinations of factors, predict whether or not students enroll in an AP class, suggesting that different mechanisms may shape the decision-making processes of different types of students. Among economically disadvantaged students, those with higher achievement are more likely to enroll in an AP class, but it is unclear why higher-SES students within this group appear less likely to enroll. For students of color, achievement is less significant to AP enrollment decisions, but more connections to the school community through extracurricular participation seems to make students more willing to take an AP class. Interestingly, the pseudo r-squared for the analyses of economically disadvantaged students and students of color is fairly high at .634 and .691, respectively, indicating that these analyses explain a large proportion of the variation in AP enrollment decisions for this group. This observation, combined with the results of these analyses identifying few significant predictors of AP enrollment, suggests that correlation between independent variables may confound the ability to identify the unique impact of each variable on AP enrollment, though this may also be an artifact of comparatively smaller samples for these groups that have less variation in the outcome of interest. Analyzing AP enrollment by ability groups shows that among students who are less likely to be successful in an

AP class, those with higher GPA and PSAT/SAT scores are more likely to enroll in an AP class. Additionally, AP enrollment within this group is associated with a stronger academic and AP identity as well as a greater willingness to consider advice and recommendations from friends in enrollment decisions. Unfortunately, for AP-caliber students, relevant factors, beyond PSAT/SAT scores, that predict AP enrollment are difficult to identify.

The analyses presented in this chapter describe trends in AP enrollment, compare the characteristics of students who do and do not enroll in AP classes, and use administrative and survey data to model students' AP enrollment decisions. I find that AP enrollment varies over time and that AP success, defined as earning a three or higher on an AP exam, parallels trends in enrollment. I also find variation in AP enrollment across subject areas and by student demographics, with economically disadvantaged students and students of color, namely Black and Hispanic students, enrolling in AP classes at lower rates than their non-economically disadvantaged and White peers. Comparing students who take AP classes with those who do not, I find significant differences in terms of demographics, achievement, recruitment, and psychological factors. However, when using these variables to model students' AP enrollment decisions, a complicated picture emerges in which some differences become insignificant after accounting for other factors and different factors appear more and less relevant to the decisions of students from different groups. In the next chapter, I continue investigating students' AP enrollment decisions using survey responses and student interview data to compare the perceptions of students from different groups as they pertain to students' AP enrollment decisions.

CHAPTER 6: RESULTS FOR RESEARCH QUESTION 4

In the previous chapter, I used administrative and survey data to identify and explore patterns in AP enrollment, compare the characteristics of students who do and do not take AP classes, and model the relationship between a range of student characteristics and students' AP enrollment decisions. I find that AP enrollment has increased over time, but that changes in AP enrollment are uneven across subject areas and demographic groups. Notably, I find that AP classes are undersubscribed by academically talented students, students of color, and economically disadvantaged students. In addition to demographic differences between students who do and do not enroll in AP classes, I find differences in terms of students' self-perceptions, social-emotional skills, and the way they think about the future. However, using administrative and survey data to model students' AP enrollment decisions paints a complicated picture of students' AP enrollment decisions that is not easily inferred using purely statistical methods. In this chapter, I build on these earlier analyses by addressing the following research question to examine students' AP enrollment decisions: How do perceptions of AP classes and students vary across student groups? To answer this question, I triangulate analyses of survey data and student interviews.

As noted in Chapter 4, survey data was obtained from a sample of 389 students during the 2017-2018 school year. This survey includes items that measure students' perceptions of themselves and the AP program, the information students use to make course enrollment decisions, a set of social-emotional skills, and various aspects of students' decision-making processes. To gather interview data, individual interviews were conducted with 19 students in the spring of 2018. The aim of these interviews was to generate data that could be used alongside survey data to analyze students' AP enrollment decisions to gain insight into the enrollment

patterns observed in the previous chapters.[24] Students were selected for interviews based on three characteristics: enrollment group classification, race/ethnicity, and cluster membership. In a previous chapter on the design and methods of this study, I discuss a method of using student achievement to identify students who are likely to succeed in AP classes and then comparing this with AP enrollment to categorize students into four groups: positive match, ambitious, under-enrolled, and negative match. Enrollment group membership was considered when selecting cases to interview so that AP enrollment decisions could be analyzed separately among the groups of AP-caliber students and students who are, on average, less academically talented. Race/ethnicity was considered during case selection so that the demographic AP enrollment gaps documented in the previous chapter could be further investigated. Finally, cluster membership was considered as a way of identifying a collection of cases that is generally representative of the types of students who may face the question of whether to enroll in an AP class. As discussed in a previous chapter on design and methods, survey responses and administrative data were used to identify a set of latent student groups, or clusters. Some of these clusters contained no variation in AP enrollment – meaning that either all students in a cluster took an AP class or no students did. Students from these clusters were excluded from the pool of potential interviewees so that additional cases could be selected from clusters in which AP enrollment was probabilistic. Characteristics of the students who were interviewed are shown in Table 6.1, while the characteristics of the cluster to which they belong are visible in Table 6.2.[25]

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[24] Resource constraints limited the number of students who could be interviewed for this study. After considering these, along with the research questions that guide this study, and analyses of research questions 1, 2, and 3, case selection for student interviews was designed so that AP enrollment could be examined by race/ethnicity (comparing students of color to White students) and academic ability (comparing positively matched to under-enrolled students and ambitious students to negatively matched).

[25] Characteristics such as GPA, assessment scores, and survey responses for individual students are not shown to protect the identity of students who participated in interviews.

Table 6.1. Descriptive Information for Interview Subjects

Pseudonym	School	Grade	Race/Ethnicity	Gender	Enrollment Group	Cluster
Greg	James	12	Hispanic	Male	Negative Match	4
Chloe	James	12	Asian	Female	Positive Match	7
Sandy	James	11	White	Female	Negative Match	3
Mike	James	11	White	Male	Under-Enrolled	6
Quinn	James	11	White	Female	Positive Match	6
Jayson	James	11	White	Male	Positive Match	1
Ana	James	12	White	Female	Ambitious	2
Sara	Lindor	10	White	Female	Ambitious	4
George	Lindor	11	Multiracial	Male	Positive Match	7
Bryan	Lindor	10	Black	Male	Ambitious	3
Liam	Lindor	11	White	Male	Under-Enrolled	6
David	Lindor	12	Multiracial	Male	Positive Match	6
Sydney	Lindor	12	Multiracial	Female	Under-Enrolled	1
Kim	Lindor	12	Black	Female	Ambitious	1
Tina	Lindor	11	Multiracial	Female	Under-Enrolled	2
Jim	Lindor	12	White	Male	Under-Enrolled	2
Pam	James	11	Asian	Female	Ambitious	2
Darrell	James	11	Black	Male	Negative Match	4
Jill	James	11	White	Female	Under-Enrolled	1

This chapter analyzes students' perceptions and decision-making using three sets of comparisons: White students and students from historically marginalized groups, under-enrolled and positively matched students, and, finally, ambitious and negatively matched students. These three comparisons examine important dimensions of students' AP enrollment decisions to generate insight into why students of color are underrepresented in AP classes, why some academically talented students do not enroll in AP classes, and why some students who are less academically talented do enroll in AP classes.

How Students Form Perceptions Related to AP Enrollment Decisions

People, such as the students in this study, make decisions based on the information that is available to them. Oftentimes, the information used to make decisions is based on one's

Table 6.2. Descriptive Information for Clusters

Cluster	Mean GPA	Mean PSAT/ACT Composite	School Extracurriculars[1]	Non-school Extracurriculars[2]	Fixed Mindset[3]	Self-Efficacy[3]	Self-Management[3]	Academic Identity[3]	AP Identity[3]	Influence of Adults in Course Decisions[3]	Grade-maximizing preferences[3]	Weight of Social Factors in Course Decisions[3]	SES Composite	Future-Self Similarity[3]	Cognitive Reflection	Mean Discount Rate	Mean Time Spent on Homework (min)
1	3.60	1133	1.38	0.72	-0.22	0.11	-0.15	-0.16	-0.05	-0.04	-0.11	0.03	0.25	-0.04	0.74	151%	124
2	3.39	1037	1.44	0.67	0.07	-0.04	0.06	0.15	0.09	-0.04	0.07	0.07	-0.01	-0.03	0.63	327%	118
3	2.97	922	1.00	0.60	0.09	-0.24	-0.06	0.00	0.03	0.06	0.24	0.11	-0.26	-0.06	0.28	244%	112
4	2.23	786	0.70	0.35	0.62	-0.68	-0.20	-0.09	-0.22	0.47	0.14	-0.12	-0.92	-0.22	0.07	848%	70
5	1.99	674	1.06	0.56	0.55	-0.88	-0.37	-0.12	-1.30	-0.07	-0.44	0.28	-0.67	-0.00	0.00	776%	85
6	3.80	1260	1.66	0.79	-0.31	0.66	0.19	0.18	0.16	-0.27	-0.30	-0.22	0.64	0.17	1.40	103%	122
7	3.90	1404	2.01	0.80	-0.14	1.01	0.34	0.54	0.28	0.00	-0.33	-0.12	0.81	0.58	2.21	141%	159
8	3.99	1545	1.52	0.83	0.03	0.49	-0.05	-0.21	0.68	-0.25	-0.72	0.49	1.34	-0.39	2.76	29%	88

[1] A higher number means a student participates in multiple kinds of extracurricular activities (e.g. sports, band, theater, etc.)
[2] Proportion of students who participate in an extracurricular activity that is not coordinated by the school (e.g. church group)
[3] Standardized score for this construct

Table 6.3. Student Weighting of Different Sources of Information

Survey Item	Measurement Scale	Mean Response
When deciding which classes to take for next year, how important is the advice or suggestions from your teacher?	Not At All Important (1) – Very Important (10)	5.72 (0.13)
When deciding which classes to take for next year, how important is the advice or suggestions from your parents?	Not At All Important (1) – Very Important (10)	4.76 (0.13)
When deciding which classes to take for next year, how important is the advice or suggestions from your friends?	Not At All Important (1) – Very Important (10)	3.65 (0.12)

*Standard errors in parentheses

perceptions of the factors that are relevant to the decision at hand. In the case of students' AP enrollment decisions, these factors may include a students' sense of fit or belonging in an AP class, perceptions of the benefits of AP classes, perceptions of the difficulty of AP classes relative to students' ability, and future plans to which taking an AP class may be relevant. Because these perceptions in many ways serve as the basis for students' decisions, understanding how students form them is an important part of understanding students' AP enrollment decisions. In this section, I discuss the two most common sources of information students consult, and how that information is used, to form the perceptions that guide their enrollment decisions.

Three sources of information students may use to form the perceptions used to make AP enrollment decisions include: teachers, parents, and peers or friends. A set of items from the student survey used in this study asked respondents to rate the importance of these sources of information in their course enrollment decisions, the results from which are presented in Table 6.3. These figures suggest that students assign the greatest weight to information or advice they receive from their teachers, followed by information from their parents/guardians, and attach the

Figure 6.1 Percent of Interviewees Who Consider Different Sources of Information

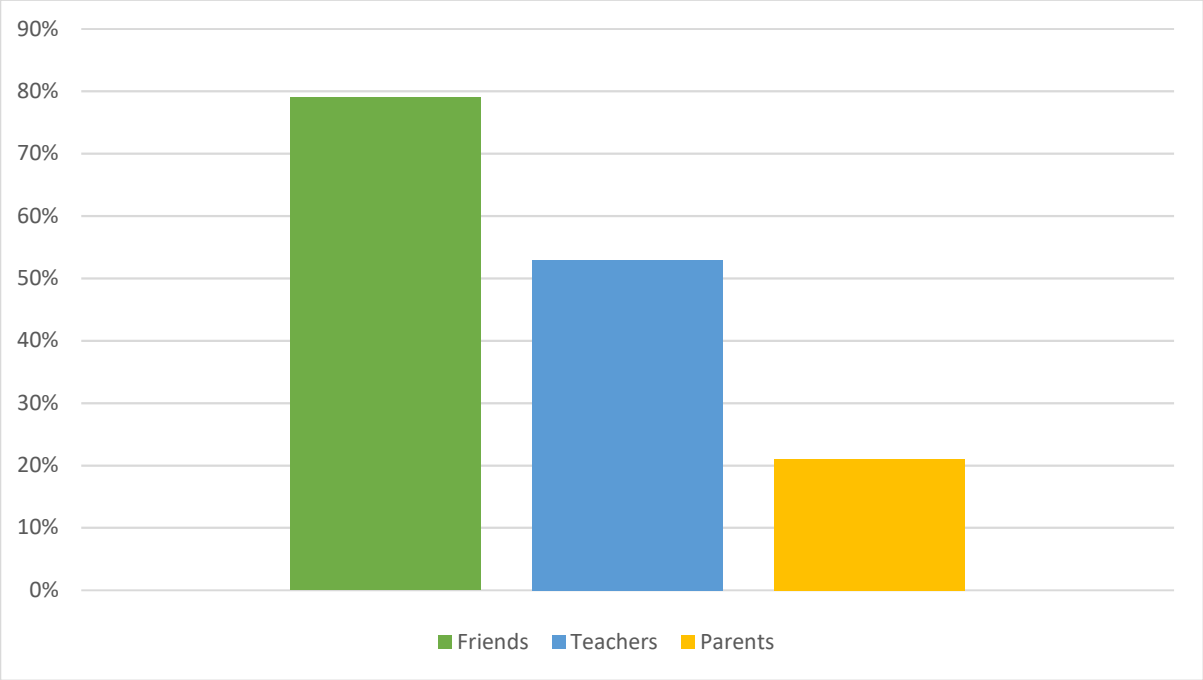
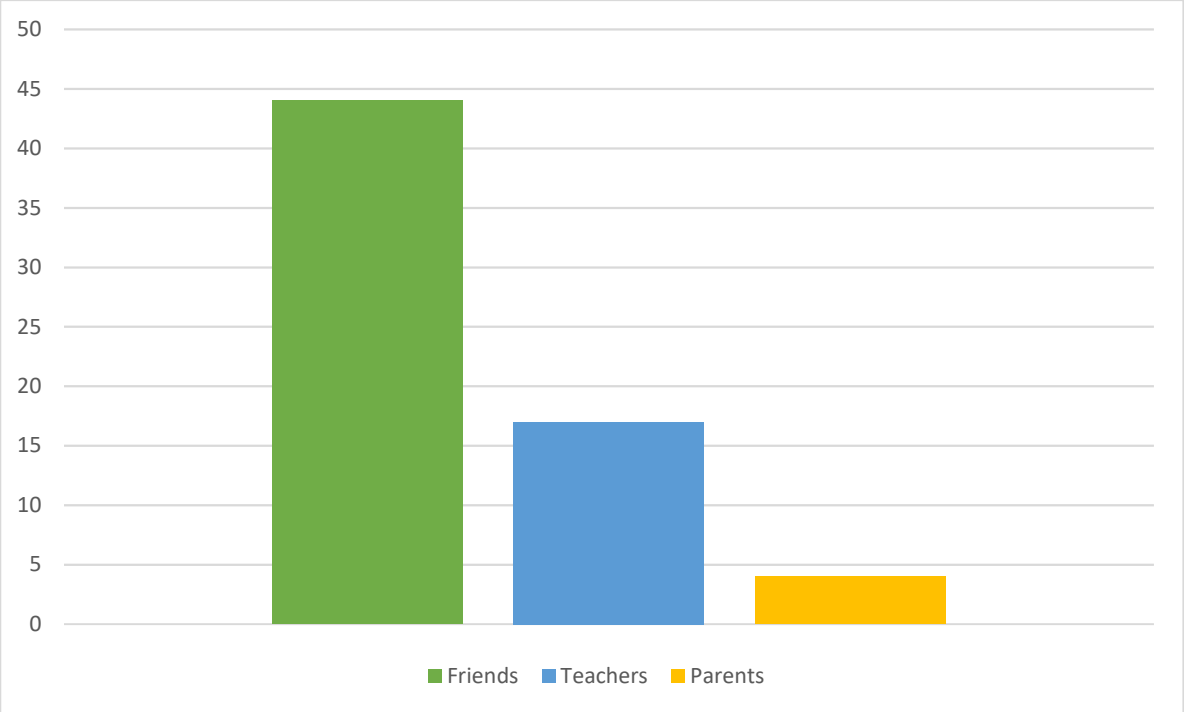


Figure 6.2 Number of Codes Mentioning Different Sources of Information



least weight to information from their friends.[26] Based on these findings, one would expect students to base their enrollment decisions primarily on what they hear or learn from their teachers. Examining student interviews, however, complicates the picture of how students collect and assemble information to use in their course enrollment decisions.

