ADVANCED PLACEMENT VERSUS DUAL ENROLLMENT: MAKING THE BEST CHOICE FOR COLLEGE SELECTION, PERSISTENCE, EARLY SUCCESS, AND TIME TO COMPLETION

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ABSTRACT

Advanced Placement versus Dual Enrollment: Making the best choice for college selection, persistence, early success, and time to completion.

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A substantial amount of research examines the benefits of high school college-credit attainment programs against non-participation. The growth in popularity of these programs, particularly Advanced Placement (AP) and dual enrollment (DE), has them competing against one another for student attention. However, students, schools, and policymakers do not have all the information they need to make an educated decision because few independent studies compare college-credit attainment programs with each other. This study examines the college level outcomes of students who enroll in a college preparatory course of study among those who pursue college credit through participation in AP, DE, Both, or Neither.

Several questions are addressed: (1) What are the characteristics of students who choose AP, DE, Both, or Neither as part of their high school coursework? (2) Is there a relationship between whether students chose a two-year or four-year college, and whether students took high school coursework for AP, DE, Both, or Neither? (3) Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between second year college persistence and whether students took high school coursework for AP, DE, Both, or Neither? (4) Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship

between time to degree completion and whether students took high school coursework for AP, DE, Both, or Neither? (5) Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between freshman-year GPA, and whether students took high school coursework for AP, DE, Both, or Neither?

This study drew from a population of more than 4,700 students from the Shawnee Mission School District in Kansas who graduated with the classes of 2005 through 2009, completed college preparatory courses, and attended college immediately after high school. Chi-Square analyses and analyses of variance found statistically significant differences in the populations of students who participated in AP, DE, Both, or Neither by race, gender, academic ability, and family income level. Subsequent logistic and linear regressions found that, after controlling for academic ability, participation in AP, DE, Both, or Neither yielded significant differences in some situations and not others: (1) Students who participated in some combination of AP and DE completed a four-year degree earlier than students who chose only AP, only DE, or Neither. (2) Students who participated in DE English or both AP and DE English completed a four-year degree earlier than students who chose only AP, or Neither. (3) In general, the evidence does not support a blanket policy of promoting AP at the expense of DE or visa verse. Freshman GPA at KU, likelihood for persistence to a third semester of college, and time to degree completion were not determined by whether students participated in only AP, only DE, or Neither.

The results suggest to families, schools, and policymakers to avoid indiscriminately promoting one program at the expense of the other. The advantages provided to students through participation in AP, DE, or Both may depend on students' goals and course of study.

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CHAPTER 1

INTRODUCTION

Overview

Educators, parents, and policymakers agree that offering academically challenging high school courses plays a significant role in the development and academic preparation of students for post-secondary study (Adelman, 1999, 2006). School districts across the United States are providing a variety of paths for students to choose from in hopes of optimizing their college preparation. Choices range from technical education electives and extracurricular activities that simulate on-the-job training to credit-based transition programs that include dual enrollment (DE), Advanced Placement (AP)®, and International Baccalaureate (IB)® which allow students to earn credit or advanced standing prior to entering college.

This study examines the college choices and outcomes of students who enroll in a college preparatory course of study and who choose to participate in AP, DE, Both, or Neither. While there has been substantial study that examines the benefits of credit attainment programs against non-participation, little research compares these programs head to head. The choice of whether to participate in AP, DE, Both, or Neither each comes with potential benefits and pitfalls that may give students certain advantages or disadvantages in college. This study examines whether participation in AP, DE, Both, or Neither provide a clear advantage to students in choosing more selective colleges after high school, staying enrolled in a college, achieving early success, or graduating earlier.

In 1997, approximately one half million students completed fewer than one million Advanced Placement exams (CollegeBoard(b), 2012). By 2006, the number of examinations and students participating in those exams more than doubled and by 2011, more than 1.9 million

students completed 3.3 million exams. Student participation in dual enrollment programs follows closely behind participation in Advanced Placement testing. In 2002-03, 680,000 high school students across the nation enrolled in a college credit course during the 12-month 2002-03 school year (Kleiner & Lewis, 2005).

Although there is limited information to show national trends, numerous local examples indicate that participation in dual enrollment programs is also increasing (N. Hoffman, Vargas, & Santos, 2009; Karp, Calcagno, Hughes, Jeong, & Bailey, 2007). For example, dual enrollment participation through Johnson County Community College in Overland Park, Kansas increased from 300 students in 1984 to an average enrollment of more than 1500 students per semester (JCCC, 2012). According to a 2003 survey of state initiatives, every state has some form of dual-enrollment initiative, many of which provide incentives to increase participation (N. Hoffman, 2003).

The continuous growth of dual enrollment and Advanced Placement programs has generated a field of educational practice that profoundly affects the academic experiences and opportunities of high school students. However, state policymakers, school and district leaders, and higher education institutions may be too often either acting on these programs in isolation or treating them as equivalent, without an appreciation for unintended consequences.

Nearly six decades ago, the College Board created Advanced Placement to provide students an opportunity to take college level coursework and earn college credits while still in high school. Students may acquire these credits or advanced standing in college by earning a certain score on the subject-specific AP exams administered each spring (CollegeBoard, 2003). Schools with large AP participation rates are recognized nationally by major media outlets such as *Newsweek* (Merrefield, Streib, & Yarett, 2011), *Washington Post* (Matthews, 2011), and *U.S.*

News and World Report (U.S.News, 2009). However, AP is not the only program offered for students to excel in college level coursework. Since the 1970's, colleges and area high schools have collaborated to provide opportunities for students to concurrently enroll in high school and college courses and earn credit from both institutions while still in high school. The number of high school students taking AP and dual enrollment courses continues to grow as part of efforts to ensure that high school graduates are prepared for a variety of postsecondary educational opportunities (Allen, 2010; Klekotka, 2005).

A plethora of research is available comparing college outcomes of students who participate in AP or dual enrollment programs versus students who do not participate. Research has shown that there are links between AP course-taking and college persistence, time to completion, and early college success (Dougherty, Mellor, & Jian, 2006; Ewing, 2006; Morgan & Ramist, 1998; Richards, 2006; Willingham & Morris, 1986). Research also shows that participation in one or more college credit attainment programs such as AP or dual enrollment increases the likelihood that students will graduate from college compared to students who do not participate (Dougherty et al., 2006; McCauley, 2007). Some evidence casts doubt on the benefits of the AP experience when controlling for students' other academic experiences. Participation in the Advanced Placement exams may not actually be the key attribute associated with increased college success. Rather, students may just need a rigorous academic experience that is strong in math and science (Geiser & Santelices, 2004; Klopfenstein & Thomas, 2006). Research has also found links between participation in dual enrollment programs and positive college outcomes such as earning higher grades in college and increased chances for completing a college degree (Allen, 2010; Duffy, 2009; Karp et al., 2007; Kleiner & Lewis, 2005; Swanson,

2008). Despite the overlapping benefits of AP and DE, there are few direct comparisons between the two competing programs.

Student retention and completion have become highly important measures of success for postsecondary institutions (Astin, 1997, 2004; Attewell, Heil, & Reisel, 2011; Hossler, Ziskin, & Gross, 2009; Reason, 2009). Despite the efforts of secondary and post-secondary institutions to improve student success and likelihood for completion, college graduation rates continue to be disappointing. Fewer than sixty percent of bachelor's degree-seeking students complete a bachelor's degree within 6 years after starting (NCES, 2012). One possible explanation for this phenomenon is that students are not taking advantage of college transition programs for their intended purposes.

A primary reason for students to pursue college credit through any credit-based transition program is that it can lower the cost of a postsecondary education (Bailey & Karp, 2003; Dutkowsky, Evensky, & Edmonds, 2009). Students can earn college credit through dual enrollment or Advanced Placement at a much lower cost than if they were to complete college courses after high school graduation. Other reasons for pursuing college credit while in high school include preparing students for the academic rigors of college, improving student motivation in high school through high expectations, and easing the academic and social transition from high school to college (Bailey & Karp, 2003; Williams, 2010).

Suppose that students seeking to earn college credit while in high school focus only on the economic benefit of earning credits at a low cost. The goal may be to accumulate as many credits as possible while in high school and attend a college that is willing to accept the credits rather than trying to master college level material and attend an institution that matches each student's long-term aspirations. Students who participate in dual enrollment nearly always earn

their college credits, which makes this program more attractive to economically-minded students (Dutkowsky et al., 2009). However, some researchers and policymakers contend that earning credit alone may not be a good indication of whether a student is truly ready for college. In fact, some argue that scores on Advanced Placement exams are a better indicator of whether a student is qualified for exemption from the corresponding freshman courses (CollegeBoard, 2009). With the potential to earn large numbers of credits, are students who earn credits through dual enrollment less likely to be successful in college than peers with similar high school experiences who participate in Advanced Placement exams?

Context for this Study

The subjects of this study are graduates from the five comprehensive high schools within the Shawnee Mission School District, which is a major school district located in the Kansas City metropolitan area. The Shawnee Mission School District is a public school district that serves approximately 27,000 students in grades kindergarten through twelve, across fourteen suburban cities in northeast Johnson County, Kansas. The district consists of thirty-five elementary, seven middle, and five high schools. Each year, approximately two-thousand students graduate from Shawnee Mission high schools and more than 1,500 of these graduates enroll in a postsecondary education program.

Among the Shawnee Mission students who enroll in a postsecondary program following their high school graduation, approximately 37% attend Johnson County Community College, 29% attend the University of Kansas (KU), 15% attend Kansas State University, and the remainder enroll in a long list of other two- and four-year college programs. I examine the progress of Shawnee Mission graduates from two perspectives. The first perspective considers the characteristics of all college-bound graduates who chose to attend a four-year college versus

a two-year college. The second perspective considers only Shawnee Mission high school graduates who enrolled at the University of Kansas in the fall immediately after completing high school. The rationale for approaching this study from two perspectives will become clearer later in this chapter, but here is a brief summary. (1) This study examines the experiences of high school students who complete a rigorous college preparatory program of studies. These students are generally on track to attend a four-year college immediately following high school. (2) The largest proportion of Shawnee Mission graduates who attend a four-year college immediately following the completion of high school attend the University of Kansas. The University of Kansas is a large public research university that offers a long list of academic, social, and athletic opportunities that parallel the characteristics of most large universities across the United States. (3) Collection of detailed longitudinal data that connects students' high school experiences with their college outcomes requires a partnership between secondary and postsecondary institutions.

Statement of the Problem

The Shawnee Mission School District provides a variety of curricular choices for students in preparing for college and attaining college credits before graduation. These choices include examination-based programs such as Advanced Placement and International Baccalaureate as well as school-based programs such as dual enrollment partnerships with local colleges. In many courses, students seated in the same room may choose to pursue college credit through more than one of these avenues. More specifically, many courses give students the opportunity to earn college credit through dual enrollment, Advanced Placement testing, or combinations of both. Students may also choose not to pursue college credit and simply use the courses to earn their high school credits.

Unfortunately, students, teachers, district administrators, and postsecondary staff have little research-based evidence to assist them with their college credit attainment choices. Students are basing their college credit attainment choices on a variety of reasons that may or may not be associated with increased college success. Reasons include the cost of each program in relationship to risk for earning credit, school tradition, peer and family influences, teacher preferences, and school district policies and practices.

There are a number of expected benefits for providing college level credit-attainment opportunities to high school students. There are also a number of drawbacks to academic acceleration through college credit attainment. Chapter 2 contains a review of the expected benefits and drawbacks of these programs. The question is not whether providing these opportunities is beneficial to students at all. Rather, the question is whether Advanced Placement or dual enrollment is more beneficial to students' college outcomes when compared to each other.

Shawnee Mission Schools receive national recognition for their student participation in Advanced Placement testing from popular publications such as *Newsweek* and the *Washington Post* and even from the College Board (CollegeBoard, 2012; Matthews, 2011; Merrefield et al., 2011). National recognition is very important to the district's residents and businesses who hope to attract the qualified professionals, customers, and homebuyers to the area. In addition, research does show a link between participation in Advanced Placement and later college success (Dodd, Fitzpatrick, De Ayala, & Jennings, 2002; Dougherty et al., 2006; Hargrove, Godin, & Dodd, 2008; Mattern, Shaw, & Xiong, 2009). Hence, there is pressure to promote participation in Advanced Placement testing as the better choice over dual enrollment. Students also see competing pressures to pursue credit through concurrent or dual enrollment. The most

notable point on the side of dual or concurrent enrollment is that students are much more likely to actually earn credit than they are by completing the AP test (Dutkowsky et al., 2009).

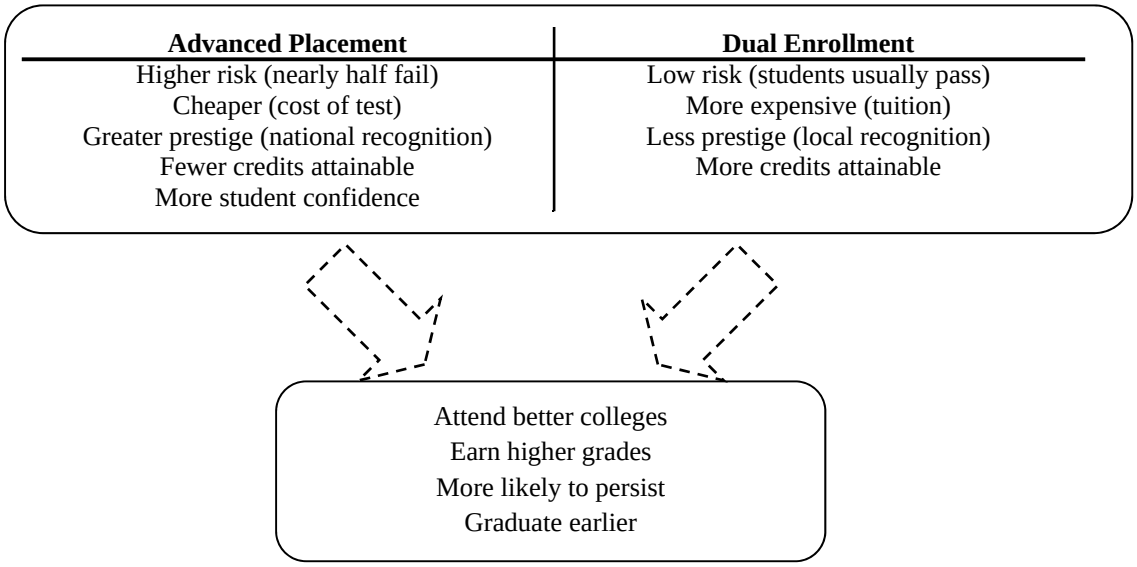
Studies of AP students' academic achievement generally support student participation in AP, but they often use rather broad methods to arrive at their conclusions. These studies typically compare AP and non-AP groups and control for their backgrounds using basic measures such as high school GPA and SAT or ACT scores. Studies of academic performance and achievement of students who participate in school-based concurrent enrollment programs look much the same. They generally support the effectiveness of acceleration and credit attainment through concurrent enrollment, finding that students perform at least at the same level as non-accelerated students (Duffy, 2009). In some instances, researchers even place AP and concurrent or dual enrollment students into the same category, comparing them with students who do not participate in either (McCauley, 2007). Only recently have researchers begun to compare college credit attainment programs directly (Richards, 2006). Little is known about whether students receive greater benefit after high school from completing the AP exam when compared directly with students who earn college credit via dual enrollment.

Some important differences between the exam-based AP program and school-based credit attainment through concurrent or dual enrollment justify the need to examine these options separately. Differences include student pre-requisites, teacher competency, the level of presumed quality control provided by the college or national organization, the assumptions under which the class is conducted, and the assumptions students are making regarding the purpose of the course. There are enough differences to suggest that students may be more (or less) prepared for college based on the type of credit attainment method that they pursue.

Students seated in the same class, participating in the same curriculum, may have the option to pursue college credit through dual enrollment or Advanced Placement. Some students may choose to participate in both programs while others may choose not to participate in either program and just earn their high school credit. School officials, teachers, and education policymakers have promoted both dual enrollment and AP as a means for ensuring that students are ready for college. Earning college credit while in high school also helps students avoid having to repeat their college-level high school courses in their undergraduate years. However, there is limited research that directly compares whether either of these choices yields differential outcomes in college. In this study, I will examine whether participation in Advanced Placement, dual enrollment, a combination of both programs, or participation in neither program provides a clear advantage for attending better colleges, staying enrolled in college, achieving early success, or graduating earlier.

Diagram 1 provides a brief overview of this study along with some of the rationale for why participation in Advanced Placement or dual enrollment may yield differential effects in postsecondary education. For example, participation in Advanced Placement examinations costs less than participation in dual enrollment and the program is more widely recognized, but nearly half of all students who complete an Advanced Placement exam do not receive a high enough score to obtain college credit (Dutkowsky et al., 2009). On the other hand, in Shawnee Mission, it costs more to enroll in a dual enrollment program than it does to complete the Advanced Placement test, but nearly every student who concurrently enrolls in college while in high school earns the college credit. I will examine these differences in further detail in Chapter 2.

Diagram 1: Contrasts between College Credit Attainment Programs



Purpose of the Study and Research Questions

This study examines whether participation in AP, DE, Both, or Neither provide a clear advantage to students in choosing better colleges after high school, staying enrolled in a college, achieving early success, or for graduating earlier. I used data on high school graduates from the class of 2005 through the class of 2009 from the Shawnee Mission School District. Each year, approximately 2000 students graduate from five Shawnee Mission high schools. Among these graduates, more than 40% complete one or more AP tests, receive college credit through dual enrollment with the local community college, or both. In addition, nearly one third of all Shawnee Mission students attend the University of Kansas in the fall immediately following graduation.

In the first stage of analysis, I provide descriptive data on the characteristics of Shawnee Mission graduates and their college choice decisions. I also examine the characteristics of students and their college choices and ultimately try to determine whether AP or DE has any bearing on whether students enroll in better colleges. In the second stage of analysis, I narrow

the focus to just the students who enroll at the University of Kansas (KU) in the semester immediately following high school graduation. The University of Kansas is a large Midwestern university with characteristics typical of other large universities. Most notably, a significant portion of their freshman enrollment comes from within the state and from nearby school districts. KU also has characteristics representative of many other publicly funded universities across the nation. For example, their overall graduation rate of approximately 61% is only slightly higher than the national rate and their admissions requirements are typical of most public universities (NCES, 2012). Limiting the analysis to a single university also reduces or eliminates the need to control for important college characteristics such as selectivity, size, and program offerings while looking at other outcome measures.

Students' high school enrollment data comes from electronic transcripts provided by the Shawnee Mission School District. Students' subsequent college enrollment data is from the National Student Clearinghouse®, which is a leading source of information for degree and enrollment verification (NSC). Advanced Placement results are from data files provided by the College Board and purchased by the Shawnee Mission School District. In addition, I use ACT data files purchased by the Shawnee Mission School district to identify some student demographic factors, such as family income, as well as student ability. Finally, the KU Office of Institutional Research and Planning (KU-OIRP) provided additional data on early success including freshman grade point average and specific information on how course credits transferred into the school.

Table 1 provides an overview of scope of AP and DE participation in Shawnee Mission schools, which also provides insight into the approximate size of my study population. Among the 10,809 Shawnee Mission high school graduates from the classes of 2005 through 2009,

nearly half (4,734) completed one or more courses offering Advanced Placement and dual enrollment for college credit attainment. Among the 4,734 students who completed DE/AP courses, 2,457 participated in dual enrollment (DE) and 1,598 completed Advanced Placement (AP) exams in those courses. It is also important to note that students who complete DE/AP courses are the top students among their graduating peers. For instance, the average weighted high school GPA among students who complete DE/AP courses is 3.76 compared to the entire population whose average GPA is 3.19.

Table 1: Count of Graduates from Shawnee Mission High Schools in College Credit Attainment Programs

Class of …	Graduates	Completed DE/AP Courses	Dual Enrollment Participants*	AP Exam Participants*
2005	2,242	901	525	251
2006	2,193	966	526	290
2007	2,158	944	481	273
2008	2,207	999	492	370
2009	2,009	924	433	414
TOTAL	**10,809**	**4,734**	**2,457**	**1,598**

* Counts are limited to students who completed courses that offered both dual enrollment and Advanced Placement

This study extends the literature that examines the effects of college preparatory choices on college selection, persistence, early college success, and degree attainment. The findings are relevant to students, parents, and secondary and postsecondary institutions. When faced with a variety of choices, students and parents should have access to research that weighs the potential consequences or benefits of choosing dual enrollment, participating in Advanced Placement testing, doing both, or choosing neither. Secondary institutions also need a research base for setting priorities for school programs as well as for advising individual students and their families. Students, teachers, and local and state administrators need research-based information that compares credit-based transition programs to guide their decisions toward helping students'

preparedness and persistence to degree attainment. The findings from this study help to narrow the gap between college preparation in high school and real success in college.

The findings are also relevant to policymakers who are interested in advocating for an expansion of one particular program, such as Advanced Placement, at the expense of competing programs that could be equally or more beneficial to students and colleges. If postsecondary credentials were indeed necessary for success in the current labor market, it would be wise for policymakers to promote programs that support the full preparation of high school graduates for postsecondary success. Media outlets such as *Newsweek* (Merrefield et al., 2011), *Washington Post* (Matthews, 2011), and *U.S. News and World Report* (U.S.News, 2009) already rank high schools based fully or partially on their participation in the Advanced Placement program. Consequently, schools may be promoting AP at the expense of DE in order to gain recognition. However, dual enrollment may be equally beneficial despite the prestige associated with Advanced Placement. The final chapters include discussion of whether these claims appear to be true.

The following questions guide the research design and statistical methods:

1) What are the characteristics of the students who choose dual credit, Advanced Placement, Both, or Neither as part of their high school coursework?
    a. Among the students who attend the University of Kansas immediately following high school graduation, what are the characteristics of the students who choose dual credit, Advanced Placement, Both, or Neither as part of their high school coursework?

2) Is there a relationship between whether students chose a two-year or four-year college, and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither?
    a. Among the students who attended a four-year institution, is there a relationship between the selectivity of postsecondary school and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither?
3) Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between second year college persistence and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither?
    a. Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between second year college persistence and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither in college preparatory English?
    b. Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between second year college persistence and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither in Calculus?

4) Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between time to degree completion and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither?
    a. Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between time to degree completion and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither in college preparatory English?
    b. Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between time to degree completion and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither in Calculus?
5) Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between freshman-year GPA, and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither?
    a. Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race,

ACT score, high school GPA, and family income level), what is the relationship between freshman-year GPA, and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither in college preparatory English?

b. Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between freshman-year GPA, and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither in Calculus?

Conceptual Frameworks

This study draws upon the literature from several fields of theory and research on college choice, persistence, and college degree completion. This study also borrows from Astin's (1991) Input-Environment-Outcomes (I-E-O) model of research.

Dual enrollment and Advanced Placement are an integral part of many students' high school backgrounds. According to the National Center for Educational Statistics, there were approximately 1.2 million enrollments in dual credit courses and 1.8 million enrollments in AP courses in 2003. In addition, 71 percent of public high schools offered courses for dual credit and 67 percent offered Advanced Placement courses (Waits, Setzer, & Lewis, 2005). Many schools, including those in Shawnee Mission, provide students with the opportunity to earn college credits through dual enrollment and/or Advanced Placement credit in a number of courses that include Calculus, Statistics, and English Literature. Students have the opportunity to decide whether to participate in either program, they may choose both, and they may choose neither and simply earn their high school credits from these courses. The reasons students

choose AP, DE, Both, or Neither must be considered in the context of the research on college choice, persistence, and completion as students gather information on their post-secondary options while simultaneously plotting their high school academic path.

The research model that I will use to guide the basic design of this study is based on a conceptual model for a "natural" longitudinal experimental design developed by Alexander Astin (1991). This research design is more commonly referred to as the Input-Environment-Outcomes (I-E-O) model (Astin, 1991). Astin's model categorizes variables into three classes: input variables, also known as antecedent/control/initial condition variables; environmental variables, also known as intervening or treatment variables; and outcome variables. I-E-O works to minimize Type I and Type II inferential errors by allowing the investigator to determine the impact of environmental variables on outcome results while accounting and controlling for the effects of inputs. The research design chosen for this study assumes that the outcome variables consisting of freshman grade point average in college, college persistence, and time to degree-completion (outcome variables) are dependent on a number of input and environment variables. The crucial environment variables are students' history of pursuing college credit in high school via AP, DE, Both, or Neither. Crucial input or control variables that may also affect the outcome variables include pre-college academic ability (high school GPA and ACT scores), gender, race, and family income level of the students.

This study uses academic ability, gender, race, and family income level as input variables to account for inherent differences between groups. Many studies in the literature do not account for the fact that AP and dual enrollment students will generally be above-average high school performers from families of adequate financial means. Failure to account for student ability and

student background may yield results favoring one choice (AP, DE, Both, or Neither) over the others because of inherent differences between the groups (Type I error).

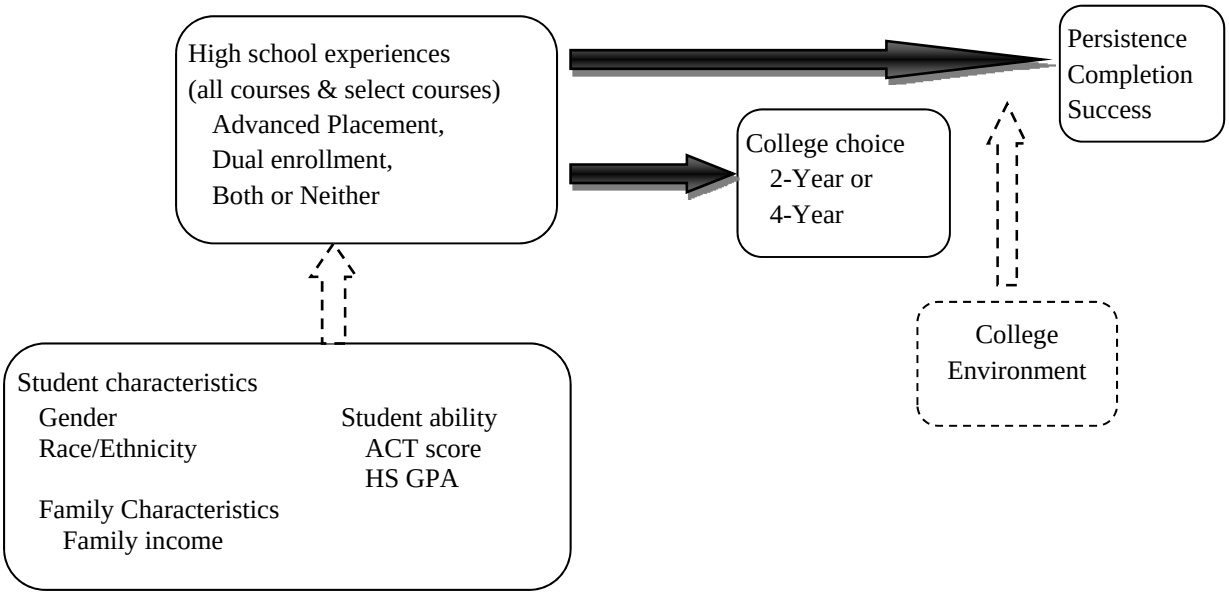
Input-Environment-Outcomes research focuses on the environment as the independent variable. This study examines whether student experiences pursuing credit through dual enrollment, Advanced Placement testing, Both, or Neither (environmental variables) are related to student success in college as determined by first year college GPA, whether the student enrolls in a third semester of college (i.e. persistence), and the number of years to degree completion. There are a number of notable differences between how students approach and react to credit attainment through Advanced Placement, dual enrollment, Both, and Neither. The question is whether these differences lead to differential outcomes in college.

Attaining credits or advanced standing in high school through dual enrollment or Advanced Placement testing means that students do not have to repeat courses they may otherwise had to take while in college. However, dual enrollment and Advanced Placement may provide different levels of expectations from high schools and colleges and different levels of academic confidence and competence from students. Compared to Advanced Placement, earning credits through dual enrollment is a much lower-risk method for attaining credits. Students who concurrently enroll in high school courses for college credit are likely to attain credit from both. Among the intended consequences of these programs is that earning credits while in high school should allow students to complete their college degree on time or sooner. Despite expectations, earning credit through this process may actually increase the likelihood that students will struggle in subsequent courses and thus decrease persistence and increase time to completion (Richards, 2006). Seeking to earn credit by participating in the Advanced Placement tests is seen as a more prestigious choice despite whether students actually pass the

exam (Matthews, 2011; Merrefield et al., 2011; U.S.News, 2009). On the other hand, students who participate only in Advanced Placement examinations are less likely to earn credit compared to concurrent enrollment in college. In fact, students may choose to participate in both because it gives them increased confidence that they will actually receive credit (Barnett, Gardner, & Bragg, 2004). Students who only participate in Advanced Placement, but do not receive scores high enough to attain college credit, may have to repeat courses in college that they had already completed in high school. Repeating content in college previously covered in high school courses is not necessarily bad for students. Two questions arise from the discussion that I will address further in Chapter 5: Does the benefit of credit attainment through dual enrollment outweigh the need to show mastery of the specific course material on an AP exam? Moreover, does participation in the AP examination provide an advantage to students, regardless of whether they actually received a high enough score to attain credit?

In summary, this study examines whether pursuit of college credit in high school through dual enrollment, Advanced Placement, Both, or Neither yield different effects on students' college choice, time to degree completion, early college success, and college persistence. As discussed through Astin's I-E-O research model, there is a variety of input factors to consider when trying control for student abilities, resources, and other experiences. Input factors include pre-college academic ability (HS GPA and ACT scores), race, gender, and family income level. Diagram 2 illustrates the relationships between each of these variables. One notable factor that I am unable to control is the level of student involvement, engagement, and integration at the college level. However, this study is designed to minimize its effects as much as possible by focusing attention on graduates from a single school district (Shawnee Mission) that enroll at a single nearby university (University of Kansas) following their high school graduation.

Diagram 2: Visual Overview of High School Inputs, High School Environment, and College Outcomes



Significance of the Study

The answers to the questions presented in this study have important implications for policy setting and practice for secondary and higher education as well as for college-bound students and their parents. Each of these groups has a significant stake in credit based transition programs and their efficacy. Advanced Placement and dual enrollment programs have overlapping goals of providing opportunities to students that increase the likelihood that they will finish college (Dougherty et al., 2006; McCauley, 2007). Colleges, secondary school staff, and state governments have promoted both programs as a means for encouraging college participation and completion, which has resulted in tremendous growth in both programs over the past thirty years (CollegeBoard(b), 2012; Karp et al., 2007; Kleiner & Lewis, 2005). Incentives for schools to offer and students to participate in these programs include financial savings to students, reduced time to degree completion or increased opportunities for extracurricular activities, enhanced alignment between secondary and postsecondary institutions,

public recognition, and even student satisfaction (Allen, 2010; Dutkowsky et al., 2009). Providing multiple opportunities for high school students to attain college credit may be seemingly beneficial to students, but students as well as secondary and postsecondary institutions now face the dilemma of determining which choice or combination of choices is better. At the same time, there continues to be questions about whether it is the named program that benefits students or whether it is the rigor of the curriculum and strong college climate regardless of the program offered (Klopfenstein & Thomas, 2006; Roderick, Nagaoka, Coca, & Moeller, 2008).