During interviews, more students mentioned considering input from their friends than any other source, as illustrated in Figure 6.1. Out of 19 students interviewed, 15 (79%) mentioned that they considered the advice or input from friends when deciding which classes to take, while 10 students (53%) indicate that they consider input from their teachers in enrollment decisions and just 4 students (21%) discuss information or advice from their parents as impacting their decision-making about course selection. These differences are even more pronounced when looking at how frequently students mention using information from each source, shown in Figure 6.2. These frequencies show that students refer to information from their peers roughly 2.5 times as often as they do information from their teachers and 11 times as often as information or advice from parents is mentioned.

Examining responses to interview questions reveals how these findings fit together. Interview responses suggest that students tend to turn to teachers mainly for information about their academic ability. When asked why she considered recommendations from teachers, Tina said "…teachers know what they're capable of, so they're probably going nag them like, "Why aren't you taking my AP class?" or something like that." On the same question about the importance of teachers' advice, Chloe responded:

> Because it's a teacher that I've had, usually the teacher I've had before, I just want to know – since they know how I am as a student – I just want to know if they think that I'd be well suited to take it as an AP class.

[26] Though not discussed here, students' rankings have little variation across subgroups based on demographics and academic ability.

A third student, Sara, described being advised by a teacher to take an AP class as encouraging, saying that "Yeah, I think it pushed me to do the AP class more because I just—I had somebody believing in me I could do it. I could do good in the class because I've had him as a teacher. He knows how I am as a student, so that was good to hear." These descriptions from Tina, Chloe, and Sara show that students generally see teachers as a trustworthy source about whether they are prepared for an AP class, which is consistent with survey responses in which students indicate that they assign greater important to teachers' suggestions than to students and parents. However, several factors appear to steer students toward other sources to inform their decisions.

While students appear to trust their teachers' assessment of whether they are academically prepared for an AP class, some factors may lead students to consult other sources. In the following exchange, Sandy, a student at James High School, points to a feature of the AP enrollment process that may steer some students away from having a conversation with their teachers about whether they should take an AP course.

> Interviewee: They give you this form. It's called a course request. You just check off all the classes that you want to take, like English 10 and AP Stats…
>
> Interviewer: Oh, okay. Teachers don't have to recommend you?
>
> Interviewee: Nope. Well, I take that back, I think they have to sign off on something. They have to say you're ready. It looks like a box, like it's just a checkbox, and they have to put their initials. Then you turn it into the counseling office.
>
> Interviewer: Do you think that that—does that discourage some people from taking, say, an AP class?
>
> Interviewee: I think so, because some people won't want to go up there and ask their teacher if they're basically good enough for this class. The teacher might tell you, "No." I think that's a little—I mean, because obviously they're doing it in your best interest. They're not going to sign off if they think you're going to fail. Yeah. I think getting told no is scary, because that just means you're not ready or you're just not good enough in some people's eyes, a little bit.

> Interviewer: Is that a good thing, do you think?
>
> Interviewee: I think it is. Because, I mean, it saves you in the long run. Why do you want to fail a class that—I mean, normally, the teachers know how you are educationally. Yeah. It saves you in the long run.
>
> Interviewer: Saves you meaning…?
>
> Interviewee: Meaning you're not going to fail the class or just waste your time or ruin your GPA, just 'because that teacher knew that you weren't ready for it. Maybe you'll take something that you enjoy more than that, like won't struggle as much.

Near the end of preceding excerpt, Sandy alludes to a faith in teachers to provide a fair assessment of a student's potential or ability. However, she also mentioned that needing to obtain an endorsement from a teacher may discourage some students from having a conversation with their teacher about whether an AP class is appropriate for them out of fear the teacher would say they are not. On one hand, obtaining an endorsement could provide a venue for students to receive advice about course selection by facilitating a conversation between teachers and students, which can be seen in the above quote from Ana. On the other hand, however, the need for an endorsement could create a barrier to students acquiring meaningful information about their course enrollment decisions. For instance, some students may be reluctant to approach their teacher if they underestimate their ability to be successful in an AP class. Also, some students may have difficulty finding a time to speak with their teacher about whether they should take an AP class. In such cases, students would need to form perceptions about their ability and the difficulty of AP classes based on other information.

A second reason that students look beyond teachers to inform their AP enrollment decisions is a belief that teachers' knowledge is limited. Students tended to express that while teachers' assessments of students based on their classroom performance is important, teachers

know less about other factors students see as relevant to their decision-making. This line of thinking is best illustrated by one student, Ana, in her recounting of what led her to take an AP class in the current school year:

> I think that what teachers have to say is really important. That's something that's definitely in my mind or that was in my mind during that. But also friends are really important, too. If my friends are like, are you sure you want to do that? Then I'm like, I don't know. Because they, obviously, know me better than my teachers. They know how I'm going to deal under pressure and how I'm going to deal with a large workload and stuff, rather than my teachers who only see the best side of me

Here, Ana specifically mentions her ability to manage stress and an increased workload as relevant to her deliberation about taking an AP class and that her friends have a better sense of these characteristics than her teachers. Students also look to friends for information about specific AP classes to use in their decision-making, particularly when students lean towards taking an AP class. In describing her decision-making process of which AP class to take, Jill explained:

> There are multiple people that are taking AP Stats and AP Calculus at the same time, or they've taken them both of them before for the teachers that are my only options. I'll ask them just, "Which one was easier for you?" or, "Which one was harder?" Just get off of that, and I've had a variety of responses. I've had people be like, "Oh, definitely don't take the AP Stats. Definitely don't take AP Calc. Take AP Stats." Like I said, the material is really hard, just overall. They'll be like, "Definitely take the one that's an easier material." Then, I'll have people be like, "No. Don't take that class. It's confusing, because you don't understand what's happening."
>
> They'll be like, "Take AP Calc, because then, he's a really good teacher," something like that. I've heard a lot of variety. It's really tugging it back and forth, back and forth [laughter]. Until I just had to decide for myself.

In her account, Jill mentions asking friends for information about the relative difficulty of AP Statistics and AP Calculus AB, but does not indicate a preference for a harder or easier class. Rather, this shows Jill looking for information about course difficulty to consider alongside other

factors. These passages suggest that students seek out different types of information from different sources by looking to teachers to form a perception of their ability to succeed in an AP class and to their friends or peers to form a perception of what to expect from AP classes.

Interestingly, students appear to see their peers as unreliable sources of information. Across multiple interviews, students report receiving mixed messages about classes and teachers, ambiguous information, and information from students whose trustworthiness is suspect. One student, George, described his reaction to hearing unclear messages about different classes thusly: "So, I mean, people will give their opinion. They don't always back it up with anything. So I generally treat that as—take that with a grain of salt." Another student, Jayson, suggests that some students provide biased information, saying "If I'm asking someone that doesn't like school or doesn't like history or whatever, and they say, 'Oh, yeah, the teacher's terrible,' I don't really know if I can trust that information." Quinn, a student at James High School, describes how mixed messages can make evaluating classes and reaching a decision difficult: "Because usually people don't know what classes they're going to take. Then they're like, 'Oh, I heard Physics is a good class,' or, 'Oh, Physics is really hard,' so then they don't take it." To address the unreliability of the information they get from their peers, students describe several approaches. The most common method students exhibit is weighting information based on what they know of its source. Students who employ this strategy often privilege information from older students or students who have taken different classes, as Quinn demonstrates: "Well, I heard before that AP Biology was really hard, so I wasn't going to take it. Then my friend took it last year and she said it wasn't that bad. There's a lot of homework, but it's not that hard." Pam describes a similar process, but also considers what she knows about the source's prior achievement or ability:

> I just think about what kind of student the person is. If I know they're lazy, they don't really do much, I probably won't really pay attention if they say they got a

> C in the class. If they say maybe, if it's maybe somebody really smart and they say, "I didn't do so great in this class," it would definitely scare me a little.

Another way students evaluate information from their peers is to give greater credence to information or messages that are received more frequently. As one student, Greg, describes in the following exchange:

> Interviewer: How do you decide which information to trust and which not to trust?
>
> Interviewee: It's like the numbers game, so I trusted the people that liked the teacher more. The more people that liked that teacher, I would schedule with them over the other teacher because more people liked them. That's the way I scheduled.

This method of evaluating information from peers does not attempt to weigh the credibility or informativeness of different sources, but rather establishes validity by determining what is most common from the information the student receives.

Analyzing survey responses and student interviews reveals how students form the perceptions that guide their AP enrollment decisions. Though students mention teachers less frequently as a source of information when making course enrollment decisions, students appear to trust teachers' assessments of whether they are prepared to take an AP class. However, students view the information they receive from teachers as incomplete and aim to learn from their peer networks about the environment and expectations of AP classes. Unfortunately, this information is often of lower quality or unreliable and to compensate, students search for and aggregate multiple sources of data to construct their perceptions of AP classes and of themselves in relation to AP students.

AP Perceptions: Students of Color and White Students

To determine whether and how students of color and White students perceive AP classes and culture differently, I analyze the following perceptions: students' beliefs about the diversity,

Table 6.4. Perceptions of Belonging in AP Classes by Race/Ethnicity

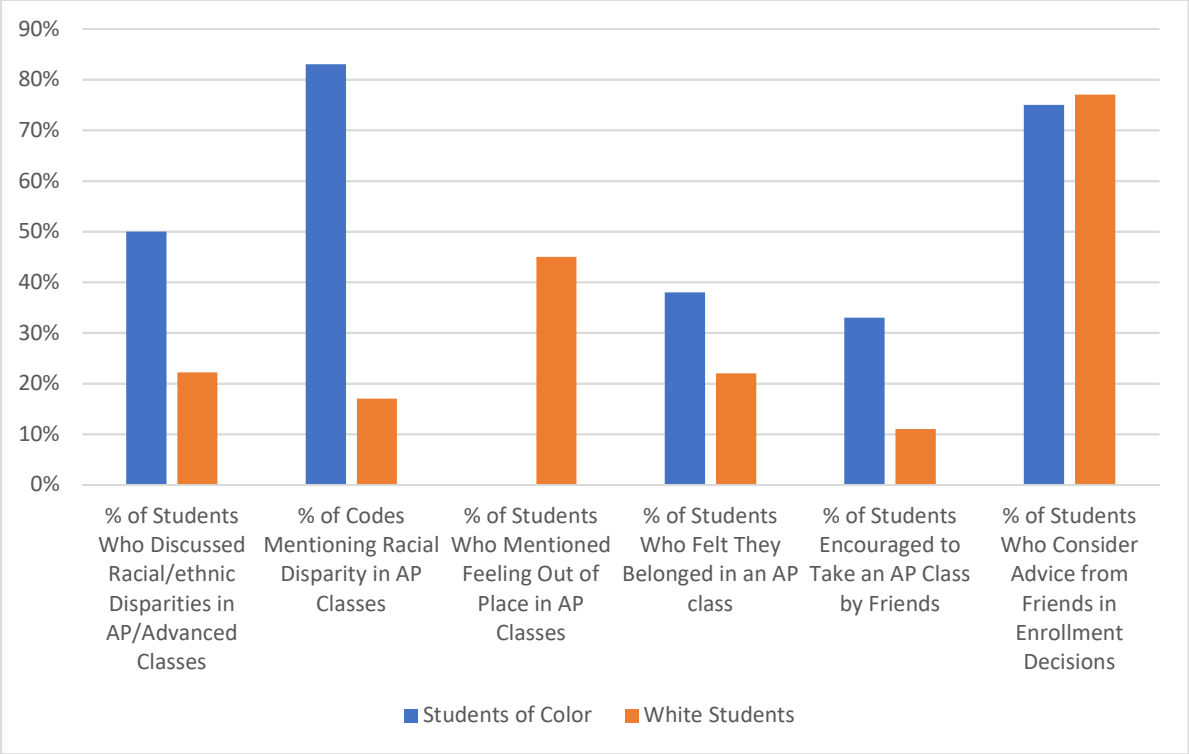
Item	Measurement Scale	Students of Color	White Students	Difference
Students in the AP classes at this school are not very similar to me.	Strongly Disagree (1) – Strongly Agree (5)	2.95	2.52	0.43**
A lot of students who are like me take AP classes.	Strongly Disagree (1) – Strongly Agree (5)	2.98	3.47	-0.49**
A lot of students who are like me are expected to take AP classes	Strongly Disagree (1) – Strongly Agree (5)	3.17	3.55	-0.38*
Students like me are generally not welcome in AP classes	Strongly Disagree (1) – Strongly Agree (5)	2.23	1.93	0.3^{+}

$^{+}$p<.1 *p<.05 **p<.01 ***p<.001

or lack thereof, found within AP classes; students' feelings of belonging or being out of place in AP classes; and the role of friends in course enrollment decisions. As described in the previous chapter, historically disadvantaged populations are significantly underrepresented in AP classes and thus it is important to know how students view this as it may impact the way they see themselves in relation to the AP program.

A comparison of how students of color (SOC) and White students responded to selected survey items is shown in Table 6.4. Responses to each of these items were recorded using a 5-point Likert scale and mean responses between these groups are compared using t-tests. For three of the four items, differences between SOC and White students are significant at conventional levels (p<.05) and the fourth is marginally significant (p<.1). Taken together, these differences show that students of color tend to associate themselves with AP classes to a lesser degree than do White students. Relative to White students, SOC shower greater agreement with the statements "Students in the AP classes at this school are not very similar to me" and "Students like me are generally not welcome in AP classes" and a lower level of agreement with the statements "A lot of students who are like me take AP classes" and "A lot of students who are like me are expected to take AP classes." Importantly, race/ethnicity is not primed or mentioned in any of these items and, conceivably, many different factors could shape what students see as a

Figure 6.3 Coded Interview Responses by Race



"typical" AP student against which they then compare themselves. That students' race/ethnicity is so strongly related to how students respond to these questions suggests that race/ethnicity is an important part of students' conception of who an "AP student" is. To unpack the meaning of these differences, I turn to students' interview responses.