This study addresses questions related to credit based transition programs that are not resolved in the literature. Although many studies exist comparing student participation in one or more credit based program to non-participants, few studies exist that compare two or more of these programs with each other. One of the few studies comparing dual enrollment programs with Advanced Placement that does exist compares the success of each group of students in their subsequent college level courses (Richards, 2006). The findings indicate that students who earn credit through an Advanced Placement score are more successful in subsequent subject-level courses than students who earned credit via dual enrollment after controlling for academic ability from high school. Although these findings contribute substantially to the examination of Advanced Placement and dual enrollment programs, controls for family income were absent from the analysis and the results do not account for students who complete the first level course and do not enroll in the second level. The comparison stopped short of answering the more broad questions regarding the success Advanced Placement students compared to dual enrollment students such as whether one group earns a degree earlier.

This study builds upon the body of knowledge related to credit based transition programs presented in the next chapter and it will make valuable contributions where limited information

currently exits. For example, many studies that examine outcome comparisons between students who attain credit through Advanced Placement or dual enrollment with other college students do not control for differences in academic ability. It is reasonable to expect that students who take advantage of credit based transition programs will be above average students. However, it is possible that participants in one group will have, on average, a higher level of academic ability than another group. This study will control for between group differences in academic ability, thus ensuring that any performance differences found between the four groups of students (Advanced Placement, dual enrollment, Both, or Neither) will not attributable to inherent academic ability differences between the groups.

Similarly, many studies that examine outcome comparisons between students who attain credit through Advanced Placement or dual enrollment with other college students do not control for differences in family income. In Shawnee Mission, students are responsible for paying for the Advanced Placement examination fees or dual enrollment tuition. Hence, family income plays an important role in determining whether students choose to participate in dual enrollment or Advanced Placement offerings as well as the number of credits they wish to pursue. Family income also plays an important role in predicting whether a student will complete college (Herzog, 2005). This study will control for between group differences in family income, thus ensuring that any performance differences found between the four groups of students (Advanced Placement, dual enrollment, Both, or Neither) will not attributable to differences in family resources between the groups.

In addition to extending the literature that examines the effects of college preparatory choices on college selection, early college success, persistence, and degree attainment, the findings from this research are relevant to students, parents, school counselors, school

administrators, and college admissions officers for a variety of other reasons. College-bound students and their parents are making financial and time investments in educational programs they hope will yield the greatest benefit. The findings from this research will contribute to their awareness of the potential consequences or benefits of choosing dual enrollment, participating in Advanced Placement testing, Both, or Neither. School counselors and administrators may use the same information to respond to calls for expansion of one particular program, such as Advanced Placement, at the expense of competing programs that could be equally or more beneficial to students and colleges. Schools may already be making the decision to promote Advanced Placement at the expense of dual enrollment in order to gain recognition. My findings may show that dual enrollment in Shawnee Mission is equally beneficial to students despite the prestige associated with Advanced Placement. School counselors and administrators will use these findings to set priorities for school programs as well as for individual students.

CHAPTER 2

LITERATURE REVIEW

Overview

This chapter first provides a review of the literature on predictors of college persistence and completion, college choice, and early college success. Much of the literature points to a great divide between K-12 and postsecondary institutions and the moving pendulum of initiatives that swings between the two. The most notable points of interest in the research oscillate between rigorous academic preparation in K-12 education and the levels of involvement, engagement, or integration of students after they enter college.

Following a review of the literature on college persistence and completion, college choice, and early college success, this chapter summarizes the purposes, advantages, and disadvantages of Advanced Placement (AP) and dual enrollment (DE) programs. Both AP and DE serve nearly identical purposes in their intent to emulate regular college classes. Thus, by virtue of the transitive property, they should be identical to each other in terms of academic outcomes. However, this chapter points out key differences between AP and DE that may affect student outcomes in college.

College Persistence and Completion

Over the past thirty years, student persistence and retention has drawn much attention from researchers and policymakers in the study of higher education (Braxton, Vesper, & Hossler, 2005; Tinto, 1993; Wortman & Napoli, 1996). The authors of this research consistently agree that college student retention is a function of academic preparation (Adelman, 1999; Tinto, 1993). In other words, some students drop out of college because they lack the requisite

knowledge and skills for college-level work; conversely, those who stay in college possess the skills needed to manage the rigor of college-level academics.

However, other studies show that student departure from college is caused by students' inability to adjust to the collegiate environment (Cabrera, Nora, & Terenzini, 1999; Eimers & Pike, 1997; Nicpon et al., 2006; Schwitzer, Griffin, Ancis, & Thomas, 1999). In fact, some of the most widely cited research on student retention in college has found that students' levels of "involvement" (Astin, 1999; Kuh, Schuh, Whitt, et al., 1991), "engagement" (Kuh, 2001; Kuh, Schuh, & Whitt, 1991), or "commitment" and "integration" (Tinto, 1993) are strong predictors of whether students stay in college and finish or whether they drop out. These constructs all refer to the amount of physical time and effort and level of psychological investment and commitment that the student devotes to the college experience. According to Tinto (1993), student departure occurs because of mismatches between the student and the institution as indicated by low academic or social integration.

There is general agreement that many factors are associated with student retention and degree completion rates in college including entering student characteristics as well as interactions between students and their college environment (Astin, 2005; Hisada, 1988; Metz, 2004; Tinto, 1993, 1999, 2006). Table 2 provides several examples of these factors, but the list is far from comprehensive.

Table 2: Overview of Environmental Factors and Predictors of College Success used in Prior Research

Entering freshman characteristics	**Freshman environmental characteristics**	**College characteristics**
High school grades or grade point average	Place of residence	Size
High school test scores (ACT, SAT)	Financial aid	Selectivity
Personal and family demographics (gender, race/ethnicity, mother's education)	Major field of study	Type of institution
		Control structures

Recent findings on the interactions between students and their college environment have convinced the higher education community of the need for institutions to take seriously the attrition of admitted students (Hossler et al., 2009; Kalsbeek & Hossler, 2010; Schudde, 2011). The old “sink-or-swim” mentality that places blame exclusively on high school preparation has been replaced by a more socially responsible and economically minded viewpoint stressing the need for colleges and universities to graduate their admitted students within a reasonable period. However, the pendulum may have swung too far in the sense that colleges have begun to forget that high school preparation efforts and characteristics continue to evolve. Despite the number of studies on student departure and attempts to improve retention and time to completion at the college level, institutions of higher education continue to face major difficulties in retaining students (Kalsbeek & Hossler, 2010). Historically, there have been limited opportunities to connect high school student choices with latent college outcomes. Nonetheless, a better model may be found in the form of increased collaborations between secondary and postsecondary institutions.

Student involvement is one of the most widely studied areas in higher education. According to Astin (1999), ‘‘involvement’’ is a complex concept that encompasses the “physical and psychological energy’’ that a student invests in college (Astin, 1999, p. 518). A great deal of evidence suggests that the greater the student’s level of involvement, the greater the chances of degree completion. The initial rise of the involvement theory resulted from this clear-cut pattern of research findings on the effects of many different types of student involvement (Astin, 1999; Clark & Cundiff, 2011; Kuh, Schuh, & Whitt, 1991; Kuh, Schuh, Whitt, et al., 1991; Skipper & Argo, 2003). However, further study finds that any effort to predict degree completion rates in terms of concepts like the students’ level of involvement or engagement are likely to be

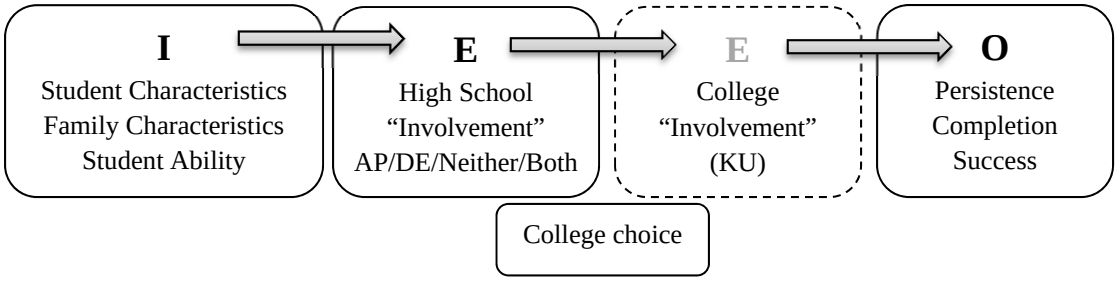
misleading unless entering student characteristics are taken into account (Astin, 2005). Conversely, Astin contends that predicting degree completion rates solely on entering student characteristics in the absence of controls for student involvement may also be misleading.

Despite the evidence pointing to the interactions between students and their college environment, a great deal of empirical research continues to confirm that college-degree completion rates are primarily a reflection of entering student characteristics, particularly at four-year colleges (Astin, 2005; Attewell et al., 2011; Horn, Kojaku, & Carroll, 2001). More than two-thirds of the variation among institutions in their degree completion rates is attributable to differences in their entering student bodies. Consequently, differences among institutions in their degree completion rates are primarily attributable to differences among their student bodies at the time of entry (Astin, 2005). This means that although involvement, engagement, and integration are important components contributing to student retention and completion, research on the effects of various characteristics of high school preparation remains important and incomplete. This study examines whether student participation in AP, DE, Both, or Neither is an entering characteristic that yields differences in college choice as among all colleges well as persistence, completion, and early success at a four year college. This study does not look at what happens in a college as an independent variable, rather it looks at the effect of precollege choices on postsecondary outcomes.

In Chapter 1, I indicated that the research model is based on the Input-Environment-Outcomes model proposed by Astin (1991). Under this model, there are actually two environments. Students who graduate from high school and enter college experience both the high school environment and the college environment. Diagram 3 provides a broad look at the relationship between these variables. Despite the evidence supporting the important role of

involvement, integration, or engagement in students' college success, my only control for this variable is that I am analyzing data from a single university rather than multiple postsecondary institutions. This is a limitation worth noting up front. Nonetheless, I will continue to discuss college environment in the context of the results and recommendations for further study in Chapter 5.

Diagram 3: Summary of the I-E-O Model as it Applies to this Study



College Choice and Access

Determining the most appropriate course of college preparatory study in high school is concurrent with the process of choosing a college. Both can be viewed as a developmental process that consider the interactions between students, institutions, and external factors over time (Bergerson, 2009). This section provides an overview of college choice models that offer a context for a student's decision to select dual enrollment, Advanced Placement, or some combination of the two. The research on college choice broadly examines both the choice of whether to attend a college along with which college to choose. This summary focuses primarily on factors that contribute to college selection in the context of deciding whether to enroll in a credit-based transition program, or whether to select a college preparatory program of studies at all.

One of the most widely used process models for college choice is Hossler and Gallagher's three-stage model (1987). This model elaborates three phases through which

students' progress as they move from educational aspirations to college enrollment (Hossler & Gallagher, 1987). The three stages are *predisposition*, *search*, and *choice*. Each stage is loosely associated with a range of student grade levels.

The predisposition phase, which occurs around grades 7 through 9, involves the development of a student's college aspirations and expectations to continue their formal education after high school (Hossler & Stage, 1992). The choices students make in this phase are influenced by a variety of factors including family socioeconomic status, student ability, peers, parent involvement, high school involvement, and interactions with higher education institutions (Dennard, 2000; Hossler & Stage, 1992; Perna & Titus, 2004; Pope & Fermin, 2003). However, parental influences appear to be the strongest influence over student college aspirations (Bergerson, 2009). During this phase, students are outlining and their plans for high school academic coursework and extracurricular involvement. High school students who face the dilemma of choosing whether to pursue attainment of college credits through dual enrollment, Advanced Placement, or both are already predisposed to college going. These students face the challenge of determining which colleges are available to attend.

The search phase, which occurs around grades 10 through 12, involves more active planning for college (Hossler & Stage, 1992). During this phase, students determine which institutional characteristics are most important, thus narrowing the field of colleges from which to choose (Bergerson, 2009). This is also the primary phase where students choose whether to seek college credit through dual enrollment or Advanced Placement avenues and complete college entrance examinations including the ACT or SAT. Ultimately, students complete the application process for institutions in their final set of choices and they move into the last stage, choice, by the end of their senior year.

During both the predisposition and search phases, parental encouragement plays a significant role in students' college preparatory choices (Bergerson, 2009). However, parents' level of influence begins to diminish during the search phase (Hossler & Stage, 1992). Students begin to develop a sense of what is important to them in light of the influence of parental expectations. Students gather information about post-secondary options through passive and active interactions with peers, family members, teachers, counselors, college representatives, and print media (Grodsky & Jones, 2007; McDonough, Antonio, Walpole, & Pérez, 1998).

A student's socioeconomic background also plays an important role in gathering information (Bergerson, 2009; Cabrera & La Nasa, 2000; Grodsky & Jones, 2007; McDonough, 2004; Paulsen & St. John, 1997). Students from higher socioeconomic backgrounds generally have greater access to and ability to locate information (Bergerson, 2009). For example, wealthier students may hire independent education consultants in their search process. They also have access to more information regarding the costs and benefits of choosing dual enrollment or Advanced Placement in their college preparatory program of studies.

Other factors examined with regard to college choice include the effects of high school curriculum and the role of high school personnel on college choice. Although some have suggested that high school personnel are an important factor in students' postsecondary education decisions (Cabrera & La Nasa, 2000; McDonough, 2005; Terenzini, Cabrera, & Bernal, 2001), other research has found that their role is quite limited and depends heavily on their training and availability in the area of college counseling (McDonough, 2005; Perna et al., 2008; Stanton-Salazar & Dornbusch, 1995). Research on the effects of high school indicate that being in an academic, college preparatory track has a positive influence over whether students attended a post-secondary institution (Adelman, 1999; McDonough, 2004, 2005). In fact, many

policymakers are even looking for a college preparatory curriculum to become the standard curriculum in the United States. However, the precise nature of the relationship between academic tracks and post-secondary choices remains to be fully explored (Hossler & Stage, 1992). Understanding the relationship between college-preparatory curricular choices and student outcomes in college is a good next step in helping students, their parents, as well as secondary and postsecondary staff in making the best college preparatory choices while in high school. Hence, a student's pursuit of credit via dual enrollment, Advanced Placement, some combination of both may have differential effects on college choice and likelihood for success at that chosen college.

Dual Enrollment in High School

Offering dual enrollment courses at the high school level offers several advantages that benefit schools, parents, students, and the local community. For example, school districts receive economic benefits by offering courses that serve dual purposes. High schools can offer dual enrollment courses without hiring new staff and districts can save money by collaborating with area colleges. Providing more opportunities that are challenging for high school students also boosts school morale by addressing a lack of student motivation and boredom experienced by top students (Allen, 2010; NCHSSY, 2001).

Students and their families also receive economic benefits when they take advantage of dual enrollment course offerings because they have a chance to save on college tuition. Credits earned though college-high school articulation agreements generally cost less than typical tuition at four-year colleges and costs may even be subsidized through state funds (N. Hoffman et al., 2009). In addition, students are not responsible for additional costs for transportation and living expenses compared to taking these courses on the college campus after completing high school.

College credits earned through dual enrollment are usually transferrable to local universities where students are likely to attend, although not all colleges are as explicit with their dual enrollment credit transfer policies as they are with Advanced Placement (Allen, 2010; Dutkowsky et al., 2009).

Parents and community leaders also appreciate collaboration between high schools, community colleges, and 4-year institutions because they work to facilitate a pipeline of students moving from high school to college. The partnerships built on dual enrollment programs help to bridge the gaps in communication and curriculum between high schools, community colleges, and other post-secondary institutions (Bueschel, 2003). School districts and community leaders may even highlight these arrangements as an asset to the community in order to attract new residents and businesses to the area and compete with neighboring districts.

Besides the economic benefits to students and their families, students who participate in dual enrollment get the opportunity to demonstrate that they can handle college-level work. Students who doubt their own abilities to succeed in college but experience success in dual enrollment courses are more likely to apply to college–and eventually graduate (Dutkowsky, Evensky, & Edmonds, 2006; McCauley, 2007; Richards, 2006; Smith, 2005). Students dually enrolled know how they are progressing in the course by grades earned on tests throughout the semester just as they do for any other high school or college course. Many believe that students who successfully complete college level courses demonstrate their ability to do college-level work (Dutkowsky et al., 2009). Experience in a college-like environment may encourage students to pursue higher education and help them make the transition to college.

Credit-based transition programs, including dual enrollment, provide students with the opportunity to accumulate college credits prior to graduating from high school, thus shortening

the time required to earn a college degree. Data from the U.S. Department of Education indicate that accumulating twenty college credits by the end of the first calendar year of college is a strong predictor that a student will successfully earn a college credential (Adelman, 2006). Logically, if students get a head start on college credit attainment by earning them in high school, their chances for graduating should increase. Students often take longer than four years to earn a baccalaureate degree and most students take longer than two years to complete an associate's degree (NCES(b), 2012). According to NCES (2012), only 36% of bachelor's degree-seeking students complete a bachelor's degree within four years after starting. Comparably, 52% complete a bachelor's degree within five years and 57% within six years. By getting an early start on college with dual enrollment classes, students may have a better chance of finishing within two or four years.

Dual enrollment courses also help to eliminate the duplication of courses for students who take high school courses similar to those required in college. For example, without a dual enrollment option, students who complete Calculus in high school may also be required to repeat Calculus in college regardless of whether the course contains the same content and level of rigor.

In spite of the benefits of dual enrollment programs, they can be challenging to implement well. Dual enrollment programs require high schools and colleges to work in close partnership, aligning curricular and instructional standards across secondary and postsecondary systems. The partnerships are challenging to build and sustain because secondary and postsecondary systems are largely disconnected by their differing academic calendars, course schedules, and organizational norms (Kirst & Bracco, 2004; Robertson, July 2005).

College courses offered through dual enrollment are only as good as the regular courses offered by the college. Course quality takes special effort to monitor in these programs because

there are few common content or learning standards across postsecondary institutions. Thus, students may not be getting the expected "college experience" they need to increase their likelihood for success in college (Allen, 2010). For example, enrollment in college level classes in a high school setting may not be equivalent to courses students may take at a major university both academically and socially. College credit is not a replacement for the college experience. Students may earn up to two years of college credit in high school, but their experiences are not a substitute for the friends they may make and extracurricular opportunities they may have in two years at college.

Another concern is that the integrity of dual credit classes hinges on whether they are taught at the same level of rigor as the college level course. Many institutions counter the concern of rigor by reviewing the alignment of syllabi, using common textbooks, use of common final exams, and tracking performance of students in subsequent courses. Finally, one of the main concerns with taking college courses in high school is the potential for these programs to become a race to earn credit. Rather than enrolling in dual enrollment courses for earning college credit in exchange for a college experience, students may enroll as a means for obtaining 'easy' credit.

Despite the purported benefits of dual enrollment programs, the research has yielded mixed findings. For example, one study found that even when controlling for student pre-entry attributes, no significant differences existed in student college persistence and performance between students who participated in dual credit options compared to those who did not (Duffy, 2009). One of the common limitations among these studies is that the research compares students who participate in dual credit courses with students who do not. In other words, results may be attributable to different high school programs of study. In this study, I examine the

outcomes of students who completed similar college preparatory courses, but who chose different experiences for transitioning to college. In particular, this study compares the college outcomes of students who participate in dual enrollment with students who also complete rigorous college preparatory courses, but participate in AP, both AP and DE, or Neither.

The Advanced Placement Program

Each year, over one million students from more than 15,000 schools worldwide participate in the AP program (CollegeBoard(b), 2012). Like dual enrollment, offering Advanced Placement courses offers several advantages that benefit schools, parents, students, and the local community. Many of these advantages mirror those of dual enrollment programs. AP classes offer students the opportunity to study college level material, thus providing a better transition to post-secondary programs (Klekotka, 2005; Rhodes, 2007). In addition, a qualifying score on and AP exam means that a student may be eligible for credit at many colleges across the United States. Students who receive a qualifying score can avoid having to repeat the same course content when they enter college (Dutkowsky et al., 2009; KU, 2012).

One advantage that the AP program offers that is not available to students of dual enrollment courses is that the College Board offers a number of awards known as 'AP Scholar' awards to students who perform at high levels on multiple exams (CollegeBoard, 2012). Advanced placement provides more opportunities for attention and recognition from selective colleges and scholarship-granting organizations.

A substantial amount of research has evaluated the impact of the AP Program on specific student outcomes. These studies include the relationship between AP and college academic performance (Burnham & Hewitt, 1971; Dodd et al., 2002; Geiser & Santelices, 2004; Klopfenstein & Thomas, 2006; Morgan & Crone, 1993; Morgan & Ramist, 1998; Willingham &

Morris, 1986), college completion (Adelman, 1999, 2006; Dougherty et al., 2006; McCauley, 2007), and performance on international assessments (Gonzalez, O'Connor, & Miles, 2001). A number of these studies also examine the relationship between the AP Program and college going, persistence, and course of study (Horn et al., 2001; Klopfenstein & Thomas, 2006).

Studies of AP Programs have generally investigated one or more of the following three groups of students: (1) students who take an AP Examination and perform well on it, (2) students who take an AP Examination, irrespective of performance on the exam, and (3) students who take an AP course, irrespective of both exam participation and performance (Ewing, 2006). The majority of research has focused on the first two groups of students: those who have completed an AP exam. Research examining the impact of AP course taking on college outcomes without exam participation are rare because there have been few assurances that the courses are taught with the same level of rigor across all schools. In addition, connecting high school experiences to college outcomes can be very challenging without a strong partnership between secondary education institutions and colleges. This study is unique because I compare the outcomes of students who complete an AP course, but choose among four options for attaining high school and/or college credit: participate in the AP exams, participate in dual enrollment, Both, or Neither.

Studies of AP programs have also generally been sanctioned or promoted by College Board (Buck, Kostin, & Morgan, 2002; Burton, Whitman Burgess, Yepes-Baraya, Cline, & Kim, 2002; Dodd et al., 2002; Hargrove et al., 2008; Willingham & Morris, 1986). The available evidence suggests that students and teachers appreciate the increased level of intellectual challenge relative to other high school courses, AP students are more likely to persist and graduate from college than students without AP participation, and AP students may be more

successful in college (Buck et al., 2002; Burton et al., 2002; Dodd et al., 2002; Ewing, 2006; Mattern et al., 2009; Willingham & Morris, 1986). However, this body of research is marked by methodological problems and does not yet provide convincing evidence that AP participation causes positive outcomes on high school and college (Callahan, June 2003; Rhodes, 2007). Although the College Board works hard to promote unbiased research, studies that do not promote the benefit of AP Programs above other courses of study can damage the legitimacy of their organization and AP in particular. Hence, the field needs further independent analyses of college preparatory programs to ensure that they continue to be viewed through an unbiased lens. By isolating specific credit-based transition programs (Advanced Placement and dual enrollment) and controlling for critical student inputs (student ability, family income, and demographic characteristics), this study provides an unbiased view of these competing programs that is independent from the College Board.

Most studies that examine the effects of AP or dual enrollment on student outcomes are conducted from the point of view of a college. For example, College Board credits Texas universities multiple times for their research on the relationships between Advanced Placement and college outcomes. (Dodd et al., 2002; Dougherty et al., 2006; Hargrove et al., 2008; Klopfenstein & Thomas, 2006; McCauley, 2007). Studies generated from the university perspective examine their graduates, dropouts, course enrollment patterns and then look at AP scores of students arriving from a wide variety of sending high schools. This study examines the effects of Advanced Placement from the opposite perspective. All the students in this study have had comparable high school experiences. Rather than examining the effects of AP on a single university system, this study first examines the effects of AP from a single high school system on multiple college and university systems. Further analysis focuses on graduates from the same set

of high schools who attend a single university (University of Kansas). I use this two-pronged approach to evaluate and discuss the robustness of results in Chapter 4.

Like dual enrollment courses, ensuring the quality and rigor of AP courses can be problematic. Many schools across the country offer college preparatory courses designated for AP that are very poorly taught by teachers who do simply do not have the content background or pedagogical skill to prepare students for the rigorous AP exams. Consequently, students may get high grades in the course but then score poorly on the exams (i.e., they fail them). Despite efforts of the College Board to standardize AP curriculum through syllabi reviews and staff development, there is considerable anecdotal evidence that AP course quality varies widely across schools and subject areas. AP course quality may be particularly variable across areas with rapid expansion of course offerings and limited supplies of qualified teachers. This study offers some advantages that control for teacher quality questions. First, the students selected for this study received instruction from the same set of teachers. In addition, these teachers all have access to the same staff development and collaboration opportunities in Shawnee Mission. Finally, all teachers of Advanced Placement courses must also have a master's degree that meets minimum criteria for them to teach dual enrollment courses through the local community college. There may be some variation in teacher quality, but an association between teacher quality and the comparable outcomes of students choosing AP, dual enrollment, Both, or Neither is unlikely.

Reasons Students Choose AP, DE, Both, or Neither

Despite the documented benefits of participating in the Advanced Placement program (Burnham & Hewitt, 1971; Dougherty et al., 2006; Morgan & Ramist, 1998; Willingham & Morris, 1986), the dual credit option appears to be equally attractive to students seeking to earn

college credit or advanced college standing while enrolled in high school (Waits et al., 2005). A key benefit that students receive from either Advanced Placement or dual enrollment is to obtain college credit from the institution of higher education that they attend. In general more colleges and universities publish explicit policies for granting college credit with AP than for dual enrollment (Dutkowsky et al., 2009). For highly selective colleges, this may be an indication that they either do not consider dual enrollment courses for credit or at the very least, they subtly discourage students from choosing dual enrollment in lieu of Advanced Placement credit. On the other hand, some colleges may also view dual enrollment in the same manner as any other transfer credit. Receiving colleges often have standard criteria such as a minimum grade of C for the course, and they may include procedures for reviewing the syllabus from the sending school to determine how the high school course and the paired college course align. Schools with existing articulation agreements with the local community college may be more attractive or more accessible to dual enrollment students because the receiving colleges can readily inform students of how credits transfer between the institutions.

Table 3 illustrates how the University of Kansas clearly treats transfer credits and Advanced Placement scores differently. For example, students who successfully complete a high school course called Calculus AB and concurrently enroll through Johnson County Community College have the opportunity to earn five credits that are transferrable to KU. In order for students to acquire the same number of credits by participating in the AP exam, students would have to earn a 5, which is the highest score possible. The differences also appear with other high school courses including Calculus BC, and English 12 AP (KU-OIRP, 2012; KU, 2012).

Table 3: Overview of Treatment of AP and JCCC Transfer Credits at KU

High School Course	Dual Enrollment		Advanced Placement Score	
	KU Credit Transfer from JCCC	**Credits**	**Score**	**Credits**
Calculus AB	Math 121	5	3 or 4: Math 115	3
			5: Math 121	5
Calculus BC	Math 121 & Math 122*	10	3, 4, or 5: Math 121	5**
English Literature & Composition (Engl. 12 AP)	English 101 & English 102	6	3: Placement only	0
			4: English 105	3
			5: English 105 & 205	6

* In some programs, students must also complete Calculus 3 at JCCC before KU will accept Calculus 2 transfer credits from JCCC.

** The AP Calculus BC exam also has a Calculus AB sub score. Students may also earn 3 credits for Math 115 if the AB sub score is 3 or 4.

Students also face a cost-benefit decision when determining whether to participate in Advanced Placement or dual enrollment programs. In 2011, the cost for competing an AP exam was $87 (CollegeBoard, 2012). In addition, economically disadvantaged students may qualify for fee reductions that only require them to pay $57 per exam. Policies that require students to participate in the AP exam in order to receive credit for an AP-designated course create an additional barrier for students under financial hardship. In 2011, the cost for student to concurrently enroll with the local community college was $81 per credit hour (JCCC). Thus, for a three credit-hour course, students would invest $243 to enroll. Although tuition for dual enrollment costs more than the fee for participating in the AP test, students also understand that they are more likely to earn credit through concurrent enrollment than through AP participation (Dutkowsky et al., 2009). Hence, students may effectively pay more to reduce the level of risk for not earning college credit.

When deciding between Advanced Placement and dual enrollment, students may prefer dual enrollment because the grade received in the course usually represents the culmination of skills demonstrated throughout the semester or year. Thus, students are more likely to *pass* the course than students who are required to demonstrate their skills within a four to six hour exam. The question remains about whether students who pursue credit through dual enrollment, Advanced Placement, Both, or Neither actually attain the expected benefit of increased success in college.

Connections between AP, DE, and College

Research shows that the intensity and quality of student's high school curriculum are the strongest predictors of college success (Adelman, 1999; Astin, 2005). Students who take advantage of postsecondary options in high school, like DE and AP, earn higher grades in college, require less remediation, and have higher rates of persistence (Robertson, July 2005). In fact, an institution's degree completion rate is primarily a reflection of its entering student characteristics (Astin, 2005). Although three-quarters of all high school graduates enter either a four-year or two-year college shortly after high school graduation, more than half fail to complete a degree at the institution where they began (J. L. Hoffman & Lowitzki, 2005). Rigorous academic preparation in high school and clear understanding of the expectations for college-level academic work is strongly correlated to success in postsecondary education (Adelman, 1999, 2006; Horn et al., 2001). Students receive the curriculum from the same academically rigorous course, but dual enrollment and Advanced Placement may not provide an equal measure of whether students have clearly mastered an understanding of college-level academic work.

High schools and higher education have been largely disconnected for many years. Educational reform and research have been isolated within either the K-12 or higher education sector. For example, postsecondary institutions traditionally set standards for defining college level coursework without much collaboration with secondary educators. Students need to know what it means to take a rigorous curriculum in high school and how to best prepare for college. A college-ready student is able to understand what is expected in college coursework, can demonstrate an ability to cope with the knowledge presented, and take away key lessons and dispositions from each course (Conley, 2007). Participation in a dual enrollment or Advanced Placement program directly addresses this definition of college-readiness. However, a lack of connection between public K-12 and higher education undermines the successful transition from one institutional level to the next.

There are notable differences between high school and college that DE and AP must seek to overcome. In the transition from high school to college, the relationship between teacher and pupil changes as do expectations for engagement, independent work, motivation, and intellectual development (Conley, 2007). According to the National Survey of Student Engagement (2006), college faculty report that entering college freshmen do not enter college with a work ethic that prepares them for instructor expectations or course requirements. Students transitioning from high school to their freshman year in college may think a college course equates to a similarly named high school class, and the two may appear similar on paper, but they may find out that expectations are fundamentally different (Conley, 2007).

Dual enrollment arrangements between colleges and high schools work to mitigate this problem by requiring high school instructors to meet the same minimum qualifications as on-campus college instructors as well as by requiring that students meet minimum qualifications for

the course. Colleges granting course credit also ensure that the high school course content meets or exceeds the content required by the college course. However, these safeguards do not always guarantee that students will receive an equivalent college-level experience in the course.

The College Board also works to mitigate this problem by requiring high school instructors to submit course syllabi for peer review, however, they did not begin this process until 2008 (CollegeBoard(c), 2012). In addition, students who 'pass' the AP test are assumed to have the level of motivation and intellectual development required to receive credit or advanced standing in a course. However, there is no direct alignment made between the high school course content and a specific course named by a specific college.

Another notable difference between dual enrollment programs and Advanced Placement, is that successful dual enrollment programs emphasize collaboration and connectedness between the student, the high school, and the college (Robertson, July 2005). For example, students enrolling in dual credit courses must interact with college personnel by registering for college in much the same manner as their degree seeking college peers. The participating college has the opportunity to provide support that focuses on the financial, social, and academic needs of individual students. The College Board cannot provide this level of support for students seeking to earn credit through the AP test and largely depends on the sponsoring high schools to provide these services.

Schools that offer academically rigorous course and give students the option to choose participation in dual enrollment, Advanced Placement exams, Both, or Neither, may inadvertently be providing a different college preparatory experience for each group. The differences between how students transition to college with dual enrollment versus Advanced Placement indicate that students may not have an equal measure of whether they have clearly

mastered an understanding of college-level academic work. The goal of this study is to determine whether these differences in student experience translate to differences in their college survival and success.