The frequency and density of different themes from student interviews is shown in Figure 6.3. This, too, indicates several differences in how students view AP classes and how they see themselves with respect to AP classes. When asked whether they noticed if the racial/ethnic composition of AP classes differed from that of the student body, half of the SOC (4/8) did while less than one-fourth of White students did (2/9). Students of color also discussed or referred to the racial composition of advanced classes at their school more frequently throughout their interview, accounting for 83% of the instances in which a student referenced the racial composition of AP classes or referred to a normative message/perception about SOC enrolling in

AP classes. As Figure 6.3 shows, few White students were aware of the underrepresentation of students of color and tended to discuss their observation in neutral terms. One student, Ana, recalled of one AP class: "In my Government class, there is three people that are Indian, maybe, or Middle Eastern… They kind of like rule the class. They are very, very up there. That's really awesome. So I feel like they are doing really well academically." Interestingly, Ana notes that the students of color in her class are among its intellectual leaders and did not mention underrepresentation. In doing this, she focused on the students of color who are in her class rather than considering why there weren't more. In a follow-up question about why she thought that was the case, or why there weren't other students of color in the class, she continued on this theme, saying "The people that are in the class that are of color. I think they have a lot higher standards of themselves. I think they are like, okay, I need to do good on this." When asked about the demographic makeup of advanced classes, Jill, who identifies as White – in the administrative data – framed her response (below) in relation to the diversity of the student body overall.

> I feel like there are a good amount of people of color, but there definitely are not as many as there are in other schools. There's not a ton. I know that I'm mixed, so my dad's white, and my mom's black. There's a good amount of people of color, but there definitely are more white people, I guess I can say. I feel like it's not really the best, accurate representation. If we had more people of color, then there'd be more of a chance that there'd be more of them in those classes.

In the above passage, Jill appears to link the underrepresentation of SOC in advanced classes stems to their representation in the study body overall. The pattern of responses in student interviews suggests that White students are generally unaware of the underrepresentation of SOC in AP classes, but also do not refer to any racial/ethnic norms around AP enrollment.

In discussing the racial disparity in advanced classes, SOC, on the other hand, were very aware of their underrepresentation. SOC often recalled, without effort or prompting, how many

other students of color are in their AP class, or honors-level class if they are enrolled in one. For instance, when asked whether he noticed any enrollment patterns along gender, race, or social groups, Bryan, a Black student taking his first AP classes this year, said "In AP World, there's one, me, two, three African-American kids in the AP World class. AP bio, there's six out of two classes. Yeah, there's two in my class, and then there's four in the other classes." Tina, an under-enrolled Black student, similarly noted how her honors class this year does not resemble the rest of the student body, observing "In honors classes, it is mostly white kids. Me and another girl are the only two black people in the class, so I guess most honors classes that I've saw have been mostly white people." However, despite sharing precise recollections of racial imbalance, when asked why they thought these disparities existed, SOC gave different responses and reactions. One student, Kim, reflected on this, saying:

> I'm not sure why that is, truthfully. Being African-American myself, I've personally seen there's not a lot of us in any type of class— which, I don't know. I don't know how I feel about that, truthfully. I see it, and there's nothing I, personally, can do about it. It's, like, "Okay." If they're not taking a class because they don't think they can, that's where I'd be, like, "That's not okay to do to yourself." You can't let something as simple as your ethnicity stop you from education, and I think that's also part of the reason why I am the way I am because there's been a lot of stuff as far as Jim Crow laws down to today. I think that's part of my reason where I'm go, go, go. I try and get the best education I can and help others along the way.

Here, Kim begins by observing that Black students are a minority within her school's student body but is reluctant to draw a conclusion about the reason(s) for that before transitioning to how the underrepresentation of SOC in AP and other academic programs has impacted her own plans for education, stating that the historical legacy of oppression actually inspires her to achieve more. Other students provided different accounts of the lack of diversity in advanced classes. Tina, an honors student this year, but who is planning to take an AP class next year, suggests that structures within the school shape how SOC are able to access advanced classes:

> I don't know if that's because of anything that has to do with the school or just that those, I guess, the white kids have just been more of the honors kids rather than the black or any other colored person.
>
> Most of the people in my honors class—that's really the only class that isn't—what's the word—diverse, I guess, is my honors class. They're all the same social group, so I don't think—I guess if the class that you have to take, like the classes that you take that you have to do more to get into, are more socially and racially based. I don't know. Yeah, the other ones, like any regular English class or whatever, it's not because it's usually alphabetical or something that they do to put you in the class.

In the above passage, Tina refers to the course registration process whereby students have to complete a process if they wish to move from a regular to an honors- or AP-level class. In describing his thoughts and experiences regarding the underrepresentation of students of color taking AP classes, Bryan referred to conversations in which other Black students said that he should not take an AP class:

> Yeah, because it's seeing—since I'm black, "you're not supposed to be taking an AP class, bro. Supposed to take the normal classes, and do good in those." It's like a stereotypical thing... It's like seeing' that they're not—they don't, the African-Americans, they don't really want to take an AP class. I don't know if they think they're going to do bad in it, or I just think it's—they think of like a stereotypical thing, like they're not supposed to be going above and beyond, but I don't know.
>
> Oh, it was a friend. It was a friend, yeah. It was a friend. They were like, "So," they were like, "What classes are you going to take?" "I'm going to take these AP classes," and they were like, "Well, why are you going to take AP classes? You ain't supposed to be takin' AP classes. Just take regular classes. You got to get a good GPA," stuff like, they're still leaning on it's going to ruin the GPA and all that.

Unlike Kim, who focused on the role of agency in making AP enrollment decisions, and Tina, who associated the lack of diversity in advanced classes with course enrollment procedures at the school, Bryan alludes to social norms around AP enrollment. Curiously, what at first glance may be a downward-leveling norm of Black students not taking AP classes is then connected to a norm that emphasizes high achievement. The accounts of Kim, Tina, and Bryan illustrate that

SOC are keenly aware of their underrepresentation in AP and advanced classes, but their differing responses suggest that students of color see underrepresentation as stemming from different factors and draw different conclusions from their observations. As Kim noted, the history of racial oppression broadly is part of her motivation to achieve and succeed. And though Tina and Bryan both recounted factors that may contribute to the AP enrollment gap, when asked whether those had impacted their own decisions, both replied that was not the case and that both planned to take an AP course the upcoming year. This sheds light on students' feelings of being "out of place" or "belonging" in AP classes.

As Figure 1 shows, during interviews no students of color gave an indication that they felt out of place in AP classes and SOC actually more frequently responded that they felt like they belong in AP classes. Examining responses to interview questions reveals students gauging belonging or alienation in terms of academic ability or achievement rather than classroom experiences or culture and that this is consistent across groups. George, a Multiracial AP student, evaluated his belongingness in AP as follows: "Yeah, I felt pretty—felt like I got—again, the environment was different because of like the class is more focused, I guess. It was a little bit more intense, but still felt pretty—like a regular class." Here, he describes his sense of belonging as stemming from his ability to successfully complete the requirements of his AP class. Ana, a White student taking multiple AP classes, exhibits a similar line of thinking and reveals a conclusion about how she belongs in different AP classes in this interaction:

> *Interviewee*: I'm taking it, and there is a lot of really smart people. I think it's different and that after being in those AP classes all year long, I'm like, okay, this isn't that bad. I feel like I belong here. I definitely belong in my AP Psychology class. But in Government, I'm like, no, I don't belong here.
>
> *Interviewer*: So what makes you feel that you belong now, now that you've had that experience?

> *Interviewee*: In Psychology, I feel like I belong because I feel like I'm good at that class. Because I have been studying it for a long time, so I have a lot of prior knowledge on it. So I feel like I'm good at it. I feel really cocky. I feel like I understand the material that we're learning. I get good grades on the assignments that we do and stuff like that. I think that that's really—it shows. Oh, my gosh. I feel bad. Then for Government, I just don't belong there. Everyone else is super, super good at what they do.

The above responses are representative of the way that students tended to think about whether they belong, or feel out of place, in AP classes during their interviews. These findings contrast with the results presented in Table 6.4, which shows that, relative to White students, students of color report feeling less similar to AP students and less welcome in AP classes. As no readily available explanation for this conflict presents itself, this topic will be considered alongside other factors in an analysis of students' overall decision-making processes.

A final area of comparison between the perceptions of students of color and White students involves the information, or messages, students use to inform their decision-making. The right side of Figure 6.3 presents data from student interviews about whether they were ever encouraged to take an AP class by a friend and whether they use information they receive from friends to information their course enrollment decisions. This shows students of color receiving more recommendations from friends to enroll in an AP class than did White students. While one may hypothesize that being recommended to take AP would have a meaningful impact on students' self-perceptions or perceptions of AP classes, they way students describe these recommendations implies that this is not the case. In an exchange during his interview about conversations with other students about which classes to take, George, a Multiracial student, said:

> Interviewee: I think I had a few friends that told me I should take AP World History, but, yeah. Yeah.

> Interviewer: So how did you respond when people gave you that encouragement or suggestion?
>
> Interviewee: I was already kind of planning on doing it, so it more like—I guess it could have cemented my decision, but other than that, I was already planning on doing it, so it didn't really affect my decision in any way.

The way George describes his reaction to being told that he should take an AP class implies that he found it to be encouraging, but that this information served more to increase George's confidence in his decision to take an AP class after the fact than it did to determine his decision. In other words, George considered the recommendation from his friends when reflecting on his decision rather than to guide that decision. The following excerpt from an interview with Jayson, a White student, outlines a similar interpretation of friends' recommendations:

> Interviewer: Has anyone ever suggested that you take an AP class?
>
> Interviewee: No one ever really—I guess my mom told me that I should take one, and then my friends.
>
> Interviewer: How did you interpret those messages? What does that mean coming from your parents versus coming from your friends?
>
> Interviewee: Well, parents, probably they're biased [laughter] because they have to support you, but— your friends may feel a little bit more genuine because they are. They don't have to support you.

These exchanges are representative of how students tended to describe their reactions to being told by friends that they should take an AP class in that students recalled receiving a recommendation from friends but did not associate it with their perceptions of the AP program, self-perceptions, or decision-making process.

Though students from both racial/ethnic groups do not appear to place much weight on a specific recommendation to take an AP class in their enrollment decisions, students do seek out and use information about classes generally, and AP classes specifically, when making course enrollment decisions. In interviews, a sizable majority of both students of color and White

students mentioned that they consider information from their peers when making course enrollment decisions, as shown in Figure 6.3. Examining students' interview responses reveals that students from both groups tend to seek out similar information from their friends and utilize it in their decision-making in similar ways. Asked about the importance of information obtained from other students, David, a Multiracial student currently enrolled in an AP class, replied that:

> If some older student had told me, or one of my friends, that such-and-such class, or so-and-so teacher was difficult, or just wasn't worth the, I guess, the amount of effort put into it, then that is usually reflected in us not taking, or signing up for it.

On the same topic, Darrell, a Black student who is not enrolled in an AP class, responded similarly, saying:

> Interviewer: When your friends say "You should take this class or that class," why do you think they're telling you that?"
>
> Interviewee: I think they're doing it because either they're older friends of mine who've taken it before, and think I will like it. Or, it's just people who are taking it who want me to take it with them [laughter].
>
> Interviewer: You mentioned you have some friends who are upper-classmen or who have been older than you. How helpful has that been when you've been trying to figure out which courses to take?
>
> Interviewee: It's been good because last year when I talked to people, or this year, seniors, if I should take Brit Lit. They said I should. Because even though it's really difficult, they think I have the time and effort to do it.

Quinn, a White student in an AP class this year, gave a similar account of the information students seek out when deciding which courses to take and how that information is used:

> Interviewer: During scheduling, do you talk about the classes that you're going to take with your friends?
>
> Interviewee: Yeah. Because usually people don't know what classes they're going to take. Then they're like, "Oh, I heard Physics is a good class," or, "Oh, Physics is really hard," so then they don't take it.
>
> Interviewer: When you hear these conversations, what kind of information do people share?

Interviewee: Usually how hard it is.

In the three cases presented above, students describe reaching out to other students they know to gather information about the difficulty level of various classes, which they then use to select the class they feel is most appropriate for them. Based on the high degree of similarity in how students describe the process of obtaining and processing, there appears to be limited variation in these processes across different types of students.

In this section, I discussed responses to several survey questions which suggest that, relative to White students, SOC perceive themselves to be less welcome in AP classes, have lower expectations around taking an AP class, and see themselves as dissimilar to students who take AP classes. To understand the cause of this pattern and how it may contribute to the under-enrollment of students of color in AP classes, I analyzed related themes in interviews conducted with SOC and White students. Interestingly, interview data does not well explain what is observed from the survey. Examining these interviews showed that students of color are very aware of their underrepresentation in AP, and even honors-level, classes. Though SOC referred to factors that could potentially produce this under-enrollment, each claimed that their personal decisions were not impacted by these factors. Further, underrepresented students did not report feeling out of place in an AP class and also expressed a feeling of belonging in AP classes more often than White students. Finally, SOC and White students appear to place the same weight on input from peers and to seek out similar information from their peer network to inform their course selection. This presents a complicated picture as to how different perceptions of AP classes and AP students may play a role in the demographic gap in AP enrollment.

AP Perceptions: Positively Matched and Under-Enrolled Students

In this section I compare AP enrollment-related perceptions of positively matched students with those of under-enrolled students. As discussed in an earlier chapter on the design and methods used in this study, 19.4% of students are classified as AP-caliber, meaning that they are likely to be successful in an AP class. This group of AP-caliber students is divided into two subgroups: positively matched students, who enroll in an AP class, and under-enrolled students, who do not enroll in an AP class. While most AP-caliber students do enroll in an AP class, more than one-fourth (27.8%) do not. This raises concerns that a sizable number of students who are prepared for AP classes are not benefitting from AP classes because even if an under-enrolled student takes an AP class in another year, there is a marginal benefit to each AP class taken in terms of developing skills and knowledge and in an opportunity to earn college credits by succeeding on an AP exam. To understand why a sizable portion of AP-caliber students do not take an AP class, I examine how positively matched and under-enrolled students perceive the environment of AP classes, the benefits of AP classes, and their future as it relates to their course enrollment decisions.

One area where positively matched and under-enrolled students differ is in their apparent level of interest in AP classes. When discussing how they select courses, more under-enrolled students named interest in the class or subject area as a factor, as can be seen in Figure 6.4, and mentioned the role of their interests more frequently. Students from these groups also tended to talk about their interest in AP classes differently. Reflecting on her choice to take an AP class, Chloe state "Mostly because I know that even if it's hard, if I like the subject then I'll take it," implying that interest in a subject increased her likelihood of taking an AP class. Under-enrolled students sometimes expressed a similar sentiment, as Tina did when she said "…the only AP

class I've really ever wanted to take was a math class because that's my favorite subject." More often, though, under-enrolled students mentioned a lack of interest in AP classes. For example, Liam, an AP-caliber student who took an AP class the previous year but not in the current year, cited a lack of interest as part of his decision, saying "None of the AP classes offered this year really—they didn't interest me enough to feel like I would be able to do really well in the class." Similarly, in the following quote, Jim seems to suggest that enrolling in an AP class would keep him from taking other classes that are of greater interest: "I thought it was more important to be figuring out taking electives that I want opposed to just taking another core class." While students' interviews unfortunately provide little insight into what makes students more or less interested in AP classes, they do indicate subject matter interest as a factor that can encourage students to, or deter students from, taking an AP class.