Summary

The literature on college persistence, completion, and choice highlights a great divide between K-12 and postsecondary institutions. A moving pendulum of initiatives swings between rigorous academic preparation in K-12 education and the levels of student involvement, engagement, or integration of students after they enter college. Although involvement, engagement, and integration are important components contributing to student retention and completion, research on the effects of high school preparation choices remains important and incomplete. This study attempts bridge the divide between secondary and postsecondary programs by examining whether student participation in AP, DE, Both, or Neither is an entering characteristic that yields differences in college choice among all colleges well as persistence, completion, and early success at a representative four year college.

Merely earning college credits while in high school may not be the best indicator of whether a student is ready for the level of engagement, independence, motivation, and intellectual development required for college courses (Conley, 2007). Even when students complete the same academically rigorous course, participation in dual enrollment or Advanced Placement may not provide an equal measure of whether students have clearly mastered college-level academic work. Recent research confirms that AP and DE yield some differences in college outcomes across different school systems (Richards, 2006). There are key differences between AP and DE that may affect student outcomes in college. For example, students who participate in dual enrollment receive a grade from the instructor that represents the culmination

of all work the student completes throughout the course. The assignment of a culminating course grade mirrors the college experience more closely than the administration of a single Advanced Placement exam. However, the College Board assigns AP exam scores through a highly rigorous validation process that is independent of the classroom teacher's instruction (CollegeBoard, 2012).

Dual enrollment (DE) and Advanced Placement programs offer several advantages that benefit schools, parents, students, and the local community. A plethora of research supports the implementation of both programs, especially when compared to non-participants. The economic motivation for encouraging student participation in AP and dual enrollment is also very strong (Dutkowsky et al., 2009). AP and DE provide opportunities for students accumulate college credits at low cost while enrolled in high school courses and they attempt to provide students with a college-like academic experience. The main goal if this study is not to challenge the value AP or DE versus non-participation. Rather, AP and DE have grown to a point where they compete with each other for student participants in courses like calculus and English literature. Students, their parents, and associated educational institutions need the right information to determine which choices will help students maximize their likelihood for success in college.

CHAPTER 3

RESEARCH METHODS

Research Design Overview

The purpose of this study is to determine whether participation in AP, DE, Both, or Neither provide a clear advantage to students in choosing better colleges after high school, staying enrolled in a college, achieving early success, or graduating earlier. The following questions guide the research design and statistical methods:

1) What are the characteristics of the students who choose dual credit, Advanced Placement, Both, or Neither as part of their high school coursework?
    a. Among the students who attend the University of Kansas immediately following high school graduation, what are the characteristics of the students who choose dual credit, Advanced Placement, Both, or Neither as part of their high school coursework?
2) Is there a relationship between whether students chose a two-year or four-year college, and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither?
    a. Among the students who attended a four-year institution, is there a relationship between the selectivity of postsecondary school and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither?
3) Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between second year

college persistence and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither?

   a. Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between second year college persistence and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither in college preparatory English?
   b. Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between second year college persistence and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither in Calculus?

4) Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between time to degree completion and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither?
   a. Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between time to degree completion and whether students took high school

coursework for dual credit, Advanced Placement, Both, or Neither in college preparatory English?

b. Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between time to degree completion and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither in Calculus?

5) Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between freshman-year GPA, and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither?

a. Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between freshman-year GPA, and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither in college preparatory English?

b. Among the students who attend the University of Kansas immediately following high school graduation, controlling for background variables (i.e. gender, race, ACT score, high school GPA, and family income level), what is the relationship between freshman-year GPA, and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither in Calculus?

The subjects used for this study are graduates from the Shawnee Mission School District, which is a large public suburban school district located in the Kansas City metropolitan area. I examined Shawnee Mission high school graduates from the class of 2005 through the class of 2009 along with their subsequent college enrollment histories to determine which program option is better for the college outcomes of Shawnee Mission graduates: dual enrollment, Advanced Placement, Both, or Neither. The dependent variables are college selection (2-year or 4-year) and college selectivity across all postsecondary institutions, and college persistence, freshman college GPA, and the time to completion of students who enroll at the University of Kansas immediately following high school graduation. Detailed analysis is limited to students who enroll at KU in the first semester following their school graduation from Shawnee Mission because significant portion of Shawnee Mission graduates enroll at KU and access to freshman grade-point average and knowledge of subject-specific dual enrollment credits requires a merging of data between Shawnee Mission School District and KU.

Researchers may define a number of labels that I use in this study differently. In order to ensure clarity, I am providing operational definitions and descriptions of critical terms that appear in my results and discussion.

Dual Enrollment (DE) means that high school students enroll in community college or university courses and apply the credits earned to their high school transcript immediately upon satisfactory completion of the course. Many organizations also refer to dual enrollment model as *dual credit* or *concurrent enrollment.* The meaning of dual credit and concurrent enrollment are inconsistent in the literature because usage in implementation varies across states and local institutions (Allen, 2010). While each model is distinct, all of them provide opportunities for high school students to enroll in college-level courses.

In my analysis and subsequent discussion, I limit the definition of dual enrollment to students who complete a college level course at their home high school under the direction of the high school teacher, and earn credit at the high school as well as in the equivalent course at the local community college. Under this model, the teacher's primary employment is with the high school and the local community college and school district administrators share responsibility for quality control. In order for the school to offer dual enrollment courses to students, teachers must meet the same qualifications for teaching their respective course as the adjunct faculty members. Students must meet minimum qualifications by completing the college's enrollment process and by meeting the same prerequisite skills for enrolling in a course as all other college students. Note that concurrent enrollment, dual enrollment, and dual credit may be used interchangeably without clarity.

The term *four-year college* includes universities and colleges that offer bachelor's degrees. *A two-year college* refers primarily to community colleges and institutions that offer associates degrees. Classifying a college as four-year or two-year is determined by listings from the National Student Clearinghouse (NSC) and Barron's Guide to American Colleges (Barron's, 2005, 2012).

Advanced Placement (AP) Students are students who complete at least one Advanced Placement course while in high school and complete the exam. Students who complete the course without completing the AP exam are not designated as *AP Students*. In this study, students who participated in both AP exams and in dual enrollment are categorized separately from students who only participate in the AP exams.

College Persistence refers to the desire and action of a student to stay in college from first year through graduation. I measure college persistence dichotomously by whether or not a

student enrolled for a third consecutive semester of college after graduating from high school. I examine persistence from an institutional perspective, which considers whether a student remained at KU or not. This measurement does not consider whether students continued their college education at another institution. Transfers between institutions is increasingly common (Attewell et al., 2011). However, very few students in the study population who left of KU after one year enrolled at a different college in the third semester.

College Completion refers to the time students take to complete the entire required course requirements and obtaining a four-year degree from first semester through graduation. College completion data for students entering four-year programs were evaluated using only graduates from 2005 and 2006 in order to allow for a minimum of six years for degree-completion. The number of semesters of college after high school graduation that a student enrolls in prior to completion of the undergraduate degree measures the time to college completion. Only the fall (August to December) and spring (January to May) enrollment periods are considered and summer enrollments ignored.

The *ACT*, formerly known as the American College Test, is a college admission test sponsored by the ACT organization. The test consists of English, math, reading, and science sections as well as a total composite score. ACT reports a score for each section and the total on an integer scale of 1 to 36. ACT also collects demographic and financial information from students through their registration process including estimates of their family income.

About Shawnee Mission

The Shawnee Mission School District spans parts of the first and second-ring suburbs surrounding the metropolitan core of Kansas City, Missouri. The district encompasses cities that are directly adjacent to Kansas City as well as cities that are one layer outside of those cities. In

the school years of 2005 through 2009, the district served approximately 27,000 students each year in grades kindergarten through twelve in fourteen cities through thirty-five elementary, seven middle, and five high schools. Each of the high schools serves approximately 2000 students from grades nine through twelve in a traditional public high school setting. In 2007, the demographic makeup across all five high schools was 81% White, 8% Hispanic, 7% Black, 4% had a home language other than English, and 11% qualified for federal lunch support.

Shawnee Mission high schools offer a variety of programs that promote college access and success. The district offers 145 honors, Advanced Placement, and International Baccalaureate courses. Many of these courses are included in a series of articulation agreements with Johnson County Community College (JCCC), which offers students the opportunity to enroll concurrently at JCCC in an 'equivalent' course while participating in the high school course. The district also provides a variety of *Signature* programs, in specialized areas of study including biotechnology, Project Lead the Way, legal studies, international studies, biomedical health science, and pre-medical health science. Signature programs give students the opportunity to investigate career options and educational requirements, explore trends in that career field, and shadow professionals at their work places. Many of the programs also provide opportunities for students to earn special certification credentials upon completion of the program.

Among the college-preparatory transition programs offered by Shawnee Mission schools, Advanced Placement and concurrent (or dual) enrollment with JCCC are by far the most popular options chosen and they share the largest number of high school courses. For example, students who enroll in English 12 AP, Calculus BC, or United States History AP may choose to complete the Advanced Placement exam, enroll concurrently in an equivalent course at JCCC, participate in both programs, or not participate in either program. Students who enroll in IB Math SL only

have one option, which is to complete the IB Math SL exam. Research generally supports student participation in Advanced Placement or dual enrollment compared to non-participation (Burton et al., 2002; Dodd et al., 2002; Dougherty et al., 2006; Dutkowsky et al., 2006; Ewing, 2006; Karp et al., 2007; Mattern et al., 2009; McCauley, 2007; Willingham & Morris, 1986). However, this study helps us to understand whether choosing AP, DE, Both, or Neither provides an advantage to students when they go to college or whether a coin flip may be sufficient.

Barron's College Admissions Selector

Barron's College Admissions Selector describes the criteria or context prospective students will face when applying for admission (Barron's, 2005). Barron's Profiles of American Colleges has provided updates of college profiles almost every year since 1964. With each edition, Barron's classifies American colleges into six categories of selectivity: Most Competitive, Highly Competitive, Very Competitive, Competitive, Less Competitive, and Non Competitive. High school class rank, median ACT or SAT scores, and the percent of applicants admitted are the primary characteristics used to place colleges in these categories. In addition, colleges that only offer specialized programs, such as schools of art or music, may have admissions requirements that based primarily on non-academic criteria. Examples include the Juilliard School in New York and the Kansas City Art Institute in Kansas City, Missouri. Specialized colleges are not classified under one of the six categories listed. Table 5 provides a brief overview of Barron's classifications as well as the classifications I used for this study.

Table 5: Descriptors of Barron's College Admissions Selector Scale

Ratings grouped for this study	Barron's	High School Grades	Median ACT/SAT	Percent Accepted
(3) Most Competitive / Highly Competitive	Most Competitive	Top 10%-20% in class	29 (ACT) 655-800 (SAT I)	Less than of third of applicants
	Highly Competitive	Top 20%-35% in class Grade average of B or better	27-28 (ACT) 620-654 (SAT I)	One third to one half of applicants
(2) Very Competitive / Competitive	Very Competitive	Top 35%-50% in class Grade average of B- or better	24-26 (ACT) 573-619 (SAT I)	One half to three fourths of applicants
	Competitive	Top 50%-65% in class Grade average of B- or better	21-23 (ACT) 500-572 (SAT I)	75%-85% of applicants
(1) Less Competitive / Non Competitive	Less Competitive	Top 65% in class Grade average below C	Below 21 (ACT) Below 500 (SAT I)	85% or more accepted
	Non Competitive*	Completed an accredited high school program	No ACT/SAT requirements	98% or more accepted*

* Colleges that admit 98% or more of their applicants and colleges that admit all state residents who apply are automatically rated Non Competitive.

A brief examination of Table 5 shows that schools may not necessarily fit cleanly into a single category. For example, some highly selective schools may have median ACT or SAT scores that fall above the stated median of 28 (ACT) or 654 (SAT). Other highly selective schools may have acceptance rates below 33%, which are more reflective of schools classified as Most Competitive. The percent of applicants accepted depends on the number of students who decide to apply in a particular year. Hence, some colleges will fluctuate between categories over time even without changing their admissions policies. In addition, colleges can change their admissions standards, which also affect these rankings over time. Barron's partially compensates for this problem by inserting a '+' to some categories.

The Barron's rating of the University of Kansas (KU) is a local example of changing Barron's rankings and overlap between categories. According the Barron's guide from 2005, KU was Very Competitive and had a median ACT score of 24 (Barron's, 2005). By 2012, KU moved down a level to Competitive+, yet their median ACT score increased to 25 (Barron's,

2012). During the same period, KU's percent of applicants accepted increased from a number below 75% to a rate slightly above 75%. Rather than attempting to obtain Barron's guides for every year associated with the high school graduates in this study, I am using Barron's ratings from 2005 as well as from 2012 and then calculating the average of the two.

Although selectivity of a college is a questionable measure of college quality, higher levels of selectivity are associated with higher graduation rates and higher salaries after degree completion (Schmidt, Burroughts, Cogan, & Houang, 2011). Despite the challenges and at the risk of overstating college quality, examining these relationships sheds some light on whether students should consider their choice of on dual enrollment or Advanced Placement participation in the context of applying for admission to colleges with higher selectivity rankings.

Data Sources and Collection Methods

The data collected for this research came from multiple sources housed in the Shawnee Mission School District in Overland Park, Kansas and with the Office of Institutional Research at the University of Kansas. Table 6 provides an overview of the data items, data sources, and formats used in the electronic files. The data set used for my analysis was limited to students who completed at least one high school course that offers college credit-attainment opportunities from dual enrollment through JCCC as well as through an Advanced Placement examination.

Students' high school course enrollment data, demographics, and ACT scores came from electronic transcripts provided by the Shawnee Mission School District. Advanced Placement results came from data files provided by the College Board and purchased by the Shawnee Mission School District. Students' college enrollment data came from the National Student Clearinghouse®, which provides information for degree and enrollment verification from more than 90% of two-year and four-year colleges nationwide (NSC). Shawnee Mission has a

subscription to this clearinghouse and the district receives updated reports three times per year. I also used the NSC data to identify which students enrolled in one or more courses for dual credit. Unfortunately, the Clearinghouse does not indicate the specific college courses students enrolled in while in high school.

The University of Kansas Office of Institutional Research and Planning (KU-OIRP) provided the data needed to examine the population of students who enrolled at KU in the first semester following their graduation from Shawnee Mission. Specifically, KU-OIRP identified which math and English courses students transferred from Johnson County Community College (JCCC), which has been the primary provider of dual enrollment credits for Shawnee Mission students. I used this information to pinpoint exactly which students completed math or English credits through dual enrollment. KU-OIRP also provided the first semester college grade-point average for each Shawnee Mission graduate. The college grade-point average is another indicator of early college success. In exchange, KU-IORP is using the Shawnee Mission transcript data to explore additional research questions that are beyond the scope of this study.

Table 6: Overview of Data Sources and Format

Data Item	Data Source	Format
College Enrollment	National Student Clearinghouse Data (purchased by SMSD)	Name of College 4-Year: Yes/No
College Selectivity	Barron's Guide to American Colleges	Selectivity Level (1-5)
College Freshman GPA	University of Kansas (provided by KU-OIRP)	Numeric
College Persistence	National Student Clearinghouse Data (purchased by SMSD)	Yes/No
Years to College Degree Completion	National Student Clearinghouse Data (purchased by SMSD)	Numeric
AP Participants and Scores	College Board AP data file (purchased by SMSD)	Subject / Course / Scores (1-5)
	University of Kansas (provided by KU-OIRP)	Math/English course name transferred in and method of transfer (AP or JCCC/DE)
Dual Enrollment Students	National Student Clearinghouse Data (purchased by SMSD)	Yes/No
	University of Kansas (provided by KU-OIRP)	Math/English course name transferred in and method of transfer (AP or JCCC/DE)
	SMSD student information system transcript files	(used to verify HS enrollment in matching DE/AP course)
Gender Race HS GPA	SMSD student information system transcript files	M/F White/Non-White Numeric
ACT Score	ACT raw data file archives (purchased by SMSD)	Number (1-36)
Family Income		Income Ranges (1-9)

The University of Kansas Human Subjects Committee approved the research project application on February 1, 2012. The research presents no risk to participants and involves no procedures for which written consent is normally required. The student subjects are graduates from each of the five high schools in the Shawnee Mission Unified School District (SMSD), located in Overland Park, Kansas. Specifically the target population includes graduates from the classes of 2005 through 2009 who completed high school courses that provide opportunities for concurrent enrollment and Advanced Placement (AP) testing. This group is a diverse sampling

that includes both genders, and students with a variety of family income levels and ability levels (as indicated by ACT data). I selected college-bound graduates from multiple years to minimize the effects of single-year population or program changes. No physical or health conditions such as special education designations were used in this study.