Perceptions of the environment in AP classes also differ between under-enrolled and positively matched students. Descriptive analysis of survey responses in Table 6.5 indicate that, relative to positively matched students, under-enrolled students tend to place greater weight on GPA and course difficulty in enrollment decisions, but these differences are not statistically significant. Differences do appear, however, in how these two groups of students responded to interview questions. More under-enrolled students mentioned both GPA as a factor in their course selection and a view that AP classes are for more intelligent students. Moreover, the content of students' interview responses suggests that perceptions of the environment in AP classes differ between under-enrolled and positively matched students. When discussing the role that GPA considerations play in course selection, under-enrolled students expressed concerns that their GPA would decrease by taking more difficult classes. This can be seen in the following

Figure 6.4 Coded Interview Responses for AP-Caliber Students by AP Enrollment

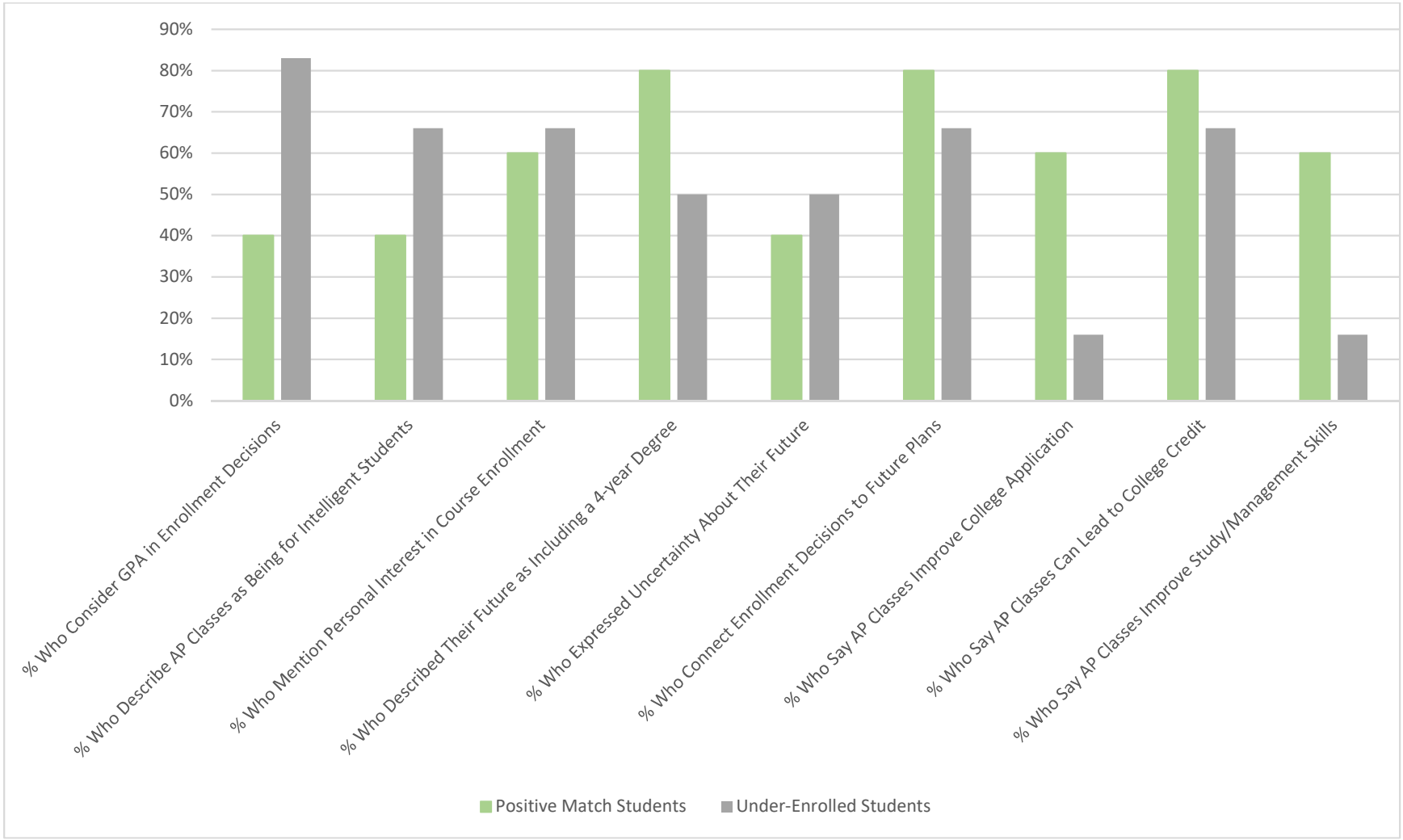


Table 6.5. Perceptions of Belonging in AP Classes: AP-Caliber Students

Item	Measurement Scale	Under-Enrolled Students	Positive Match Students	Difference
My work in school now is strongly related to my future.	Strongly Disagree (1) – Strongly Agree (5)	4.06	3.84	0.24
When deciding which classes to take for next year, how important is how the class might affect my GPA?	Not At All Important (1) – Very Important (10)	6.27	5.57	0.7
When deciding which classes to take for next year, how important is how difficult the class is?	Not At All Important (1) – Very Important (10)	6.8	6.23	0.57
When deciding which classes to take for next year, how important is advice or suggestions from my friends?	Not At All Important (1) – Very Important (10)	3.37	2.99	0.38
When deciding which classes to take for next year, how important is advice or suggestions from my teacher?	Not At All Important (1) – Very Important (10)	5	5.56	-0.56
Have you ever been encouraged to take an AP class by a friend?	No (0) – Yes (1)	0.7	0.8	-0.1
Have you ever been encouraged to take an AP class by a teacher?	No (0) – Yes (1)	0.97	0.88	0.09
After high school, I will attend a 4-year college	Strongly Disagree (1) – Strongly Agree (5)	4.57	4.73	-0.16

$^{+}$p<.1 *p<.05 **p<.01 ***p<.001

response from Sydney, a student at Lindor High School, about how different courses may impact her GPA:

> I think it all leads—maybe it's just me, but I think it leads—fear of failing. You're going into this thing, and you're, "I think I can do this." Then it's way too hard, and you just get lost and overwhelmed and stressed out. They're, "What if I go into this super AP class and I just fail it? What's that going to do?" I think it's also the GPA thing, too, because it'll drop your GPA.

Another student, Jill, expresses a similar concern and links GPA to prospects for college admissions, saying:

> I definitely would say that GPA has always been pretty important to me, because a lot of the colleges are—I'll look up a college, and it'll be like, "The average

> GPA is this," or, "You need a GPA of this to get in," or something. I've always tried to keep my GPA in the three-point-seven, three-point-eight type range.

These comments from Sydney and Jill point to a concern that it may be more difficult to succeed in higher-level classes, which is not unreasonable given that the dominant characteristic of the AP program is its academic rigor. Additionally, the quote from Jill implies that success is defined as earning a grade of "A."[27] On this point, positively matched students sometimes agree, as can be seen in the following exchange with Quinn about her decision to take an AP class in which she mentions that "doing fine" in a class means earning the highest grade:

> Interviewee: I thought I'd be fine, because I talked to people about it first.
>
> Interviewer: What do you mean? What's fine?
>
> Interviewee: I could get an A

Quinn's consideration of GPA in course selection differs from Sydney's in that Quinn expresses greater confidence in her ability to be successful. Whereas Sydney refers to a fear of failing, Quinn says quite straightforwardly that when deciding to take an AP class, she believed she could earn an "A." Not all positively matched students exhibited the same level of confidence in their ability as Quinn, but others showed a belief that course difficulty will be considered when their GPA is evaluated, as Jayson does in the following statement: "I was like oh, I don't really want my GPA to get broken or whatever. [Laughter] Then I was like colleges would probably like to see you working harder than to see a slight decrease in your GPA." Along with different concerns around evaluation and success in AP classes, under-enrolled and positively matched students also showcase different views of who AP students are. While two positively matched students did refer to a normative belief that AP classes are the domain of more intelligent

[27] Since a target GPA of 3.7-3.8 would require a student to earn mostly As.

students, they referred to this belief as something that is held by students generally rather than their personal belief. As Jayson describes:

> Interviewee: Probably just the stigma around them. People are just afraid [laughter] to—
>
> Interviewer: You said stigma. What—?
>
> Interviewee: Just the general atmosphere around AP classes. They're an elite type of thing. People think that other people, normal students can't take them.

Under-enrolled students, on the other hand, appeared to internalize this view. Sydney describes her observations of AP students as "I've noticed a lot of the AP classes or the kids that are serious about it and do everything and put their full effort into everything—and they mostly get As and stuff." Another student, Liam, describes AP students similarly, saying:

> Well, it can be kind of hard to explain. There always top of the class, always getting all A's. Then, they see other people struggling. They're like, "Well, obviously you're just a dumb." They just think that they are better than them in everything just because they get better grades. Even though a lot of the time, just because you get better grades, that it doesn't mean you're smarter than someone or better than someone. They just think they're better. There's kind of a connotation, if that's the right word, with— that, with AP classes and people like that.

The way under-enrolled and positively matched students talk about their views of GPA and of AP students and classes reveals different perceptions of the environment found within AP classrooms. The dissimilarity in these perceptions is striking considering that both positively matched and under-enrolled students are all likely to be successful in AP classes and are encouraged to take AP classes by teachers and friends at similar rates!

Thirdly, under-enrolled and positively matched students display different perceptions of their future. While survey results show these groups as being similar in terms of their plans to attend a 4-year college after high school, a larger share of positively matched students refer to their college ambition. Also, more positively matched students make connections between the

courses they choose to take and the plans they have for their future. In one instance, Quinn explains that a reason she chooses to take AP classes is to gain background knowledge that will be useful in college, saying "I take classes I like usually and what classes I think I want to take before I get to college, so I'll know that stuff before I take the class in college." George describes a similar logic when explaining his course selections:

> So like for classes—I'm in AP Stats and AP Calc right now. For those classes, it was more about the learning because I would have taken those classes anyway, but for AP Government and AP Biology, those were more to get them out of the way, I guess. That was more about just saving credits or money on credits later So, I mean, just self-preparation for college. I don't want to take a super easy senior year and then jump into freshman year in not be prepared for that, I guess.

Some under-enrolled students similarly consider their plans when selection courses, as Tina does here when talking about her plan to become an occupational therapist: "I've researched it, and I know I have to—some of the classes I'm taking now, like I've signed up for—I forgot what the class is called, but it's about human anatomy, and things that have to do with more medical things." Other under-enrolled students, though, seem to consider their future more in an abstract sense when choosing their courses, as Jill describes:

> I definitely do that future thing a lot, where if I have a problem and I don't feel like dealing with it, I'll just be like, "Future me will deal with it. I'm not going to do that now." [Laughter] Besides that, scheduling classes, sometimes, I might take a—I do consider what it does for me in the future, when I would schedule my classes in the past. It was less about the classes I took and more about the grades that I got.

Compared to the way Tina, George, and Quinn connect their course selections with specific goals, Jill refers only to her grades. This alludes to a pattern in student interviews in which under-enrolled students show greater uncertainty about their future than do positively matched students. In the following exchange with Mike, an under-enrolled 11th grader, he acknowledges his lack of a plan for the future:

> Interviewer: If we could fast forward into the future, what do you see yourself doing? What kind of job or career do you think you'll have?
>
> Interviewee: No idea.
>
> Interviewer: Okay. Have you thought about a path, anything, like what comes after high school yet?
>
> Interviewee: Not quite. It's hard to think about.

Jill, also an 11th grader, similarly mentions that the lack of a plan, but also states that this has steered her away from AP classes:

> I definitely feel like there are some AP classes that can help you a lot with what you want to do. I'm not really 100 percent sure what I want to do, so I'm just doing the classes that I have more interest in and that I feel like I can take.

As survey and interview responses show, AP-caliber students show generally similar intentions about attending college after high school, but positively matched students have more specific plans regarding their postsecondary education and careers. Positively matched students appear to use these plans to orient their course enrollment decisions while under-enrolled students seem to inject uncertainty about their future into their course selection despite a recognition that AP classes may help them in the future.

Finally, under-enrolled students appear to perceive fewer of the benefits of taking an AP class. As the right side of Figure 6.4 shows, an approximately equal proportion of under-enrolled and positively matched students are aware that taking AP classes can help students earn college credits, which can be of significant material value. However, no students showed an understanding of the potential monetary value of earning, or waiving, college credits toward a degree. Beyond this, though, under-enrolled students were less aware of the range of potential benefits from taking AP classes, including using it as a signal of ability on college applications or improving one's time management and study skills from working to master a larger volume of

more complex material. Though it is difficult to determine whether greater knowledge of the broader range of benefits of AP classes caused positively matched students to take AP classes when they otherwise may not have, these responses suggest that under-enrolled students may perceive AP classes as less rewarding than positively matched students.

Analyses of student surveys and interviews reveals that while all AP-caliber students are similar in terms of being advised to take an AP class, considering difficulty and grades in course selection, and in their future plans, how they operationalize these factors to inform their decision-making differs considerably. Compared to positively matched students, under-enrolled students emphasize GPA and associate students in AP classes with high intelligence; have less interest in the subject matter taught in AP classes; exhibit greater uncertainty about their future and make fewer connections between their contemporary choices and future; and appear to be less familiar with the benefits of taking AP classes. That this is the case for two groups of students who are highly similar in terms of academic ability is surprising – the strongest predictor of success in an AP class – is surprising and speaks to the powerful role of students' perceptions in their course enrollment decisions.

AP Perceptions: Ambitious and Negatively Matched Students

As reported in an earlier chapter, slightly more than 80% of the students examined in this study are classified as not likely to be successful in an AP class, meaning that they have a predicted probability of success in an AP class (based on PSAT/SAT scores and GPA) of less than .3. Yet, many students who are less likely to be successful in an AP class do enroll in one, a group referred to in this study as ambitious. Enrollment among this group is such that ambitious students make up 46% of the AP student population. Given their significant representation in AP classes, it is important to understand what motivates ambitious students to enroll in an AP class.

Table 6.6. Perceptions of Belonging in AP Classes: Students Not Likely to Succeed in an AP Class

Item	Measurement Scale	Ambitious Students	Negative Match Students	Difference
My work in school now is strongly related to my future.	Strongly Disagree (1) – Strongly Agree (5)	3.67	3.34	0.33+
When deciding which classes to take for next year, how important is how the class might affect my GPA?	Not At All Important (1) – Very Important (10)	6.14	6.8	-0.66+
When deciding which classes to take for next year, how important is how difficult the class is?	Not At All Important (1) – Very Important (10)	6.37	6.72	-0.35
When deciding which classes to take for next year, how important is advice or suggestions from my friends?	Not At All Important (1) – Very Important (10)	4	4.03	-0.03
When deciding which classes to take for next year, how important is advice or suggestions from my teacher?	Not At All Important (1) – Very Important (10)	5.69	5.97	-0.28
Have you ever been encouraged to take an AP class by a friend?	No (0) – Yes (1)	0.7	0.46	0.24***
Have you ever been encouraged to take an AP class by a teacher?	No (0) – Yes (1)	0.86	0.57	0.29***
After high school, I will attend a 4-year college	Strongly Disagree (1) – Strongly Agree (5)	4.62	3.8	0.82***

+p<.1 *p<.05 **p<.01 ***p<.001

To investigate this topic, in this section I compare students' perceptions of the AP class environment, self-perceptions shaped by AP recruiting, benefits of AP, and role of future plans in course selection between ambitious students and negatively matched students, who are less likely to succeed in an AP class and do not take an AP class.

According to survey responses, shown in Table 6.6, ambitious students are significantly more likely to have been advised by a friend (by 24 percentage points) or a teacher (by 29 percentage points) to take an AP class and students' interview responses suggest that this encouragement positively influences students' self-perceptions. Recalling one teacher's

suggestion to take an AP class, Sara, an ambitious student, said that helped her make the decision to take an AP class:

> Yeah, I think it pushed me to do the AP class more because I just—I had somebody believing in me I could do it. I could do good in the class because I've had him as a teacher. He knows how I am as a student, so that was good to hear.

Here, Sara weights her teacher's recommendation since he knows her "as a student" and she appears to interpret this as an indication that she is the type of student who should be an AP class. According to another ambitious student, Pam, friends' advice is also relevant to enrollment decisions. When asked what led her to take an AP class, she responded:

> I mean one of my friends convinced me to take AP Biology because I didn't really think about it. I was thinking I'm not taking an AP classes and this would be a good chance to see how well I do in one because my senior year I'm going to be talking two or three of them. I might as well try it out. She convinced me to do it but I didn't do it because she was in that class…
>
> I don't know where she got the idea from honestly. She never brought it up before except for I was doing drops and adds. I didn't have enough room in my schedule for physics. I was like I don't know what class I want to take. She was like, well, I think her brother took it and he did pretty well in the class. She wanted to try it out. She recommended that I take it with her.

Interestingly, Pam does not give a reason why her friend's advice was considered in her decision to take an AP class, but it seems that she needed to make a decision when schedules were being finalized[28] and her friend offered a suggestion she deemed reasonable. The impact of these interactions with teachers and peers on enrollment decisions indicates that encouragement can help students to perceive themselves as "AP students."

Ambitious students define AP classes as rigorous and challenging but tend not to be discouraged by this perception. As shown in Figure 6.5, both groups of students refer to a normative view that AP classes are "for" more intelligent students, react differently to this

[28] Drops and adds is a window of time when students are able to change their original course requests.

message. Negatively matched students appear to generally accept that AP classes are reserved for the most intelligent students, as Sandy explains:

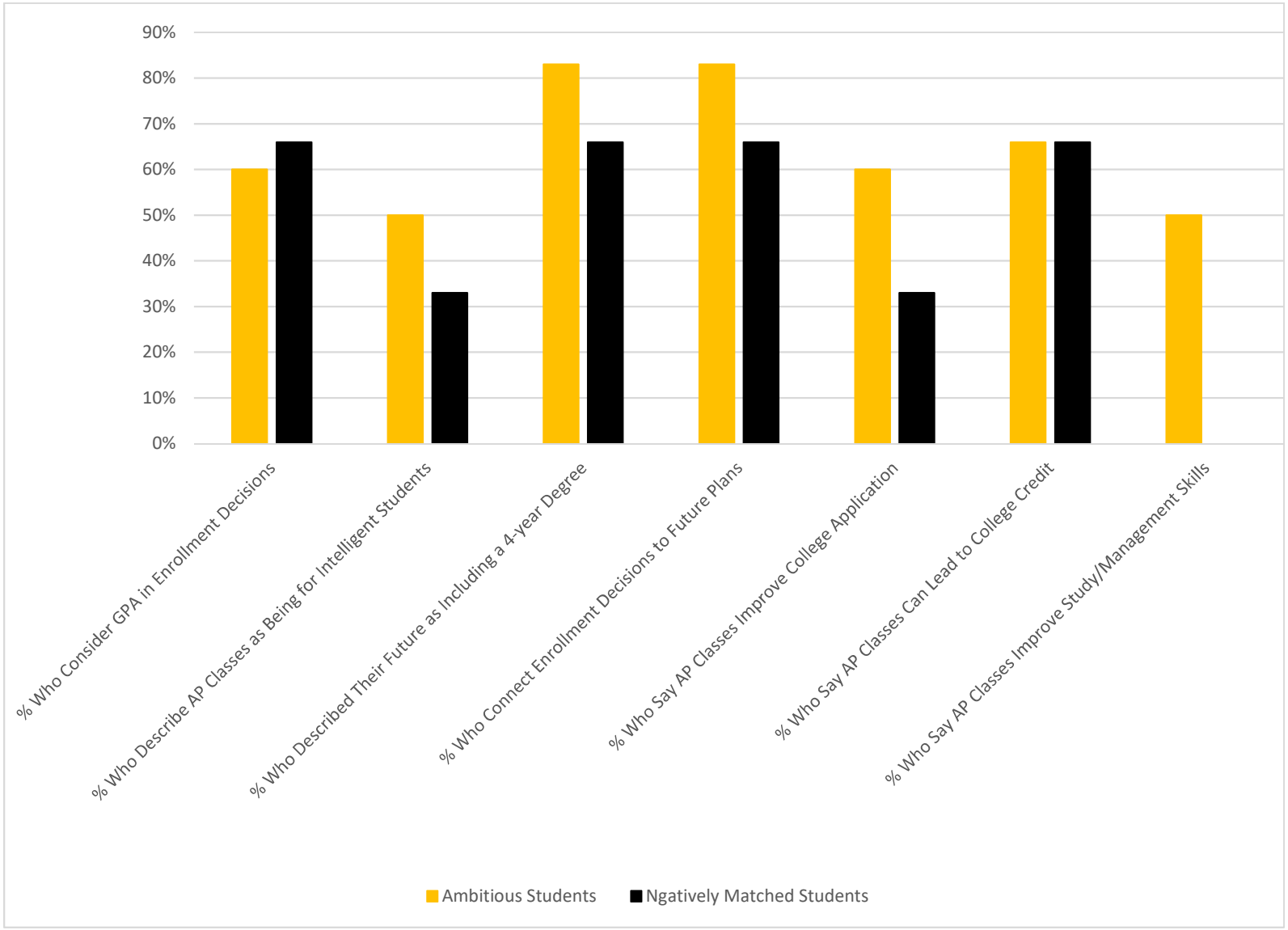
> Yeah. AP English is supposed to be really hard. People consider that to be if you're really smart or really good at English or just the normal—and then FST (functions and trigonometry), if you're a senior, that's supposed to be known as the dumb senior class. Just because it's super easy or a blow-off class, I guess. A lot of the AP classes are known for the smart people or the 4.0 or whatever.

Ambitious students, on the other hand, tend to reject the notion of AP classes as exclusive or elite. Responding to this, Sara opined "I think the kids in my AP Bio class are smart, but they're just the same as any other kid in my other classes." Another ambitious student, Ana, was chagrined at the idea that only the most intelligent students should be in AP classes, saying:

> I think that it definitely holds people back for sure. There are some people that would be like, yeah, I think I'm pretty good at this subject. I'd be like, yeah, I'm kind of interested in taking AP Chemistry, for instance. But then they find out that a lot of really, really smart people are taking that. They are like, oh, well, I can't compare to that, so I don't think I'll take it. That's really sad.

These differences in how ambitious and negatively matched students view messages about the "type" of students who are catered to by AP classes provide context for how ambitious and negatively matched students' consider GPA in their course selections. As can be seen in Table 6.6, ambitious students rate GPA as a less important factor in their course enrollment decisions than do negatively matched students, though the difference is only marginally significant in statistical terms. This is also visible in Figure 6.5, which also shows a slight difference in the percentage of ambitious and negatively matched students interviewed who mention considering GPA when choosing courses. The way students from these groups talk about GPA, though, is

Figure 6.5 Coded Interview Responses for Ambitious and Negatively Matched Students



distinct. Negatively matched students often discuss their GPA as an end in itself, as Darrell does here:

> Interviewee: GPA is really all about college and stuff. Now, with being a junior, I just look at colleges and community colleges, to see what's the best option for me.
>
> Interviewer: Do you get concerned about your GPA when you've been taking classes?
>
> Interviewee: Yeah. That's another AP reason, too. Because I feel if I struggle a lot, then that just won't help me or my GPA.

Sandy, another negatively matched student, also frames GPA as something to pursue, saying:

> Interviewer: You bring up GPA, why do you think that's so important?
>
> Interviewee: Because that's what we're told the colleges look off of. I think [University 1], you have to have a 3.5 for an average or a 3.4 or something like that. It's pretty important just based on what college you want in general. [University 2] a 3.4 to maybe 3.2. To actually get into the college that you want—so it's not just a ranking in your school. It's what colleges actually look at.

Ambitious students approach GPA differently, seeing the relative challenge of one's courses as related to how GPA should be interpreted, which is demonstrated in the following response from Bryan about students who allow a concern for their GPA to prevent them from taking AP classes:

> They [other students] don't see it that way because they don't want to ruin their GPA. That's what they said. They didn't want to ruin their GPA. They didn't want to change anything. They had everything set. That's what they *thought*, but a college would look at it. They don't know what you think. They would think of it as he didn't want to accept a challenge.

Above, Bryan suggests that GPA is should not been seen as independent of the types of courses and states an assumption that college will do this when evaluating GPA on an application. Pam, another ambitious student, also frames the interpretation of GPA as relative to course level:

> My GPA isn't—well it depends. If I'm taking an easy class and I don't do well in it then it's really upsetting to me. If I take a harder class, for example like AP Bio, and I get a B minus, it's not as devastating to me as it would be if I'd took regular Biology and get a B minus because that means I'm taking a college class and it's not great but it's not really bad either. It means I can do this. If I work a little bit harder then I can get there.

In this response, Pam outlines how she would interpret GPA differently under separate circumstances, with lower grades being acceptable if the course is more challenging and less acceptable if the course is less challenging. Also, Pam characterizes her grades as a feedback mechanism she can use to adjust her focus and effort, which she elaborates further in the following exchange:

> Interviewer: What has reinforced that belief? Can you tell me about a time when that happened?
>
> Interviewee: Yeah. Like I was talking about earlier with AP Biology. I started off not thinking there was going to be that much work for it. I didn't schedule that in my daily schedule. I ended up not having enough time to do the homework or study for the test or anything like that. That's why I ended with a B minus for the first term. Eventually I'd create a new schedule and then same thing with Pre-Calc. I'd create a new schedule and fit it all in to my daily routine. I saw growth, like I said. I started with a B minus and now I have an A. I just try to make the schedule work for me.

The way Pam describes using GPA to influence her decision-making stands in sharp relief to Darrell's statement that struggling in a class and earning a lower grade as a result would make him worse off. Rather than seeing a lower grade as defeating, Pam recounts an experience when earning a less-than-desirable grade inspired her to become a better student. Notably, not all ambitious students expressed this same interpretation of their grades, but thoughts similar to Bryan's and the first part of Pam's responses were common among this group. Collectively, these contrasts suggest that negatively enrolled students view the environment in AP classes as rigorous and therefore intimidating, and potentially a threat to their academic status, while

ambitious students view the AP environment as rigorous and therefore an opportunity to take on new challenges and grow as a result.

Thirdly, the perceptions that ambitious and negatively matched students have of their future shape their AP enrollment decisions. Compared to negatively matched students, ambitious students have a stronger agreement with the statement that they will attend a 4-year college after high school and report that the work they do in high school is strongly related to their future, indicated in Table 6.6, though this difference is more pronounced for college attendance. This pattern is mirrored in Figure 6.5, which shows that, in interviews, a higher proportion of ambitious students mention earning a 4-year degree and make connections between their course enrollment decisions and future plans. The content of students' interview remarks further reinforces these distinctions. Both groups show evidence of considering future plans when choosing their courses but describe their futures in different levels of detail. In his interview, Greg indicated an interest in pursuing a career in the medical field; when asked what he will need to do to prepare for that future, he replied "Obviously pass high school, which I'm doing good, and go to school for a little bit, get my—what's the first one you get, the first degree?" In response to another probing question about how his current academics relate to that, Greg said:

> Interviewee: Most of those classes prepare me. The main classes that prepare a student for the future are math, English, and history, I'd say. Those are the main three subjects I focus on the most because those are going to prepare me the most for after high school.
>
> Interviewer: Okay. How do you think that those courses are preparing you or setting you up to do well in that?
>
> Interviewee: Because everything in life requires a lot of knowledge in those areas like math, English, and science maybe, and history.

These responses indicate a relatively loosely defined plan for Greg's future, which involves focusing learning primarily on math, English, and history; graduating high school; and forging a

career in the medical field. Other negatively matched students described more detailed and coherent plans. Discussing her future, Sandy highlighted speech pathology and dental hygiene as two paths she has considered but was undecided between them. Asked how her academics relate to that future, Sandy explained:

> For sure work really hard on my sciences, because I don't like science. If I want to be a dental hygienist, obviously, I need science. Probably do a lot more of my homework. [Chuckles] Yeah. I plan to go to [community college]. It shouldn't be too bad.

While this plan is linear and connects Sandy's current studies and future plans, it is still somewhat ambiguous in that she does not identify specific courses and did not identify the subject matter relevant to a speech pathologist or the steps needed to become one. Ambitious students also expressed some uncertainty about their future but were more specific about the steps in their long-term plan and often make direct connections between courses they have taken, or plan to take, and their future plans. For instance, Sara described her career ambition as

> Well, right now I'm pretty set on what I want to do. I'm looking at going to [University 2] for—there's a five-year physical therapy program, so yeah, I see myself going down physical therapy or athletic training or something of that sort.

and explained how her studies connect to that plan, saying:

> Right now, I have to focus on my grades and that's because I had a rough start freshman year. I wasn't really fully in it, so that's part of the reason I signed up for AP Bio so better—when I go to apply for colleges and stuff. I want to do athletic training here, so I'll probably do that.

Bryan also describes a link between his present and future, mentioning how taking AP Biology in the present year and AP Chemistry the following year will prepare him to potentially major in biochemistry:

> I think about what a college would want me to do, but then what else I would want myself to do. Then, when I take an AP class, AP chem when I'm a senior, and chemistry next year, you have to—since I have to—I might major in bio-chemistry. I could get a little insight on normal chemistry and get me ready for

> college because AP, it's made by the college board, so it's supposed to help you later, and it gives you insight. It's not really like college because college would be much more stressful than the normal AP class that I'm taking, so it's like thinking about what's going to prepare you for later in life.

In the following passage, a third ambitious student, Ana, outlines a plan to become a social worker that does not include specific courses, but demonstrates an understanding of the field and the requirements to enter it:

> Well, my mom's a school social worker. I love psychology a lot. I love hearing what she does. Sometimes we'll just talk about what a typical day looks like for her. It's something that I really enjoy. School social work would be really fun, but, obviously, you don't get paid a lot. That's why I'm trying to go to [community college] first, to get my prerequisites done, and then transfer into [University 1] because I'm not going make money in the first place, so I might as well save what I have now.

The preceding survey responses and interview passages show that ambitious students perceive a future that is more likely to specifically include attending a 4-year institution and that flows from the plans and decisions they make in high school whereas negatively matched students perceive a more generalized future with a more tenuous connection to the present.

Finally, ambitious and negatively matched students have different perceptions of the benefits of AP classes. In interviews, the most commonly cited benefit described by students from both groups is the potential to earn college credit through AP participation and success, as shown in Figure 6.5. However, a larger proportion of ambitious students identify improving the quality of one's college application as a benefit from taking AP classes and no negatively matched students list improving academic skills such as studying and time management as a desirable outcome from taking an AP class. Here, too, it is difficult to tell whether ambitious students were more aware of the range of ways they could benefit from taking an AP class before they enrolled or if this knowledge was acquired through experience in an AP class. Regardless, a

greater recognition of the benefits that can be realized from an AP class may steer some students towards enrolling.