I identified the subjects using the data from SMSD records of students who graduated from any of its five high schools and who completed one or more courses that provide opportunities for dual/concurrent enrollment or AP testing. The Shawnee Mission Assessment and Research Department provided transcript, assessment, and demographic data. The University of Kansas Office of Institutional Research and Planning (KU-OIRP) provided specific college course enrollment information and college freshman grade point averages.

Data collection involved a multi-step process that ensured the confidentiality of individually identifiable information. First, I constructed a database with all of the Shawnee Mission data fields completed. Data provided by Shawnee Mission included each subject's gender, race, family income level, final high school GPA, ACT score, and college enrollment information. I specially coded field names and data elements for all demographic and academic variables (race, gender, family income race, HS course work, AP scores, ACT scores, and high school GPA) in order maintain confidentiality of individual data elements. Translations for decoding these demographic and academic fields remained with the SMSD Assessment & Research Department. When this database was completed, I shared the files with KU-OIRP through a secure file sharing connection. KU-OIRP staff added University of Kansas data on credits transferred by incoming freshman in math and English, first semester college freshman GPA, and first semester freshman total credits earned by matching student name, student birth date, high school graduation year, and college enrollment status indicated by the clearinghouse

data. KU-OIRP staff then removed all identifiers such as name and identification numbers and codes before returning the file to Shawnee Mission. Analysis then took place on a secure server under the supervision of the Shawnee Mission School District Department of Assessment and Research. All students maintained anonymity throughout the process.

In order to compare whether dual enrollment or Advanced Placement participation have differential effects on student persistence, time to degree attainment, college freshman GPA, and college selection, this study will use both a causal model and a quasi-experimental analysis. Table 4 summarizes the variables and type of analysis that I used to answer each of the research questions. My analysis includes inferential statistics, by way of the Chi-squared test, analysis of variance, logistic regression, and multiple regression analysis.

The Chi-squared and analysis of variance tests are applied to determine whether there is a relationship between the student background factors (race, gender, family income, HS GPA, and ACT score) and whether students participated in AP, DE, Both, or Neither. The two tests are also used to determine whether there is a relationship between college characteristics (choice and selectivity) and whether students participated in AP, DE, Both, or Neither.

The logistic and multiple regression analyses explore the total and direct effects of participation in dual enrollment alone, AP alone, and AP/DE combined, controlling for student demographic and high school attributes upon the dependent variables describing post-secondary persistence, time to completion, and early college success. I use logistic regression analysis for examining post-secondary persistence because persistence is a bivariate value representing ‘yes’ or ‘no’. I use multiple regression analysis for examining the number of years to degree completion and early college success measured by college freshman GPA.

Table 4: Overview of Research Questions, Variables Used, and Type of Analysis

Research Question	Independent Variable(s)	Dependent Variable(s)	Control Variable(s)	Statistical Analysis
1 Characteristics	Type of program (DE/AP/Neither/Both)		Gender Race ACT Score HS GPA Family Income Type of college	Descriptive Chi-Square & One-Way ANOVA
2 College Choice & Selectivity	Type of program (DE/AP/Neither/Both)	Type of college (2-yr/4-yr) 4-yr selectivity		 Chi-Square
3 College Persistence	Type of program (DE/AP/Neither/Both)	Persistence at KU (Y/N) Persistence to any college (Y/N)	Gender Race ACT Score HS GPA Family Income	 Logistic Regression
4 Time to Completion	Type of program (DE/AP/Neither/Both)	Number of years to complete degree	Gender Race ACT Score HS GPA Family Income	 Multiple Regression
5 College Freshman GPA	Type of program (DE/AP/Neither/Both)	Freshman GPA	Gender Race ACT Score HS GPA Family Income	 Multiple Regression

Limitations of the Data and Methodology

There are a number of limitations of the data and methodology. First, the data set is limited to graduates from five high schools that belong to a single large Midwestern suburban school district. While the students are diverse by income levels, ability, and gender, other demographic characteristics are less diverse. More than 80% of the graduates from the class of 2005 through the class of 2009 are White and fewer than 10% received federal lunch support while in high school. Hence, the data set contains few low-income or minority students.

In addition, given the geographic location of the school district, a majority of college-bound graduates attend only a small number of in-state colleges. Among the Shawnee Mission students who enroll in a postsecondary program following their high school graduation,

approximately 37% attend Johnson County Community College, 29% attend the University of Kansas (KU), 15% attend Kansas State University, and the remainder enroll in a long list of more than three hundred other two- and four-year college programs (NSC). Students earning credit through dual enrollment received their credit through a single institution: Johnson County Community College. Hence, the effects of dual enrollment programs on student outcomes in college may be limited to secondary-postsecondary partnerships that mirror the partnerships between Shawnee Mission and JCCC.

Another limitation is that the research design does not account for all potential input and environmental variables. The most notable of these is student involvement, engagement, or integration in college (Astin, 1999; Kuh, 2001; Kuh, Schuh, Whitt, et al., 1991; Tinto, 1993). While detailed data on student high school transcripts was readily available, there remains a disconnect between high school and college level data that makes controlling for both high school and college level factors very difficult. The data and subsequent analysis used for this study may also not remove all selection bias among students who participate in AP, DE, Both, and Neither. Students who participate in college preparatory courses offering college credit are already the most academically talented students in the school and they self-select into their respective groups. While not practical, randomly assigning students to participation in AP, DE, Both, or Neither may increase the reliability of my findings.

Even with these limitations, the results of this study provide useful information in the debate over whether to promote dual enrollment, Advanced Placement, some combination of both programs, or neither as the best choice for maximizing student success in college. In particular, the findings of this study examine whether Advanced Placement or dual enrollment

provides better opportunities for Shawnee Mission students to choose better colleges, persist in those colleges, and graduate earlier.

CHAPTER 4

RESULTS

Overview

This chapter is divided into three sections based on the research questions and type of analysis used. I describe the populations of students who chose to participate in Advanced Placement (AP), dual enrollment (DE), some combination of both programs, or neither, and I identify any notable differences between these populations. Then I examine the college choices of students in each of these groups according to the percent of students who enroll in four-year colleges and by the selectivity of the four-year colleges students chose. In the third section, I narrow the study population to students who attended the University of Kansas and determine whether there is a relationship between student success at KU and student participation in AP, DE, Both, or Neither. There is a summary of observations at the end of each section as well as a summary of all findings at the end of this chapter.

The first section examines the descriptive characteristics of students who completed courses that offered Advanced Placement (AP) testing and dual enrollment (DE) choices by their college credit attainment choices of AP, DE, Both, or Neither. The comparisons include Chi-Square tests and analysis of variance, depending on whether the predictor variable is categorical or continuous. Analysis includes all students in the data set as well as the subset of students identified as attending the University of Kansas immediately following high school graduation.

In the second section, I examine students' college choices, including whether students who chose AP, DE, Both, or Neither attended a four-year college. I extend the analysis of students attending four-year colleges to determine whether there are meaningful differences in

the selectivity of the college among students who chose AP, DE, Both, or Neither as defined by Barron's College Admissions Selector (Barron's, 2005, 2012).

In the final section of this chapter, I focus exclusively on the subset of AP/DE students who attended the University of Kansas (KU) immediately following high school graduation. Criterion variables in this section include whether students persisted by enrolling in a third semester at KU, the number of years students take to complete a four-year degree, and first semester freshman GPA at KU. I narrow the focus from the first two sections by examining the relationship between persistence, college freshman GPA, time to degree completion and whether students took high school coursework for AP, DE, Both, or Neither. I extend the analysis in each of these areas even further by examining the subsets of students who completed AP/DE Calculus and AP/DE English while in high school. Comparisons include logistic and multi regression models with controls for gender, race, student ability (ACT composite and high school GPA), and family income level.

Student and Family Characteristics

My first goal in examining student participation in Advanced Placement (AP), dual enrollment (DE), Both, or Neither is to consider the background variables for each of these groups. The research design later in this chapter includes controls for these variables, which include gender, race, composite ACT scores, high school GPA, and family income level. Before proceeding with these controls, we must first examine the degree to which participants in AP, DE, Both, and Neither share characteristics. For example, if AP students are predominantly male and DE students are predominantly female, then attempting to control for gender may skew our conclusions about the effects of AP or DE on college choice and outcomes. An examination of

the four groups will provide additional insight into how students choose make their college preparatory decisions.

Table 7 contains descriptive characteristics for all Shawnee Mission graduates who participated in DE/AP courses while in high school. Inspection of this table reveals the overall characteristics of each group. Students identified as DE Only are 93% White and 41% male. Their mean high school GPA is 3.78 and their mean ACT Composite score is 25.0. 85% of DE Only students attended four-year colleges immediately following their high school graduation Students identified as AP Only are 88% White and 48% male. Their mean high school GPA is 4.04 and their mean ACT Composite score is 28. 92.9% of AP Only students attended four-year colleges immediately following their high school graduation. Students who took advantage of AP and DE programs (Both), are 91.6% White and 47.7% male. Their mean high school GPA is 4.12 and their mean ACT Composite score is 28. 93.9% of students in Both attended four-year colleges immediately following their high school graduation. Finally, students who completed AP/DE courses, but did not participate in either AP or DE (Neither) are 84.0% White and 52% male. Their mean high school GPA is 3.36 and their mean ACT Composite score is 23.9. 74.3% of students in Neither attended four-year colleges immediately following their high school graduation.

Table 7: Descriptive Demographic, Achievement, and College-Going Characteristics for All DE/AP Course Participants (N=4,734)

Group (ALL)	White	Male	HS GPA	ACT Composite	4-Year College†
DE Only	93.0%	41.4%	3.780 (0.506)	25.030 (3.627)	84.6%
AP Only	88.0%	47.5%	4.040 (0.545)	28.205 (3.804)	92.9%
Both	91.6%	47.7%	4.124 (0.487)	28.132 (3.697)	93.9%
Neither	84.0%	51.9%	3.359 (0.581)	23.874 (3.693)	74.3%

† Statistic limited to students known to be going to a two or four year college.

Table 8 shows the same descriptive characteristics as Table 7, but for the subset of students who enrolled at the University of Kansas. A visual inspection of both tables reveals similar patterns in demographic and academic characteristics. DE Only students at KU are 92.5% White and 43.4% male. Their mean high school GPA is 3.79 and their mean ACT composite score is above 25. KU students identified as AP Only are 87.4% white, 53% male, have a mean high school GPA of 3.9, and a mean ACT Composite score above 27. KU students identified as Both are 92.1% white, 51% male, with a mean high school GPA of 4.1 and a mean ACT Composite score above 28. Finally, KU students identified as Neither are 84.3% white, 59% male, have a mean high school GPA of 3.4 and a mean ACT Composite score above 24.2.

Table 8: Descriptive Demographic and Achievement Characteristics for DE/AP Course Participants who enroll at the University of Kansas (N=1,290)

Group (KU Students)	**White**	**Male**	**HS GPA**	**ACT Composite**
DE Only	92.5%	43.4%	3.788 (0.494)	25.131 (3.493)
AP Only	87.4%	52.9%	3.906 (0.529)	27.804 (3.761)
Both	92.1%	50.9%	4.086 (0.524)	28.077 (3.738)
Neither	84.3%	59.4%	3.392 (0.500)	24.208 (3.439)

While simply reviewing the descriptive statistics and making general observations begins the conversation regarding the differences in characteristics between students who participate in AP, DE, Both, or Neither, additional tests are required to determine whether the observed characteristics are significantly different than expected if students were to be randomly distributed. Table 9 contains the results of a Chi-Square test comparing student participation in AP, DE, Both, and Neither by student race. The overall significance value of 0.00 (< 0.05) indicates that there is a significant difference between expected and observed results within the table. Additional post-hoc analysis points to the student selections where significant differences exist. In particular, Non-White participation in DE Only is well below expected values with

standard residual of -4.8. In contrast, the number of Non-White students that completed AP/DE courses and did not participate in either AP or DE is well above expected values with a standard residual of +5.9. AP Only is the only group with residuals closest to zero, which indicates that their racial make-up is near expected values.

Table 9: Chi-Square Test on College Readiness Choice by Race/Ethnicity

		AP / DE Status				
		AP Only	**DE Only*** **	**Both***	**Neither*** **	**Total**
Non-White	Count	110	125	57	218	510
	Expected Count	98.7	191.2	73.5	146.6	510.0
	Std. Residual	1.1	-4.8	-1.9	5.9	
White	Count	806	1650	625	1,143	4,224
	Expected Count	817.3	1,583.8	608.5	1,214.4	4,224.0
	Std. Residual	-0.4	1.7	0.7	-2.0	
Total	Count	916	1,775	682	1,361	4,734
	Expected Count	916.0	1,775.0	682.0	1,361.0	4,734.0
	Pearson Chi-Square	*70.240*	*3*	*.000*		
	Likelihood Ratio	*69.209*	*3*	*.000*		
	N of Valid Cases	*4,734*				

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

Table 10 contains the results of a Chi-Square test comparing AP, DE, Both, and Neither by student gender. The overall significance value of 0.00 (< 0.05) indicates that there is a significant difference between expected and observed results. Further post hoc analysis indicates the greatest differences between expected and actual participation by gender occur among students who participated in DE Only or Neither. Most notably, female students participated in DE Only at higher than expected rates while male did not participate in either AP or DE at higher than expected levels. Student participation in AP Only and Both are near expected values for gender distribution.

Table 10: Chi-Square Test on College Readiness Choice by Gender

		AP / DE Status				
		AP Only	**DE Only*** **	**Both**	**Neither*** **	**Total**
Female	Count	481	1,041	357	655	2,534
	Expected Count	490.3	950.1	365.1	728.5	2,534.0
	Std. Residual	-0.4	2.9	-0.4	-2.7	
Male	Count	435	734	325	706	2,200
	Expected Count	425.7	824.9	316.9	632.5	2,200.0
	Std. Residual	0.5	-3.2	0.5	2.9	
Total	Count	916	1,775	682	1,361	4,734
	Expected Count	916.0	1,775.0	682	1,361.0	4,734.0
	Pearson Chi-Square	*35.432*	*3*	*.000*		
	Likelihood Ratio	*35.506*	*3*	*.000*		
	N of Valid Cases	*4,734*				

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

In this study, I use high school grade point average and ACT composite scores to measure students' academic abilities prior to college. *High school grade point average* from the Shawnee Mission School District is a weighted calculation that provides additional weighting (+1.0 points) for courses designated as honors. Honors courses include courses that offer Advanced Placement and dual enrollment options such as English AP and Calculus. The grade point average also adds extra weighting (+0.86) for credits earned beyond a minimal threshold of twenty-three credits earned. Hence, students may earn grade point averages extending beyond the traditional 4.0 scale. Table 11 provides further illustration of the distributions of grade point averages for students who participated in courses that offer Advanced Placement testing and dual enrollment. Mean GPA for all students in the data set as well as mean GPA for students who attended KU are between 3.78 and 4.12, and maximum high school GPA's are between 4.7 and 5.0.

Table 11: Descriptive GPA Statistics for All DE/AP Course Participants and for Students who enroll at the University of Kansas

Group	All Students				KU Students			
	N	Mean GPA	SD	Max. GPA	N	Mean GPA	SD	Max. GPA
DE Only	1,774	3.780	0.506	4.850	604	3.788	0.494	4.743
AP Only	916	4.040	0.545	5.009	191	3.906	0.529	4.885
Both	682	4.124	0.487	4.918	214	4.086	0.524	4.902
Neither	1,359	3.359	0.581	4.850	281	3.392	0.500	4.850

The results of a one-way ANOVA shown in Table 12 reveal that significant differences exist between grade point averages across all students who participate in AP, DE, Both, or Neither. From this table, it is clear that a student's choice to participate in AP Only, DE Only, Both, or Neither is related to high school GPA. The groups may be ranked in order from highest grade point average to lowest: Both (4.124), AP Only (4.040), DE Only (3.780), Neither (3.359). Given the significant differences, controlling for high school GPA is critical in determining whether participation in AP, DE, Both, or Neither have any differential effects on college outcomes.

Table 12: One-Way ANOVA Comparing Mean HS GPA for All DE/AP Course Students

	DE Only	Both	Neither
AP Only	0.26***	-0.08**	0.68***
DE Only		-0.34***	0.42***
Both			0.76***

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

Like the data shown on high school GPA, Table 13 provides an overview of *ACT Composite scores* among students who participated in courses that offer Advanced Placement testing and dual enrollment. This table includes all students in the data set, regardless of college choice as well as students who attended the University of Kansas. At least one student identified as AP Only earned a 36 on the ACT, which is the highest score possible for that exam. Students in DE Only have a mean ACT score of 25 among all students as well as among the subset of

students who attended KU. AP Only students and their respective subset at KU earned a mean ACT score of 28, as did students identified as Both. Finally, students identified as Neither earned an average composite score of 24 among all students in the data set as well as the subset of students who attended KU.

Table 13: Descriptive ACT Statistics for All DE/AP Course Participants and for Students who enroll at the University of Kansas

Group	All Students				KU Students			
	N	Mean ACT	SD	Max. ACT	N	Mean ACT	SD	Max. ACT
DE Only	1,702	25.03	3.627	35	590	25.13	3.493	34
AP Only	853	28.21	3.804	36	184	27.80	3.761	36
Both	665	28.13	3.697	35	209	28.08	3.738	35
Neither	1,163	23.87	3.693	35	269	24.21	3.439	35

The results of a one-way ANOVA shown in Table 14 reveal that significant differences exist between ACT Composite scores across students who participate in AP, DE, Both, or Neither. For some groups, it is clear that a student's choice to participate in AP Only, DE Only, Both, or Neither is related to ACT scores. Students identified as AP Only and Both do not earn significantly different ACT scores. However, significant differences exist among all other pairings. Students identified as AP Only or Both earn the highest ACT scores, followed by DE Only, with Neither students earning the lowest ACT scores. Like high school GPA, controlling for student ACT performance is critical in determining whether participation in AP, DE, Both, or Neither have differential effects on college outcomes.

Table 14: One-Way ANOVA Comparing Mean ACT Composite Scores for All DE/AP Course Students

	DE Only	Both	Neither
AP Only	3.18***	0.07	4.33***
DE Only		-3.10***	1.16***
Both			4.26***

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

In addition to examining student characteristics of race, gender, and academic ability, family characteristics may also influence whether students participated in AP, DE, Both, or Neither. ACT asks students to categorize their annual *family income* in one of nine choices, which allows us to examine socioeconomic status across a wide range of income levels. Measuring socio-economic status from the ACT data set provides a more diverse picture of students' economic resources than the federal lunch support indicator typically used with K-12 populations. I condensed the nine family income categories provided by ACT into four income ranges:

(1) Less than $30,000
(2) About 30,000 to $60,000
(3) About $60,000 to $100,000
(4) More than $100,000

While nearly all college bound students in Shawnee Mission participate in the ACT, students are not required provide information on family income with their registration materials.

Table 15 shows the number of students who participated in the ACT and provided family income information. 71.4% of graduates who participated in courses offering AP/DE also reported family income and ACT exam results. In some instances, there was also no ACT score available. For example, among students identified as DE Only, 73 did not have an ACT score.

Table 15: Summary of College Preparatory Activities and Whether ACT Family Income Level is Provided

Group	Totals	Provided Family Income Level and ACT	No Family Income Level Provided	No ACT Score
DE Only	1,775	1,315 (74.1%)	460	73
AP Only	916	660 (72.1%)	256	63
Both	682	503 (73.8%)	179	17
Neither	1,361	904 (66.4%)	457	198
Total	**4,734**	**3,382 (71.4%)**	**1,352**	**351**

Table 16 shows the distribution of the study population across each of the ACT income levels. Among the students who provided family income levels, 15% of families earned less than $30,000, 32% earned between $60,000 and $100,000, while nearly 29% earned more than $100,000. Overall, approximately 29% of students did not provide a family income. One concern about this statistic was whether to exclude students who did not provide family income from the regression analyses later in this chapter. In order to evaluate whether to include these students, I used Chi-Square analysis to compare the distribution of all AP/DE students as well as among only AP/DE students who provided income levels. The results of these analyses, which appear in Table 17 and Table 18 and yield same conclusions, indicated to me that excluding the students might not be necessary.

Table 16: Summary of Study Participants and ACT Family Income Level

Family Income Level	**Number of Students**	**Percent of Total**	**Percent with Income Level Provided**
(1) Less than $30,000	499	10.5%	14.8%
(2) 30,000 to $60,000	825	17.5%	24.5%
(3) $60,000 to $100,000	1085	22.9%	32.1%
(4) More than $100,000	973	20.6%	28.8%
Data Not Provided	1,352	28.6%	
Total	**4,734**		

Table 17 contains the results of a Chi-Square test comparing AP, DE, Both, and Neither by family income level. This table included students whose income level was not available. The overall significance value of 0.00 (< 0.05) indicates that there is a significant difference between expected and observed results. Further post hoc analysis indicates the greatest differences between expected and actual family income level occur among students who participated in DE Only or Neither. Students who participated in DE Only have higher rates of participation among families who earn more than $60,000 and lower rates among families earning less than $60,000

as well as lower rates among students whose family income was not provided. In other words, students who could afford the tuition for DE were more likely to participate compared to students with lower family incomes. In contrast, students who did not participate in either AP or DE have lower than expected rates of participation among families earning more than $60,000 with standard residuals of -3.4 and -3.7. Students not participating in AP or DE also have higher counts among students whose family income is not provided. Student participation in AP Only and Both is very close to expected values for family income distribution.

Table 17: Chi-Square Test on College Readiness Choice by Family Income with All Participants

		AP / DE Status				
		AP Only	**DE Only*** **	**Both**	**Neither*** **	**Total**
Less than $30,000	Count	112	165	69	153	499
	Expected Count	96.6	187.1	71.9	143.5	499.0
	Std. Residual	1.6	-1.6	-0.3	0.8	
$30,000 to $60,000	Count	148	292	104	281	825
	Expected Count	159.6	309.3	118.9	237.2	825.0
	Std. Residual	-0.9	-1.0	-1.4	2.8	
$60,000 to $100,000	Count	201	464	168	252	1,085
	Expected Count	209.9	406.8	156.3	311.9	1,085.0
	Std. Residual	-0.6	2.8	0.9	-3.4	
More than $100,000	Count	199	394	162	218	973
	Expected Count	188.3	364.8	140.2	279.7	973.0
	Std. Residual	0.8	1.5	1.8	-3.7	
Family Income not Provided	Count	256	460	179	457	1,352
	Expected Count	261.6	506.9	194.8	388.7	1,352.0
	Std. Residual	-0.3	-2.1	-1.1	3.5	
Total	Count	916	1775	682	1,361	4,734
	Expected Count	916.0	1775.0	682.0	1,361.0	4,734.0
	Pearson Chi-Square	*76.121*	*12*	*.000*		
	Likelihood Ratio	*76.637*	*12*	*.000*		
	N of Valid Cases	*4,734*				

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

Like Table 17, Table 18 contains the results of a Chi-Square test comparing AP, DE, Both, and Neither by family income level. However, the data excludes students whose income level was not available. The overall significance value of 0.00 (< 0.05) indicates that there is a significant difference between expected and observed results. Further post hoc analysis indicates that differences exist between expected and actual family income levels occur among students

who participated in DE Only or Neither. Conclusions drawn from analyses in Table 17 and Table 18 are the same. Like Table 17, the results shown in Table 18 indicate that students identified as DE Only have higher incomes. Similarly, students who did not participate in either AP or DE tend to be from lower income families with participation among families earning more than $60,000 showing standard residuals of -2.2 and -2.6 among higher income families. Student participation in AP Only and Both is very close to expected values for family income distribution.

Table 18: Chi-Square Test on College Readiness Choice by Family Income among Participants Providing a Family Income Level

		AP / DE Status				
		AP Only	**DE Only*** **	**Both**	**Neither*** **	**Total**
Less than $30,000	Count	112	165	69	153	499
	Expected Count	97.4	194.0	74.2	133.4	499.0
	Std. Residual	1.5	-2.1	-0.6	1.7	
$30,000 to $60,000	Count	148	292	104	281	825
	Expected Count	161.0	320.8	122.7	220.5	825.0
	Std. Residual	-1.0	-1.6	-1.7	4.1	
$60,000 to $100,000	Count	201	464	168	252	1085
	Expected Count	211.7	421.9	161.4	290.0	1,085.0
	Std. Residual	-.7	2.1	0.5	-2.2	
More than $100,000	Count	199	394	162	218	973
	Expected Count	189.9	378.3	144.7	260.1	973.0
	Std. Residual	0.7	0.8	1.4	-2.6	
Total	Count	660	1,315	503	904	3,382
	Expected Count	660.0	1,315.0	503.0	904.0	3,382.0
	Pearson Chi-Square	*52.825*	*9*	*.000*		
	Likelihood Ratio	*52.177*	*9*	*.000*		
	N of Valid Cases	*3,382*				

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

Summary of Descriptive Characteristics

Results of the descriptive and comparative analyses show that the background characteristics are not distributed randomly among Shawnee Mission graduates who participated in Advanced Placement (AP), dual enrollment (DE), Both, or Neither. Table 19 contains a summary of these findings, which specifically focus on the differences between the AP Only, DE

Only, Both, and Neither groups. Among the students identified as AP Only and Both, participation is near expected levels across races (White/Non-White) and gender. DE Only has higher than expected numbers of students who are White and female while Neither has larger numbers of students who are Non-White and male.

Measures of student ability are also notably different between students who participated in AP, DE, Both, and Neither. Students with the highest high school GPA and the highest ACT Composite scores participated in AP Only or Both while students with the lowest scores participated in Neither. Given the significant differences, controlling for student performance on high school GPA and ACT is critical in determining whether participation in AP, DE, Both, or Neither have any differential effects on college outcomes.

Finally, student reported family income levels are near expected levels for some student groups and different for others. Among the students identified as AP Only or Both, participation is near expected levels across each of the family incomes. The results are the same regardless of whether students without family income data are included. Students identified as DE Only, have more students at the higher income levels and fewer at the lower income levels. The opposite occurs for students identified as Neither with higher than expected numbers of students falling at the lower income levels.

Table 19: Summary of Descriptive Characteristic Comparisons

	AP Only	DE Only	Both	Neither
Race	Near Expected Levels	More White	Near Expected Levels	More Non-White
Gender	Near Expected Levels	More Female	Near Expected Levels	More Male
HS GPA	Ranked 2nd	Ranked 3rd	Ranked 1st	Ranked Lowest
ACT Composite	Tied for 1st with Both	Ranked 2nd	Tied for 1st with AP Only	Ranked Lowest
Family Income	Near Expected Levels	More Higher Income	Near Expected Levels	More Lower Income

College Choice and Selectivity

My second task is to determine whether there is a relationship between a two-year or four-year college, and whether students took high school coursework for AP, DE, Both, or Neither. Among the DE/AP/Both/Neither students who attended a college immediately following their graduation from high school, approximately 85.1% attended a four-year college. Given that all of these students participated in college preparatory courses, we can suppose that approximately 85.1% of the students in each of the DE/AP/Both/Neither groups also attended. However, the residuals resulting from the Chi-Square test shown in Table 20 indicate that students who participate in AP Only or Both have higher levels of participation in four-year colleges and that students identified as Neither have lower levels of participation. Students identified as DE Only enroll in four-year colleges at expected rates compared to what could be expected from random distribution of students.

Table 20: Chi-Square Test on Four-Year College Attendance

		AP / DE Status				
		AP Only* **	**DE Only**	**Both*** **	**Neither*** **	**Total**
2-Year College or No College Determined	Count	57	250	39	261	607
	Expected Count	119.1	242.0	95.1	150.9	607.0
	Std. Residual	-5.7	0.5	-5.8	9.0	
4-Year College	Count	744	1378	601	754	3,477
	Expected Count	681.9	1386.0	544.9	864.1	3,477.0
	Std. Residual	2.4	-0.2	2.4	-3.7	
Total	Count	801	1628	640	1015	4,084
	Expected Count	801.0	1,628.0	640.0	1015.0	4084.0
	Pearson Chi-Square	*171.648*	*3*	*.000*		
	Likelihood Ratio	*174.768*	*3*	*.000*		
	N of Valid Cases	*4,084*				

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

Among the students attending four-year colleges, 313 schools are represented across a variety of competitive levels. A second important question to examine with regard to college choice is whether there is a relationship between the selectivity of the postsecondary school and whether students took high school coursework for AP, DE, Both, or Neither. Table 21 contains the results of a Chi-Square test comparing college selectivity, using Barron's Selectivity Index, across each of the groups of AP/DE students. The overall significance value of 0.00 (< 0.05) indicates that there is a significant difference between expected and observed results. Further post hoc analysis indicates that differences exist between expected and actual selectivity levels occur among all four groups of students: AP Only, DE Only, Both, and Neither. Students identified as AP Only and Both attend Most Competitive and Highly Competitive colleges while students identified as DE Only and Neither are less likely to attend this group of colleges. Table 21 includes students that attend the University of Kansas, which is a Very Competitive / Competitive institution attended by nearly one fourth of all Shawnee Mission high school graduates.

Table 21: Chi-Square Test on College Readiness Choice by College Selectivity of All Four-Year Colleges

		AP / DE Status				
		AP Only* **	**DE Only*** **	**Both*** **	**Neither*** **	**Total**
Most Competitive / Highly Competitive	Count	168	47	80	31	326
	Expected Count	69.7	129.9	56.7	69.7	326.0
	Std. Residual	11.8	-7.3	3.1	-4.6	
Very Competitive / Competitive	Count	552	1,260	504	656	2,972
	Expected Count	635.9	1,184.1	517.0	635.0	2,972.0
	Std. Residual	-3.3	2.2	-.6	.8	
Less Competitive / Non-Competitive	Count	13	58	12	45	128
	Expected Count	27.4	51.0	22.3	27.3	128.0
	Std. Residual	-2.7	1.0	-2.2	3.4	
Total	Count	733	1,365	596	732	3,426
	Expected Count	733.0	1,365.0	596.0	732.0	3,426.0
	Pearson Chi-Square	*263.901*	*6*	*.000*		
	Likelihood Ratio	*247.567*	*6*	*.000*		
	N of Valid Cases	*3,426*				

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

Table 22 contains the results of a Chi-Square test comparing college selectivity, using Barron's Selectivity Index, across each of the groups of AP/DE students who attended any four-year college except KU. I am including this analysis out of concern that the large enrollment at KU could skew the results shown in Table 21. However, like in Table 21, the overall significance value of 0.00 (< 0.05) indicates that there is a difference between expected and observed results. Further post hoc analysis indicates that differences exist between expected and actual selectivity levels occur among all four groups of students: AP Only, DE Only, Both, and Neither. Even when excluding KU, students identified as AP Only and Both attend Most Competitive and Highly Competitive colleges at higher levels while students identified as DE Only and Neither attend this group of colleges at lower levels compared to random selection.