In this chapter, I used student surveys and the content of student interviews to analyze and compare the perceptions students use to inform their AP enrollment decisions. I find that to create many of these perceptions, students look to, and trust, their teachers for information relating to their ability or level of preparedness to take an AP class. However, students desire additional information about the culture and expectations in AP classes and reach out to their peers to obtain it but must sift through conflicting accounts and unreliable sources to form their relevant perceptions. Examining how students' perceptions vary across groups, I find that students of color have perceptions of AP classes and culture that differs from those held by White students; that under-enrolled students have perceptions that differ slightly from positively matched students, and that the perceptions of AP classes and culture held by ambitious students differ from those held by negatively matched students. In the following chapter, I discuss the findings from Chapters 5 & 6 along with the implications of this study for policymakers and educators, limitations, and directions for future research.

CHAPTER 7: DISCUSSION, IMPLICATIONS, AND FUTURE DIRECTIONS

This study investigates the topic of how high school students make decisions about whether to enroll in an Advanced Placement (AP) class by focusing on four themes: patterns in AP participation over time and by student groups; the characteristics of students who do and do not take AP classes, how student-level factors or characteristics predict AP enrollment, and how students' AP-related perceptions vary across groups of students. Previous chapters discussed the framing of this study, design and analytical methods used in this study, and the major findings of this research. In this chapter, I draw on the conceptual frameworks that motivate this study to discuss the results presented in previous chapters and synthesize these findings into a proposed model of students' AP enrollment decision-making. I also discuss the implications of this study for researchers, educators, and policymakers as well as the limitations of this study and suggested directions for future research.

Patterns in AP Participation

This study examined several patterns that contribute to the scholarly conversation around AP participation. First, different definitions of AP participation lead to differences about the population of AP students. While existing research on trends in AP enrollment focus on the students who sit for an AP exam, I find that roughly one-third of the students who enroll in an AP class do not take the corresponding exam that year. I also find that among the students who take an AP course, those who take an AP exam are systematically different from the students who do not. Among the students who take an AP class, Black, Hispanic, multiracial, and economically disadvantaged students are less likely to take an AP exam than are their White, Asian, and more affluent peers. This adds important nuance to the research on demographic gaps in AP participation. While examining course enrollment suggests narrower gaps in AP

participation along demographic lines, these gaps nevertheless remain significant. Further, this suggests that students from disadvantaged groups who do take AP classes may face obstacles to fully participating in AP. Future research should examine potential barriers students historically underserved students face in registering for AP exams.

A second trend I observe in AP participation is that changes in AP enrollment are mirrored by changes in student success on AP exams. This finding is consistent with national trends in AP success (College Board, 2014) and bears on the question of whether, or to what extent, AP enrollment should be expanded. Some have expressed concern that efforts to boost AP participation may go too far and end up recruiting students into AP classes who are not adequately prepared (Finn & Winkler, 2009). A survey of AP teachers found that many of them share this concern (Duffett & Farkas, 2009) and journalistic accounts of AP expansion identify examples where this indeed has occurred (Tugend, 2017). The findings of the present study suggest that concerns about increased enrollment setting some students up for failure may be overblown.

Thirdly, I find significant under-enrollment in AP classes by academically talented students. Of the students who are likely to pass an AP exam, over 25% do not enroll in an AP course. This involves significant opportunity costs for students who may otherwise learn more advanced content, improve the quality of their college application, and waive college credits. To better understand why these students do not take AP classes while others do, I turn to the conceptual frameworks of judgment and decision-making, social-emotional learning, and identity that guide this study.

An Interpretation of AP Enrollment Decisions Using Judgment and Decision-Making

The findings of this study are consistent in many respects with concepts from judgment and decision-making. First, students appear to consider a range of potential outcomes and associate probabilities with those outcomes to inform their decisions. Students generally appear to have an accurate sense of the probability that they will be successful in an AP class. Students who are likely to be successful in AP make up a majority of AP students and the vast majority of students who are not likely to be successful in an AP class do take one. Additionally, higher-ability students have a greater tendency to take an AP exam. Students appear to supplement their perception of their ability with information from their peers and teachers and to weight this information depending on the reliability of its source. Students also appear to make AP enrollment decisions that are consistent with their preferences as those who show greater concern for their grades appear to shy away from the rigor of an AP class while those who wish to prepare themselves for college or improve their college application are more likely to take an AP class.

Second, students who take at least one AP class display less present-bias. On the survey, AP students discounted the future at a much lower rate than students who do not. In interviews, students enrolled in AP classes more frequently referenced the future. For example, one student stated that "So, I mean, just self-preparation for college. I don't want to take a super easy senior year and then jump into freshman year in not be prepared for that, I guess." This suggests that AP students are better able to delay rewards into the future.

Thirdly, some students appeared to rely on heuristic reasoning when deciding whether to take an AP class. In interviews, students who were less certain about their prospect for success in

an AP class appeared to employ the representativeness heuristic by comparing themselves against students they knew who were taking an AP class. In other words, some students appear to operationalize the question "Should I take an AP class?" into the easier to answer, but different, question of "How similar am I to an AP student?" Many students indicated that they felt encouraged to take an AP course if they knew someone similar to them who had taken the class previously. Other students mentioned being discouraged from taking an AP class after learning that students they see as "smart" performed poorly in a certain AP class. For instance, Quinn recounted "I heard that AP Chemistry and all the 4.0 students, they were getting C-minuses in the class. They're like, 'Oh, I got a C on the test. This is so good…' so I knew I didn't want to take that class." In these cases, students consider how their friends or peers performed in an AP class and then compare themselves to that student to determine whether they should enroll in an AP class.

However, some findings from this study challenge the utility of JDM to explain students' AP enrollment decisions. Students, even students in AP classes, showed a relatively low degree of awareness that AP classes could be a way to earn college credit. Even among students who were aware that they could waive college credits for earning a high score on an AP exam, there was little understanding of the economic value of doing so. Given that the value of this can be several thousand dollars for each course waived, it is curious that the potential to waive college credit was not a salient outcome for students.

Another finding of this study that is difficult to explain using JDM has to do with the prevalence of ambitious students. Although higher-ability students exhibit a greater likelihood of taking an AP class, over 40% of the students who do take an AP class have a low probability of success. One could reasonably expect that students with a low probability of success would be

far less likely to enroll in an AP class. It may be that ambitious students place a higher value on the potential benefits of AP classes, which may be enough to offset the lower probability of success. Alternatively, if ambitious students are primarily concerned with improving the quality of their college application and are aware that relatively few students in AP classes earn a grade lower than a B, they may see themselves as being more likely to be successful. While college applications were commonly mentioned by students in interviews, it does not appear that ambitious students have a lower threshold for defining success or were indifferent regarding AP exams. A third possibility is that ambitious students enroll in AP classes due to heuristic reasoning, seeing themselves as more representative, or typical, of AP students, though it is unclear what factors ambitious students use to form these judgments and why heuristic reasoning seems to steer under-enrolled students away from AP classes.

In many ways, students appear to employ a rational process when deciding whether to take an AP class by considering their ability, relevant information from their friends and teachers, and the benefits offered by the AP program. Where they deviate from the rational model, students who discount the future to a lesser extent and who see themselves as being similar to AP students they know appear to be more likely to take AP classes. These factors shed light on the decision-making processes of positively matched and negatively matched students, but JDM is less informative regarding ambitious and under-enrolled students.

An Interpretation of AP Enrollment Decisions Using Social-Emotional Skills

Analyses of survey and interview data show that social-emotional faculties are significantly related to AP participation. Survey results indicate that relative to non-AP students, students who take AP classes have a higher degree of self-management, a greater sense of self-efficacy, and more of a growth mindset (less of a fixed mindset). In interviews, some students

also describe experiences that evince these constructs. Recall, for instance, Pam's story in Chapter 6 about recovering from a disappointing grade: "I'd create a new schedule ... I'd create a new schedule and fit it all in to my daily routine. I saw growth, like I said. I started with a B minus and now I have an A." This showcases both a high degree of self-management and a growth mindset and gives insight into why Pam, an ambitious student, chose to take an AP class.

While social-emotional skills serve to distinguish students who do and do not take AP classes, it is difficult to gauge how these factors shape students' decision-making processes around course selection. Across interviews, students provided relatively few examples that exhibit connections between social-emotional skills and decisions. Though Pam's account above serves as an excellent example of a student drawing on her social-emotional competencies, it is more illustrative of how she persevered through a challenge she encountered in her AP class than why she chose to be in that class. It may therefore be that social-emotional skills are more relevant to how students navigate challenging environments like AP classes or that a different research design is needed to explore the link between students' social-emotional skills and their course enrollment decisions.

An Interpretation of AP Enrollment Decisions Using Identity

Various facets of students' identity appear strongly related to students' decision-making around AP enrollment. Descriptive analysis of survey constructs show that AP students have both a stronger sense of academic identity as well as AP identity. In analyses that used logistic regression to model AP enrollment, both of these elements of identity are related to ambitious students' decision to enroll in AP classes. In interviews, students' responses suggest that academic identity and AP identity are related to their experiences. In some cases, experiencing

success in an AP class fostered a sense that the student belonged. For other students, identity was related to a specific subject or domain in which a student had an interest.

Racial identity appears to be related to how students of color make decisions about AP enrollment. Examining the items that make up the construct of AP identity, students of color report feeling less welcome in AP classes, less similar to AP students, and agree less with the statement that students like them are expected to take AP classes. Notably, none of these items mention or allude to race or ethnicity. These survey responses are consistent with observations students of color recalled about AP classes in interviews, which often noted that there were few students of color. This aligns with findings in earlier research suggesting that students of color can feel racially isolated in advanced classes. However, during interviews students of color did mention factoring this into their decision-making. One student, Kim, drew on this as motivation for taking an AP class, saying "… that's also part of the reason why I am the way I am because there's been a lot of stuff as far as Jim Crow laws down to today. I think that's part of my reason where I'm go, go, go." This is more consistent with studies finding that a strong racial identity encourages students of color to take ambitious classes.

Students' temporal identity also appears related to whether they choose to take an AP course. Students in AP classes have a significantly higher degree of future-self similarity, a belief that one's life in the future will resemble one's life in the present, and ambitious students are more likely to report that they will pursue a 4-year degree after high school. This implies that AP students make decisions in the present to invest in their future selves. This was most evident for students who had a concrete idea of plan for their life after high school. One ambitious student, Bryan, aspired to major in biochemistry and based his decisions to take AP Biology and AP Chemistry on that plan. Under-enrolled students had less specific plans or sometimes no plan

regarding their life after high school, such as Mike who, when asked about the career he could see himself in, responded "No idea."

A limitation of using identity to examine students' decision-making process around AP enrollment is that it de-emphasizes students' academic ability. Students often situated their identity within their interests, future plans, experiences that fed a sense of belonging, and what it meant to be part of a group. The relationship between academic ability and identity was not apparent, which is curious given that ability is the strongest predictor of both AP enrollment and success.

Discussion of Competing Frameworks

Analyzing administrative data, student surveys, and student interviews presents a complex picture of how students make decisions about AP enrollment that is difficult to unravel. Patterns in AP enrollment and perceptions by demographics and academic ability are readily apparent but difficult to explain as they sometimes appear to conflict. Under-enrolled students seem to see themselves as different from what they consider to be typical AP students despite their higher ability and probability of success while ambitious students who are less academically talented see themselves as similar to typical AP students. Survey responses from students of color suggest that they see themselves as different from typical AP students and are acutely aware of demographic AP enrollment gaps but in interviews claim to make their enrollment decisions independent of these factors. Under-enrolled students have high achievement and tend to associate AP classes with high-achieving students, but do not take an AP class.

Though the frameworks of judgment and decision-making, social-emotional learning, and identity all provide insight into high school students' AP enrollment decisions, a single

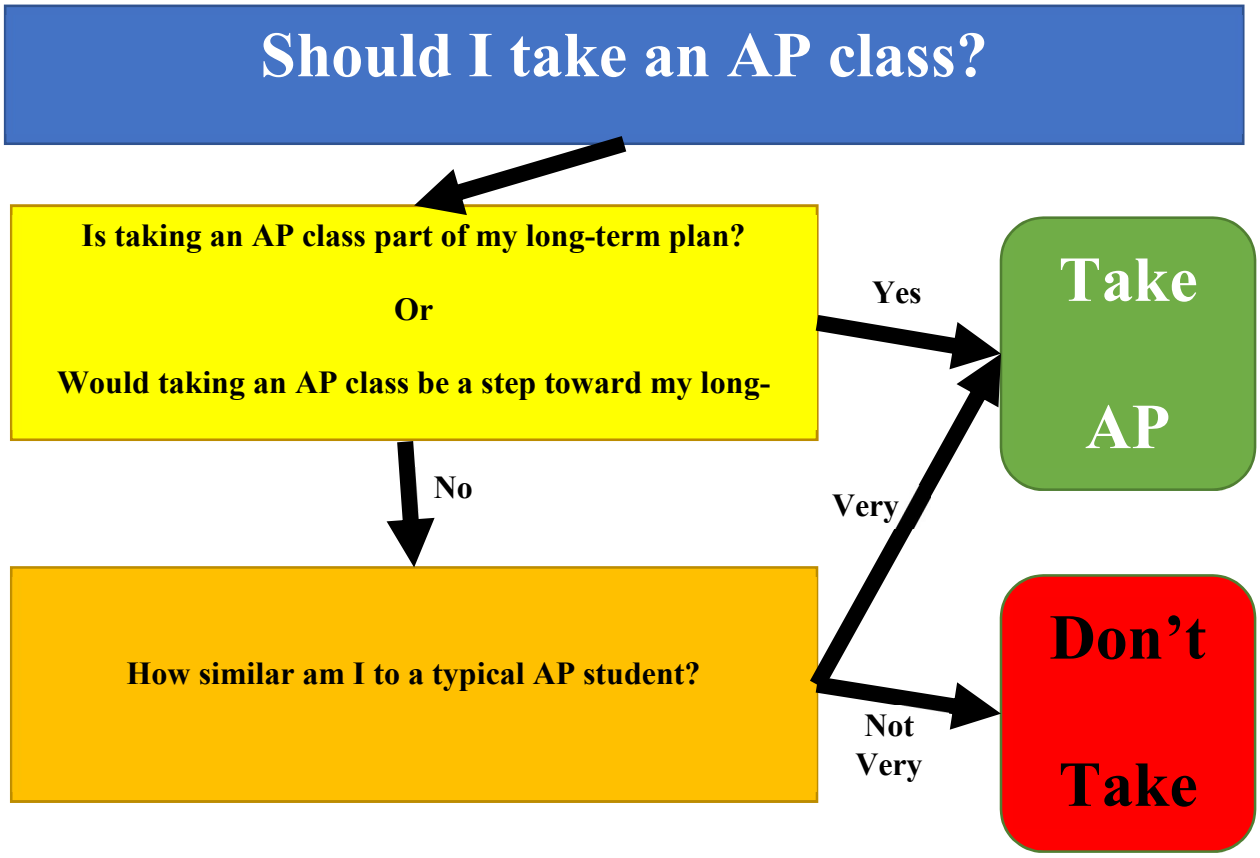
framework does not emerge as the one with the greatest explanatory power for this phenomenon. Considering these frameworks simultaneously, different elements begin to converge. Significant differences between groups in terms of constructs measured using the student survey fade when these are examined at the same time using regression. The experiences and perceptions shared by students in interviews sometimes show a conception of one's ability and a connection to a future identity.

To resolve these issues, I propose a model that integrates insights from the frameworks of JDM and identity to explain students' AP enrollment decisions. In the next section, I describe the features and stages of this model.

A Model of Students' AP Enrollment Decisions

I argue that students' AP enrollment decisions can be explained by a process through which they subconsciously transform the initial question of "Should I take an AP class?" into other questions that are more easily answered, as shown in Figure 1. The first stage of this model draws on the notion of cognitive ease from the two-systems model of cognition from JDM. Recall that cognitive ease refers to a tendency for the mind to reduce the complexity of decisions to facilitate quicker, more efficient decision-making, which can be accomplished by re-framing difficult questions into simpler ones (Kahneman 2011). The initial question that students confront "Should I take an AP class?" is difficult in nature as it involves a number of factors and preferences related to academic ability; likelihood of success; present costs in terms of coursework and future rewards in terms of college preparation, applications, and credit; the number and range of other courses in which a student is interested in enrolling, along with other factors. Thus, re-framing that question into one that is similar but more easily answered can reduce the cognitive strain and mental resources required to make a decision.

Figure 7.1 Proposed Model of Students' AP Enrollment Decisions



As Figure 7.1 shows, the first way that students re-frame the question of whether they should take an AP class is to consider whether taking an AP class is specifically a part of their long-term plan or whether doing so would represent a step toward that long-term plan. As discussed in chapter 6, students' long-term plans were associated with AP enrollment across student groups. Students who took AP classes tended to have more concrete long-term goals and used these in their AP enrollment decisions. For instance, Bryan, an ambitious student, chose to take AP Biology in one year and AP Chemistry the following year due to his interest in biochemistry as a college major while another under-enrolled student, Jill, mentioned that she did not take an AP class because of uncertainty about what she wanted to study in college or pursue as a career. That long-term plans were a salient factor in students' decisions regardless of

academic ability suggests that when considering AP enrollment, students first evaluate whether doing so would advance them toward their college or career goals.

The second transformation of the question "Should I take an AP class?" shown in Figure 7.1 is a form of the representativeness heuristic. I argue that in the case of students' AP enrollment decisions, students evaluate the degree of similarity between their self-perception and their perception of a typical AP student. If the differences between those perceptions are small, the student then concludes that they should take an AP class but if the differences are significant they do not. Importantly, this need not be a conscious process in which students call to mind what they think a "typical" AP student is like.

Students' use of the representativeness heuristic in AP enrollment decisions can account for several findings discussed in earlier chapters. When describing how they seek out information to inform their course selection, students often mentioned that they considered information from another student to be more useful in their decision-making if that student is similar in terms of achievement and temperament. Many students indicated that they felt encouraged to take an AP course if they knew someone similar to them who had taken the class previously. Other students mentioned being discouraged from taking an AP class after learning that students they see as "smart" performed poorly in a certain AP class. For instance, Quinn recounted "I heard that AP Chemistry and all the 4.0 students, they were getting C-minuses in the class. They're like, 'Oh, I got a C on the test. This is so good…' so I knew I didn't want to take that class." In these cases, students consider how their friends or peers performed in an AP class and then compare themselves to that student to determine whether they should enroll in an AP class.

Students' use of the representativeness heuristic can also resolve the lack of agreement between the responses given by students of color to several items in the survey and in interviews. As noted earlier, analyses of survey responses indicate that, relative to White students, students of color feel less welcome in AP classes and that the students in AP classes are less similar to them, but in interviews students of color claimed that perceptions involving race did not influence their decisions. A heuristic process based on representativeness does not require that survey and interview responses such as these align. Consciously, students of color may view their own thinking as the only relevant factors in their AP enrollment decisions. Yet, if the prototypical student against which students compare themselves to determine representativeness has a racialized dimension, this would lead students of color to view themselves as less similar to "AP students" and therefore be less likely to enroll in an AP course.

The model of students' AP enrollment decisions presented in Figure 1 is consistent with the major findings discussed earlier in this dissertation. It can also be used to interpret some findings the meaning of which is elusive. Finally, it provides an accessible explanation for how students make AP enrollment decisions that could be used to inform future research and/or interventions on students' AP enrollment decisions.

Implications for Research

This study addresses an important knowledge gap about how students decide whether to participate in the AP program by examining enrollment, achievement, demographics, and psychological factors. One important finding from the present study is that how AP participation is defined influences the conclusions one draws about the population of AP students. As discussed in chapter 5, taking an AP exam is often used to define AP participation, which is a reasonable choice since succeeding on an AP exam brings the greatest benefit to students.

However, defining participation as enrolling in an AP class captures students who receive a broader range of benefits and also includes a more diverse group of students, though defining AP participation as enrollment does not eliminate the enrollment gap by students of color and economically disadvantaged students. This suggests that future research should consider these different definitions when studying AP participation depending on the research question(s) at hand and the outcome of interest.

In this study I also describe a method for identifying AP-caliber students, the students who are most likely to do well in an AP class, using multiple points of data that are generally available in many contexts. The question of which students ought to be in an AP class based on their academic ability is an important part of studying AP enrollment given the rigorous nature of AP coursework, but has received scant attention in the literature on AP participation. Employing the definition of AP-caliber described in this study could be used in future research to examine AP enrollment by ability along with demographic factors.

Implications for Educators

This research has several implications for educators. One is that educators should leverage the weight students give to their input to support students' AP enrollment. In the survey that was administered in phase two of this study, students reported giving more consideration to suggestions from teachers than to recommendations from counselors, parents, and friends. This suggests that AP enrollment could be increased if teachers were able to provide more of the kinds of information students use to make their course selection and could do so more objectively. For example, teachers could conduct a brief survey to gather data about the amount of time spent on homework and projects and communicate this to prospective AP students or share activities and assignments that students could use to gauge the difficulty of AP material.

Strategies such as this could lead students to be less reliant on anecdotes heard from friends when forming their AP perceptions and draw on higher-quality information about the difficulty and workload of AP classes.

Another implication of this research for educators is that students should be made more aware of the range of benefits they may receive from taking an AP class. Most students appear to be aware that being successful in an AP class can lead to college credits and many believe that taking AP classes can improve the quality of one's college application. However, students who did not take an AP class were seldomly aware of other benefits while several students who took AP classes mentioned that doing so improved their study habits, time management skills, and even the discipline with which they approached their studies. Increasing awareness of these benefits, which can be realized independent of achievement in AP classes, may encourage more students to enroll in AP classes.

A third implication of this research is that educators should be mindful of how the AP program at their school is presented to students. As discussed earlier, many students appear to base their AP enrollment decision on how similar they are to their conception of a prototypical AP student. In many cases, students see this prototypical student as very high achieving based on the rigorous reputation of AP classes and likely also perceive this prototypical student to be White being that the overwhelming majority of students who take AP classes are White. Some of this conception is informed by what students hear from their peers about how difficult AP classes are or how intelligent AP students are. However, teachers and school leaders also have the power to shape these conceptions through how they describe and characterize their AP program to students. For instance, communicating the types of skills, aside from intelligence or prior achievement, that make students successful in AP classes could provide a way for students with

those skills to see themselves as AP students and thus take AP classes. Additionally, increasing students' awareness of AP participation and success by students of color could help historically marginalized students see themselves as AP students, though care would be needed so as not to spotlight students.

Implications for Policymakers

This dissertation suggests several ways that policymakers could support AP participation. One is that policymakers at the district level should consider how grading policies could encourage or discourage AP enrollment. In interviews, many students discussed GPA as an important part of their college application and it appears that some may be discouraged from taking an AP class out of concern that their grades would suffer due to the more rigorous environment in AP classes. Thus, it may be worth considering policies such as weighting grades in AP classes on a different scale, which could allay this concern.

A second implication of this study is that policymakers should consider AP participation in terms of enrollment as well as exam-taking. As discussed in chapter 5, not all students who take AP classes also take the associated AP exam and the group of students who take an AP class but not an exam contains a higher proportion of students from traditionally underserved backgrounds. This suggests that interventions to encourage AP participation should examine both enrollment and exam-taking, which may require different approaches, so that students are better able to access the full range of benefits from an AP class.

Limitations

Though this study yields important insight into how decide whether to enroll in Advanced Placement (AP) classes, it has several limitations, mainly emanating from the sample studied in this dissertation and are relevant to the generalizability of this study's findings. First,

this study included just two schools. Though the data collected from partner schools is indeed rich, it nevertheless includes limited variation at the school level, which may impact the external validity of this study's findings if the relationships between students' perceptions, experiences, and AP enrollment decisions varies considerably across schools. Also, as discussed in chapter 4, the two schools that participated in this research are located in a suburban environment. Given that the context found in suburban schools is often markedly different from what is found in urban and rural schools, the findings of the present study may not be applicable to these other settings. For example, the smaller size of rural schools can limit a school's capacity to offer AP classes, meaning that fewer AP classes are offered or that AP classes are offered in an on-line or virtual format (Mann et al., 2017), which may influence students' decision-making about whether to take an AP class. Also, urban schools that serve comparatively more diverse student bodies may have different cultures around, and perceptions of, their AP program that could lead students to make their enrollment decisions in a different manner than that exhibited by the students in this study. A second limitation of the generalizability of the present study is that it focuses primarily on students who *might* enroll in an AP class. That is, lower-achieving students who have a very low probability of being successful in an AP class, which is roughly half of the overall student body, and therefore also have a very low probability of enrolling in an AP class, were excluded from the second and third phases of this study by design. Similarly, students with a very high probability of AP success, a smaller group, were excluded from the third phase of this study because their enrollment in AP is a near certainty. As a result of these choices in sampling, the findings of this study can be said to apply primarily to those students for whom AP enrollment is probabilistic as opposed to certain or nearly certain.

Another limitation of this study stems from the timing in how data was collected for this study. The survey phase of this study was designed to coincide with the time period when students were selecting the courses they intended to take the following year so that their decision-making was more salient, with the survey phase being conducted shortly thereafter. However, it is possible that students may change their decision-making processes after this in a way that systematically influences their enrollment. For instance, if students tend to request schedule changes into, or out of, AP classes over the summer, the thought processes that motivate these changes may not be captured in this study. Conversations with principals and counselors at partner schools suggest that this is likely not the case, it may nevertheless be relevant to these findings.

A final limitation has to do with the nature of the phenomenon being studied. Decision-making involves a variety of information and data points along with complex cognitive processes to interpret these data to reach a decision. Additionally, some of the data and processes that are used to make decisions exist or operate below the conscious level. Moreover, little or none of this can be directly observed, which naturally limits the conclusions one is able to draw about how individuals make decisions. The design of this study aims to attenuate the limitations associated with decision-making research by drawing from existing studies of decision-making and triangulating observable behavior (AP enrollment) with survey responses and interview data related to AP enrollment decisions to paint a picture of students' AP-related decision-making processes; but the nature of decision-making is such that studies of it can rarely provide a full account of decision-making processes. Thus, there may be additional facets of students' AP enrollment decisions beyond those studied in this dissertation.

Future Directions

Future research is needed to both replicate the findings from this study and to pursue new lines of inquiry suggested by the findings of this dissertation. Replicating this study in additional suburban schools would help to establish external validity of the present findings and to identify how much students' decision-making varies across schools of a similar type. Conducting this study in urban and rural settings could establish the degree to which the students' decision-making is related to their school's context and would be especially relevant in designing interventions or programs to increase AP enrollment.

Along with replicating the findings of this study, future research should more deeply investigate the degree to which the representativeness heuristic explains students' AP enrollment decisions, especially for students of color and students who are less certain of their future plans. Earlier in this chapter, I argue that the findings of this study are consistent with students using the representativeness heuristic to decide whether to enroll in an AP class based on their resemblance to a prototypical "AP student," this study does not employ the type of experimental design that has been used to identify and validate the representativeness heuristic. Additional research is needed to determine whether representativeness indeed contributes to AP enrollment decisions and the characteristics of the prototypical AP student against which students compare themselves. A special focus of this research should be to determine whether students' conception(s) of AP students have demographic dimensions that may bias students from some demographic groups toward not taking an AP class.

Another fruitful area of exploration suggested by this study is how AP enrollment may be shaped by the way students make sense of their future and how that may involve AP classes. The present study finds that students' future plans play an important role in their enrollment decisions

but does not address how students form these plans that can guide their course selection. These plans may be shaped by students' socioeconomic status and family background, aspirations, educational experiences, messages from educators, personal interests, or a variety of other factors. Research focusing on how students develop and enact long-term plans would contribute to knowledge of students' course enrollment decisions and could be used to inform interventions that help students connect their school experiences with their future, which could encourage greater AP participation.

An additional line of research suggested by this study is how social networks impact students' AP enrollment decisions. This study finds that students reach out to their friends and peers to gain information about the expectations and workload associated with AP classes generally and sometimes with specific AP classes. In interviews, students mentioned that they acquire this information from friends who are older or who have taken AP classes before, from teammates if they play sports, and sometimes it is simply overheard during passing times between classes. Based on this, one can hypothesize that students with larger social networks or who belong to networks that are more connected to AP classes may receive more of the information they desire and may receive more accurate information compared to students whose networks include fewer students with knowledge of, or firsthand experience with, AP classes. Understanding how the information that shapes students' perceptions of AP classes flows across the student body could be used to limit the influence of low-quality information or to provide needed information to the students who could benefit from it.

Concluding Remarks

This study contributes to the research on Advanced Placement (AP) enrollment by studying how a range of achievement-related, demographic, and psychosocial factors are related

to students' decision-making around AP enrollment and how these decisions are related to student participation in AP classes by race/ethnicity and academic ability. Using a multi-stage explanatory design that includes analyses of administrative data, a student survey, and targeted student interviews, I find that students' AP enrollment decisions are complex in nature, but that several themes are consistent across student groups. One of these themes is that students trust the information and advice they receive from their teachers, but that students supplement this with information from their peer network, though peers are seen as less reliable sources. Another is that students who have specific or concrete plans for after high school are more likely to take an AP course regardless of their underlying academic ability. Finally, students' AP enrollment decisions are shaped by their perceptions of AP classes and of their academic selves. I argue that AP enrollment decisions can be explained by a two-stage model in which the question of whether a student should take an AP class is re-framed in the first stage as whether taking an AP class aligns with the student's postsecondary plan and in the second stage as whether the student perceives herself to be similar to a prototypical "AP student." This has implications for how researchers study AP enrollment and students' decision-making as well as for educators working to increase AP enrollment and to make enrollment more equitable.

APPENDICES

APPENDIX A

Variables in Administrative Data

Category	Variable	Information
Descriptive Data	Race	Student racial/ethnic identification: American Indian or Native Alaskan; Asian; Black or African-American, Hispanic or Latino/a; Native Hawaiian or Other Pacific Islander; Two or More Races (categorical)
	FARM	Free and/or reduced price meals (categorical yes/no)
	SOC	Whether the student is enrolled through Michigan's Schools of Choice policy (categorical yes/no)
	SPED	Whether the student receives special education services under an individualized education plan (IEP) or 504 (categorical yes/no)
	ELL	Whether the student is classified as an English Language Learner (categorical yes/no)
	Female	Whether the student is female (categorical yes/no)
Enrollment Data	Absences	Number of absences in that academic year (continuous)
	Grade Level	Grade level a student is in that year, i.e. 9, 10, 11, 12 or Freshman, Sophomore, Junior, Senior (categorical)
	Classes Taken	Classes in which a student is enrolled each year (string variable, can be recoded in dummies for each course)
	AP Exam(s) Taken	AP exams the student sat for that year (categorical yes/no for each AP subject)
Achievement Data	Course Grade	Grade for each course on a student's transcript. This could be either letter grades which could then be coded categorically or percentages (continuous)
	Cumulative GPA	Cumulative GPA at the end of each academic year (continuous)
	ACT Score	Student score on the ACT assessment (continuous)
	AP Exam Scores	Scores the student earned on AP exams that year, which range from 1 at the lowest to 5 at the highest (1-5 categorical).
	PSAT Score	Student score on the PSAT9, 10, or PSATNMSQT assessment that year (continuous)
	SAT Score	Student score(s) on the SAT assessment that year (continuous)

APPENDIX B

Counselor and Administrator Interview Protocol

Understanding Students' Decisions Around AP Enrollment

Jason Burns

Administrator/Counselor Interview Protocol

Thank you for participating in the study entitled "Understanding Students' Decisions Around AP Enrollment." This research study will evaluate students' decision-making processes around taking AP courses to better understand what leads some students to choose AP courses while others, even academically talented students, do not. To understand this, it is important for me to understand the context at this school relating to the role of the AP program here and the process used to enroll students in courses. Given your role, it would be very helpful to learn about this context from you.

Our interview will last approximately 12 minutes. The interview will be audio recorded to ensure accuracy. However, after recordings have been transcribed they will be destroyed. Participation in this research is completely voluntary. You may choose not to participate at all, refuse to answer any questions, or withdraw at any time.

The results of this study may be published or presented at professional meetings. In these reports, you will not be identified. Any information or quotes from you that are used will be done anonymously. The data collected for this study will be stored on a password protected device. Only the researcher team (Jason Burns and Dr. Rebecca Jacobsen) and Michigan State University's Institutional Review Board will have access to the research data.

Study title: Understanding Students' AP Enrollment Decisions
Principal Investigator: Jason Burns
Phone: XXX-XXX-XXXX
Email: burnsja6@msu.edu
Participating in this study poses minimal risk to you. The only potential discomfort you may experience is that which is experienced by some persons during interviews. Additionally, studying how students make decisions around AP classes may identify factors that prevent academically talented students from taking AP classes, which could become the targets of interventions and student supports. From this, you and others in similar positions may benefit from these insights into the types of supports different students may benefit from.

If you have concerns or questions about this study, such as any issues, how it is carried out, or to report an injury stemming from this study, please contact the above project investigator. If you have any questions about your role and rights as a research participant, or would like to register a

complaint about this study, you may contact, anonymously if you wish, the Michigan State University's Human Research Protection Program at 517-355-2180, or email irb@msu.edu, or regular mail at: 400 Collins Rd, Suite 136, Lansing, MI 48910.

At the start of the interview, you will be able to ask any questions or raise any concerns you may have. You will then be asked for your verbal consent, which will be audio recorded at the start of the interview. This verbal consent means that you voluntarily agree to participate in this research study.

Interview Protocol

What purpose does the AP program serve here at this school?

Who benefits most from AP classes? In what ways do you think they benefit?

How popular are the various AP classes with students?

How does the course registration process go? What are the major steps? How much choice do students have?

Are there different paths into AP (particularly by subject)?

What role do parents or primary caregivers have in the enrollment process?

Are there any special requirements or prerequisites that students have to meet to take an AP class?

Are there any "tracks" that shape student enrollment? How can a student switch?

Do teachers play a role in the process? Are there teachers who actively encourage students to enroll? Do some teachers need to approve enrollment?

Why do you think some kids take AP classes?

What do you think might discourage some kids from taking AP classes?

What types of students do you think should take AP classes?

How popular are the various AP classes with students?

How do you determine how many sections of AP classes to offer? At what point does a class run or is a class added?

What is your policy or expectation around students taking the AP exam? How is that communicated to students?

Do students simply choose?

Do teachers encourage students?

Is there assistance for students who may not be able to afford the exam fee?

APPENDIX C

Survey Instrument (Exported from Qualtrics Software)

Understanding Students' Decisions Around Course-Taking

Start of Block: Default Question Block

Dear Student

My name is Jason Burns and I am a researcher at Michigan State University. I am conducting a study at your school to learn how students make decisions about the classes they take in high school and think I could learn a lot from you. I hope that you are willing to participate in this important research by sharing your thoughts and experiences in the following survey.

The survey will take approximately 10 minutes to complete. All of your responses will be confidential, meaning that no one but me will know the answers you provide.

You can agree to participate in this survey by proceeding to the next page and responding to the questions on this survey. You can choose not to participate, skip any questions you do not wish to answer, or stop at any time. If you choose to participate in this survey, please read each question and follow the directions.

There are no right or wrong answers for this survey. Please read and follow the directions for section section. When you are finished with the survey, please click “Submit” to finalize your responses. If you have any questions regarding this research, please feel free to contact the researcher, Jason Burns, by email at burnsja6@msu.edu or by mail at:

Jason Burns 620 Farm Lane Room 217B East Lansing, MI 48824

Thank you,

Jason Burns

Page Break

First Name

Last Name

_____

What grade are you in right now?

_____

Page Break

Section I. This section asks about the things you think about when choosing the classes you take. Please read each question and answer truthfully.

When deciding which classes to take for next year, how important are the following?

	Not At All Important	A Little Important	Somewhat Important	Fairly Important	Extremely important
How the class might affect my GPA. ()	0	2	4	6	8	10
How difficult the class is. ()						
Whether friends are taking the same or similar classes. ()						
Advice or suggestions from my parents or family. ()						
Advice or suggestions from my teacher. ()						
Advice or suggestions from my counselor. ()						
How the class will prepare me for college or my career. ()						

What other factors influence the courses you take (optional)?

_____

Page Break

Have you even been encouraged to take an AP class by...

	Yes (1)	No (2)
A friend? (1)	○	○
Your parent or guardian? (2)	○	○
One of your teachers? (3)	○	○
Your guidance counselor? (4)	○	○
Another adult aside from a parent or teacher? (5)	○	○

Other (optional)?

_____

Page Break

Section II. This section asks you to choose between different rewards at different times. Please choose one option from each pair.

Which would you rather have?

	Or	

	1 (1)	2 (2)	
$1 now	○	○	$10 in one week
$2 now	○	○	$10 in one week
$3 now	○	○	$10 in one week
$4 now	○	○	$10 in one week
$5 now	○	○	$10 in one week
$6 now	○	○	$10 in one week
$7 now	○	○	$10 in one week
$8 now	○	○	$10 in one week
$9 now	○	○	$10 in one week
$10 now	○	○	$10 in one week

Which would you rather have?

	Or		
	1 (1)	2 (2)	
$10 now	○	○	$100 in one year
$20 now	○	○	$100 in one year
$30 now	○	○	$100 in one year
$40 now	○	○	$100 in one year
$50 now	○	○	$100 in one year
$60 now	○	○	$100 in one year
$70 now	○	○	$100 in one year
$80 now	○	○	$100 in one year
$90 now	○	○	$100 in one year
$100 now	○	○	$100 in one year

Page Break

Section III. This section asks for your perceptions of yourself and your school. Please read and respond to each question.

Identify the degree to which you agree or disagree with the following statements

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I am an academically strong student. (1)	○	○	○	○	○
Students like me are generally not welcome in AP classes. (2)	○	○	○	○	○
My work in school now is strongly related to my future. (3)	○	○	○	○	○
After high school I will attend a 4-year college. (4)	○	○	○	○	○
After high school I will attend a community college. (5)	○	○	○	○	○
I generally receive poor grades in school. (6)	○	○	○	○	○
Students in the AP classes at this school are not very similar to me. (7)	○	○	○	○	○
After high school I will work full-time. (8)	○	○	○	○	○

My peers would describe me as a jerk. (9)	○	○	○	○	○
I plan to take an AP class next year. (10)	○	○	○	○	○
A lot of students who are like me take AP classes. (11)	○	○	○	○	○
Students who are like me are expected to take AP classes. (12)	○	○	○	○	○

Page Break

Please answer how often you did the following during the past 30 days. During the past 30 days...

	Almost Never (1)	Once in a While (2)	Sometimes (3)	Often (4)	Almost All the Time (5)
I came to class prepared. (1)	○	○	○	○	○
I remembered and followed directions. (2)	○	○	○	○	○
I got my work done right away instead of waiting until the last minute. (3)	○	○	○	○	○
I paid attention, even when there were distractions. (4)	○	○	○	○	○
I worked independently with focus. (5)	○	○	○	○	○
I participated in class. (6)	○	○	○	○	○

Page Break

Please indicate how true each of the following statements is for you.

	Not At All True (1)	A Little True (2)	Somewhat True (3)	Mostly True (4)	Completely True (5)
My intelligence is something that I can't change very much. (1)	○	○	○	○	○
Challenging myself won't make me any smarter. (2)	○	○	○	○	○
There are some things I am not capable of learning. (3)	○	○	○	○	○
If I am not naturally smart in a subject, I will never do well in it. (4)	○	○	○	○	○

Page Break

How confident are you about the following at school?

	Not At All Confident (1)	A Little Confident (2)	Somewhat Confident (3)	Mostly Confident (4)	Completely Confident (5)
I can earn an A in my classes. (1)	○	○	○	○	○
I can do well on all my tests, even when they're difficult. (2)	○	○	○	○	○
I can master the hardest topics in my classes. (3)	○	○	○	○	○
I can meet all the learning goals my teachers set. (4)	○	○	○	○	○
If I were to take an Advanced Placement (AP) exam this year, I would score high enough to earn college credit. (5)	○	○	○	○	○

Page Break

Section IV. For this section, answer the following questions.

You have the option to purchase a savings bond that will be worth $100 in one year. If you have up to $100 to spend now, what is the most you would pay for this savings bond today (in dollars)?

_____

You have the option to purchase a savings bond that will be worth $3000 four years from now. If you have up to $3000 to spend now, what is the most you would pay for this savings bond today (in dollars)?

_____

A bat and a ball together cost $1.10. The bat costs $1 more than the ball. How much does the ball cost (in cents)?

_____

If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets (in minutes)?

_____

In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half the lake (in days)?

_____

Page Break

Section V. This section asks for information about your background and future plans. Please respond to each question.

What job or career do you plan on having?

_____

What kind of training or education will you need for that career?

_____

On a typical school day, how much time do you spend doing homework or other school projects outside of school?

- ○ Hours (1) _____
- ○ Minutes (2) _____

Are you...

	Yes (15)	No (16)
a member of any sports teams at your school? (1)	○	○
involved in your school's band or theater company? (2)	○	○
involved in any clubs at your school, such as student government, the science club, etc.? (3)	○	○
Do you participate in any extracurricular activities that are not associated with your school? (4)	○	○

Display This Question:

If Are you... = involved in any clubs at your school, such as student government, the science club, etc.? [Yes]

Which club(s) are you involved in?

_____

Think of the kind of person you will be ten years from now. Compared to now, how similar or different will you be in ten years? Use the following scale to select your response, from 1 (my future self in ten years will not be very similar to how I am now) to 7 (my future self in ten years will be very similar to how I am now).

- ○ Image:Future self similarity 1 (1)
- ○ Image:Future self similarity 2 (2)
- ○ Image:Future self similarity 3 (3)
- ○ Image:Future self similarity 4 (4)
- ○ Image:Future self similarity 5 (5)
- ○ Image:Future self similarity 6 (6)
- ○ Image:Future self similarity 7 (7)

What is the highest level of education completed by your...

	Middle School Graduate (1)	High School Graduate (2)	Some College (3)	Associate's Degree (4)	Bachelor's Degree (5)	Master's Degree (6)	Doctoral Degree (7)	Professional Degree (law, MBA) (8)
Mother (1)	○	○	○	○	○	○	○	○
Father (2)	○	○	○	○	○	○	○	○

Please answer the following questions about your household

- What kind of job does your mother have? (1) _____
- What kind of job does your father have? (2) _____
- How many parents/guardians live with you in your home? (3) _____

Please answer the following questions about your household

	Yes (1)	No (2)
In your home, do people speak a language other than English? (1)	○	○
Do you have a job where you work outside of school hours? (2)	○	○
Do you help to care for family after school, such as younger siblings or grandparents? (3)	○	○
Does your family usually eat dinner together? (4)	○	○
At home, do you have your own desk or table where you can work? (5)	○	○
At home, do you have a computer or tablet (such as an iPad) of your own? (6)	○	○
At home, do you have a smart speaker, such as an Amazon Echo (Alexa) or Google Home? (7)	○	○
At home, do you have your own bedroom? (8)	○	○

About how many books are there in your home?

- ○ A few (0-10) (1)
- ○ Enough to fill one shelf (11-25) (2)
- ○ Enough to fill one bookcase (26-100) (3)
- ○ Enough to fill several bookcases (more than 100) (4)

End of Block: Default Question Block

APPENDIX D

Student Interview Coding Scheme

Students' Decision-Making and AP Enrollment

Student Interview Coding Scheme

1. Home Environment
   - 1.1. Parents encourage tougher classes
   - 1.2. Parents discourage tougher classes
   - 1.3. Student discusses future plans with parents
   - 1.4. Parents support students' future plans
2. Experiences and Perceptions
   - 2.1. Perception of AP Classes/AP Culture
     - 2.1.1. AP Classes for certain types of students/with certain characteristics
       - 2.1.1.1. Gender
       - 2.1.1.2. Race/ethnicity
       - 2.1.1.3. Intelligence/ability
       - 2.1.1.4. SES
     - 2.1.2. Tracking
     - 2.1.3. Sense of belonging in AP classes
     - 2.1.4. Feels out of place in AP classes
     - 2.1.5. Difficulty of AP classes
   - 2.2. Course taking
     - 2.2.1. Took AP in the past
     - 2.2.2. Plans to take AP in the future
     - 2.2.3. Has considered taking AP
     - 2.2.4. Has been in an honors class
3. Course enrollment process
4. View of future
   - 4.1. Considers future when making decisions
   - 4.2. Mentions connection between courses and future plans
   - 4.3. Mentions earning a 4-yr degree
   - 4.4. Unsure or uncertain about their future
5. AP Recruiting – Advised to take an AP course by
   - 5.1. Teacher
   - 5.2. Parent
   - 5.3. Friend
   - 5.4. Sibling or other family member
   - 5.5. Other adult
6. Educational Decision-Making

6.1.1. Educational Preferences
6.1.1.1. Considers course difficulty in enrollment decisions
6.1.1.2. Considers non-school or extracurricular commitments in course enrollment decisions
6.1.1.3. Interest in subject matter
6.1.1.4. Mentions importance or relevance of teacher
6.1.1.5. Expresses concern for GPA
6.1.2. Sources of advice/information for decisions
6.1.2.1. Considers advice or input from friends
6.1.2.2. Considers advice or input from parents
6.1.2.3. Considers advice or input from siblings or other family members
6.1.2.4. Considers advice or input from teachers
7. Good quote

APPENDIX E

AP Subject Areas and Courses

Subject Area	Courses
Art	Art History
	Music Theory
	Studio Art: 2-D Design
	Studio Art: 3-D Design
	Studio Art: Drawing
English	English Language and Composition
	English Literature and Composition
Social Studies	Comparative Government and Politics
	European History
	Human Geography
	Macroeconomics
	Microeconomics
	Psychology
	United States Government and Politics
	United States History
	World History
Math	Calculus AB
	Calculus BC
	Computer Science A
	Computer Science Principles
	Statistics
Science	Biology
	Chemistry
	Environmental Science
	Physics C: Electricity and Magnetism
	Physics C: Mechanics
	Physics 1: Algebra-Based
	Physics 2: Algebra-Based
World Languages	Chinese Language and Culture
	French Language and Culture
	German Language and Culture
	Italian Language and Culture
	Japanese Language and Culture
	Latin
	Spanish Language and Culture
	Spanish Literature and Culture

Source: College Board. Retrieved from https://apstudent.collegeboard.org/apcourse

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