Table 22: Chi-Square Test on College Readiness Choice by College Selectivity of All Four-Year Colleges except University of Kansas

		AP / DE Status				
		AP Only* **	**DE Only*** **	**Both*** **	**Neither*** **	**Total**
Most Competitive / Highly Competitive	Count	168	47	80	31	326
	Expected Count	82.3	116.3	57.5	69.9	326.0
	Std. Residual	9.4	-6.4	3.0	-4.7	
Very Competitive / Competitive	Count	370	674	293	392	1,729
	Expected Count	436.4	617.0	304.9	370.7	1,729.0
	Std. Residual	-3.2	2.3	-.7	1.1	
Less Competitive / Non-Competitive	Count	13	58	12	45	128
	Expected Count	32.3	45.7	22.6	27.4	128.0
	Std. Residual	-3.4	1.8	-2.2	3.4	
Total	Count	551	779	385	468	2,183
	Expected Count	551.0	779.0	385.0	468.0	2,183.0
	Pearson Chi-Square	*209.181*	*6*	*.000*		
	Likelihood Ratio	*207.932*	*6*	*.000*		
	N of Valid Cases	*2,183*				

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

Summary of College Selection and Selectivity Results

Results comparing selectivity of colleges attended, and whether students participated in AP, DE, Both, or Neither, indicate that the factors are not independent. Students who participate only in AP examinations and students who participate in both AP and dual enrollment enroll in four-year colleges at higher rates compared to the outcome of random distributions. In addition, among the students attending four-year colleges, students who participate in AP and Both enroll in colleges that are more selective. In contrast, students who complete AP/DE courses but do not participate in AP or DE attend four-year colleges at lower rates compared to the outcome of random distributions. In addition, among the students enrolling in four-year colleges, students participating in neither AP nor DE attend less competitive or non-competitive colleges. The results following students who participate only in dual enrollment while in high school fall between the latter and former groups. DE Only students enroll in four-year colleges at a rate

consistent with expected levels. However, DE Only students are less likely to enroll in the most competitive schools compared to a random distribution.

College Persistence, Time to Completion, and Freshman GPA

My final goal in examining student participation in Advanced Placement (AP), dual enrollment (DE), Both, or Neither is to narrow the focus on the effects of these programs on the success of students who attend the University of Kansas immediately following high school graduation. The three dependent or criterion variables are college persistence, freshman GPA at KU, and the number of years to complete a four-year degree. I use logistic and multiple regression models depending on whether the criterion variable is dichotomous (persistence) or continuous (freshman GPA, and time to completion). Preceding each analyses are descriptive statistics and brief overviews of the results. The models take into account student demographics, high school ability measures, and family income levels.

In order to account simultaneously for continuous and nominal data types, I recoded several of the variables into binary values. Students who participated in AP Only, DE Only, Both, or Neither were each coded as 1 if the category applies to the student and 0 if not applicable. No student falls in more than one of these areas. Hence, a student identified with AP Only would never also be DE Only, Both, or Neither. I also recoded race and gender with 1 = White, 0 = Non-white, 1 = Male, and 0 = Female. I recoded the reported family income categories in the same manner. Students identified with each annual family income have a 1 if the category applies and 0 if it does not. Family income categories also include students who did not report a family income level and I performed some of the tests with and without this group of students to determine whether I could draw different conclusions.

In addition to coding nominal variables, I also linearly adjusted High school grade point average (HS GPA) and ACT Composite scores to center them on the mean of the entire data set. For example, a centered high school GPA value of 0.12 means that the GPA is 0.12 points higher than the mean GPA for the entire data set. The logical score ranges of HS GPA and ACT Composite do not include zero. Without centering these elements at the mean, the constant or intercept values shown in the following tables would be difficult to interpret.

The results that follow each begin with descriptive statistics on each of the variables used in the models. The populations of students include (1) students who attended the University of Kansas (KU) and participated in any AP/DE courses while in high school, (2) students who attended KU and participated in AP/DE Calculus while in high school, and (3) students who attended KU and participated in AP/DE English while in high school.

College Persistence

Table 23 contains descriptive statistics for each of the variables used for examining the relationship between student persistence and whether students participated in AP, DE, Both, or Neither. While I discussed a number of descriptive characteristics earlier in this chapter, Table 23 serves as an introduction to the results that appear in subsequent tables. The first column contains data on all students who completed high school courses offering AP/DE. The second column contains data on students who completed high school Calculus, which is a specific example of a class that offers both AP and DE. Like the second column, the third column also contains data on students who complete the advanced English 12 course, which offers both AP and DE. Mean values are listed with standard deviations in parentheses.

Persistence rates in all three columns are high, ranging from 0.89 for all students to 0.94 for Calculus students. Persistence to a third semester at KU may be higher than most nationally

reported data because the students identified for this study completed one or more advanced, college preparatory courses.

Among all students in the data set, approximately 15% are identified as AP Only, 47% as DE Only, 17% as Both, and 21% as Neither. These statistics contrast with the subsets of students who completed Calculus and the advanced English courses with 21-22% identified as AP Only and 4% identified as Both. Among the Calculus students more than one-third (39%) participated in DE Only and more than one third (35%) participated in Neither. A majority of the students who completed advanced English while in high school participated in DE Only (55%).

Table 23: Descriptive Statistics on Variables for Analysis of Student Persistence for Students Completing AP/DE Courses and Enrolling at the University of Kansas

	All AP/DE Courses Mean (SD) N=1204	**AP/DE Calculus Mean (SD) N=587**	**AP/DE English Mean (SD) N=497**
Persistence Rate	0.89 (0.31)	0.94 (0.24)	0.92 (0.27)
AP Only	0.15 (0.35)	0.22 (0.42)	0.21 (0.41)
DE Only	0.47 (0.50)	0.39 (0.49)	0.55 (0.50)
Both AP and DE	0.17 (0.38)	0.04 (0.20)	0.04 (0.19)
Neither AP Nor DE	0.21 (0.41)	0.35 (0.48)	0.20 (0.40)
White	0.90 (0.29)	0.92 (0.28)	0.91 (0.29)
Male	0.50 (0.50)	0.55 (0.50)	0.43 (0.50)
HS GPA	3.77 (0.55)	4.00 (0.50)	4.05 (0.50)
ACT Composite	25.86 (3.84)	27.59 (3.49)	27.65 (3.61)
Less than $30,000	0.09 (0.29)	0.08 (0.27)	0.08 (0.27)
$30,000 to $60,000	0.15 (0.36)	0.13 (0.34)	0.16 (0.36)
$60,000 to $100,000	0.26 (0.44)	0.25 (0.43)	0.27 (0.45)
More than $100,000	0.25 (0.43)	0.27 (0.45)	0.25 (0.43)
No Finance Level	0.25 (0.43)	0.27 (0.44)	0.25 (0.43)

Using the data set that includes all students who participated in one or more AP/DE courses, Table 24 contains the results of a logistic regression analysis. Prior to introducing controls for student ability, AP Only, DE Only, and Both each increase the likelihood for student persistence to a third semester at KU compared to students who did not participate in either

program. However, upon the introduction of high school GPA, all other factors lose significance including ACT Composite scores, gender, and family income. In other words, among all students who completed one or more AP/DE courses, participation in AP Only, DE Only, or Both has no noticeable effect on student persistence at KU.

Table 24: Logistic Regression Comparisons of Student Persistence for Students Attending the University of Kansas Identified by High School Enrollment in any AP/DE Courses (N=1204)

	MODEL I		**MODEL II**		**MODEL III**		**MODEL IV**	
	B	Exp(B)	B	Exp(B)	B	Exp(B)	B	Exp(B)
AP Only	1.43***	4.17	1.02**	2.78	0.58	1.78	0.53	1.69
DE Only	1.11***	3.04	1.01***	2.75	0.45	1.57	0.48	1.61
Both	1.38***	3.97	0.93*	2.55	0.22	1.25	0.22	1.24
White	0.04	1.05	-0.12	0.89	0.20	1.22	0.37	1.44
Male	-0.38	0.68	-0.47*	0.63	-0.02	0.98	-0.05	0.96
ACT Composite‡			0.13***	1.14	0.00	1.00	0.00	1.00
HS GPA‡					2.04***	7.69	2.07***	7.91
Less than $30,000							0.44	1.55
$30,000 to $60,000							0.67	1.96
$60,000 to $100,000							-0.18	0.84
More than $100,000							-0.09	0.92
Constant	1.67***	5.30	2.12***	8.31	2.37***	10.71	2.19***	8.92

‡ GPA and ACT Composite are mean centered.
* p < 0.05, ** p < 0.01, *** p < 0.001

Using the subset of data that is limited to students who completed Calculus in high school, Table 25 contains the results of another logistic regression analysis. In all four models, there are no noticeable effects of participation on the AP Calculus exam only, dual enrollment in Calculus, or Both on student persistence at KU. Like in Table 24, students with a higher than average HS GPA are more likely to persist compared to students with a lower GPA. In addition, Model IV contains evidence that after introducing controls for family income, White students who completed high school Calculus are four times more likely to persist at KU than non-White students are. However, among Calculus students, there is no relationship between participation

in the Calculus AP exam, dual enrollment in Calculus, or Both and a student's chances of persisting at KU.

Table 25: Logistic Regression Comparisons of Student Persistence for Students Attending the University of Kansas Identified by AP/DE Choice in High School Calculus (N=587)

	MODEL I		**MODEL II**		**MODEL III**		**MODEL IV**	
	B	Exp(B)	B	Exp(B)	B	Exp(B)	B	Exp(B)
AP Only	0.36	1.43	0.18	1.19	-0.27	0.76	-0.17	0.84
DE Only	0.78	2.19	0.74	2.10	0.14	1.14	0.26	1.30
Both	18.54	>100	18.36	>100	17.70	>100	17.30	>100
White	0.78	2.18	0.73	2.07	1.09	2.97	1.43*	4.19
Male	-1.51**	0.22	-1.58**	0.21	-0.96	0.38	-1.03	0.36
ACT Composite‡			0.12	1.13	0.00	1.00	-0.02	0.98
HS GPA‡					2.18***	8.80	2.10***	8.14
Less than $30,000							17.79	>100
$30,000 to $60,000							0.55	1.74
$60,000 to $100,000							-0.52	0.59
More than $100,000							0.07	1.07
Constant	3.06***	21.37	3.07***	21.58	2.82***	16.79	2.51**	12.35

‡ GPA and ACT Composite are grand-mean centered.
* p < 0.05, ** p < 0.01, *** p < 0.001

Using the subset of data that is limited to students who completed advanced senior English in high school, Table 26 contains the results of my third logistic regression analysis. Under all four models shown, participation in the English AP exams and participation in English dual enrollment are statistically significant factors in increasing student persistence. Student participation in Both is not statistically significant. However, recall from Table 22 that the sample of English students identified as Both is very small at around 4%, which may not be large enough to produce meaningful results.

Like in Table 24 and Table 25, students with a higher than average HS GPA are more likely to persist compared to students with a lower GPA. However, unlike prior results, introduction of HS GPA and family income do not reduce the effects of AP and DE to levels that are not statistically significant. The results indicate that students who complete AP/DE English

and participate in the English AP exam are more than twelve times more likely to persist at KU than students who completed AP/DE English and did not pursue college credit via AP or DE. Similarly, students who participate in DE are four times more likely to persist at KU compared to students who completed AP/DE English and did not pursue college credit via AP or DE. However, the evidence does not reveal a relationship between participation in both the AP English exams and dual enrollment in English and persistence to a third semester.

Table 26: Logistic Regression Comparisons of Student Persistence for Students Attending the University of Kansas Identified by AP/DE Choice in High School College Level English (N=497)

	MODEL I		**MODEL II**		**MODEL III**		**MODEL IV**	
	B	Exp(B)	B	Exp(B)	B	Exp(B)	B	Exp(B)
AP Only	2.97**	19.51	2.81**	16.58	2.53*	12.60	2.66*	14.28
DE Only	1.71***	5.55	1.88***	6.58	1.39**	4.00	1.47**	4.33
Both	19.49	>100	19.38	>100	18.27	>100	18.22	>100
White	0.47	1.60	0.30	1.35	0.73	2.07	0.93	2.53
Male	-0.50	0.60	-0.82	0.44	-0.25	0.78	-0.27	0.77
ACT Composite‡			0.16*	1.17	0.01	1.01	0.01	1.01
HS GPA‡					2.47***	11.86	2.48***	11.90
Less than $30,000							0.59	1.80
$30,000 to $60,000							0.12	1.13
$60,000 to $100,000							-0.55	0.58
More than $100,000							0.08	1.09
Constant	1.47**	4.36	1.54**	4.68	1.39*	4.01	1.27	3.55

‡ GPA and ACT Composite are grand-mean centered.
* p < 0.05, ** p < 0.01, *** p < 0.001

Time to Degree Completion

In order to allow students adequate time to graduate from college, I limited the data set to students who graduated from high school in 2005 or 2006 and enrolled at KU immediately following completion of high school. This population is further limited to students who completed a four-year degree by August of 2012. Thus, students have at least six years to

complete their four-year degree. This process resulted in a data set consisting of 420 students who started at KU and completed a four-year degree within six years.

Table 27 contains descriptive statistics for each of the variables used for examining the relationship between time to degree completion and whether students participated in AP, DE, Both, or Neither. This table serves as an introduction to the results that appear in subsequent tables. The first column contains data on students who completed one or more high school courses offering AP/DE, attended KU, and graduated with a four-year degree within six years. The second column contains data on the subset of students who completed high school Calculus, which offers both AP and DE options. The Third column contains data on the subset of students who completed the advanced English 12 course. Mean values are listed with standard deviations in parentheses.

Among the 420 students who completed AP/DE courses in high school, attended KU, and graduated with a four-year degree, the average time to completion was 4.38 years. 15% of these students participated in AP Only, half participated in DE Only, 17% participated in both programs, and 16% did not participate in either program. The students are racially homogeneous with 93% White and have nearly equal numbers of males and females with 48% male. Finally, more than 50% of families represented earn more $60,000 or more annually.

Table 27: Descriptive Statistics on Variables for Analysis of Time to Degree Completion for Students Completing AP/DE Courses and Enrolling at the University of Kansas

	All AP/DE Courses Mean (SD) N=420	**AP/DE Calculus Mean (SD) N=221**	**AP/DE English Mean (SD) N=189**
Years to Completion	4.38 (0.68)	4.31 (0.66)	4.23 (0.62)
AP Only	0.15 (0.36)	0.24 (0.42)	0.23 (0.42)
DE Only	0.50 (0.50)	0.41 (0.49)	0.59 (0.49)
Both AP and DE	0.17 (0.38)	0.04 (0.20)	0.02 (0.14)
Neither AP Nor DE	0.16 (0.37)	0.32 (0.47)	0.16 (0.37)
White	0.93 (0.26)	0.92 (0.27)	0.91 (0.29)
Male	0.48 (0.50)	0.56 (0.50)	0.41 (0.49)
HS GPA	3.87 (0.53)	4.04 (0.47)	4.13 (0.47)
ACT Composite	26.22 (3.84)	27.73 (3.50)	27.98 (3.55)
Less than $30,000	0.03 (0.17)	0.01 (0.12)	0.01 (0.10)
$30,000 to $60,000	0.16 (0.37)	0.14 (0.35)	0.16 (0.37)
$60,000 to $100,000	0.29 (0.45)	0.25 (0.44)	0.32 (0.47)
More than $100,000	0.24 (0.42)	0.24 (0.43)	0.23 (0.42)
No Finance Level	0.29 (0.45)	0.35 (0.48)	0.27 (0.45)

Using the data set that includes all students who participated in one or more AP/DE courses and graduated from high school in 2005 or 2006, Table 28 contains the results of a multiple regression analysis. Model III and Model IV indicate that, after controlling for high school GPA and family income, there is a relationship between participation in both AP and DE and reducing the time to completing a degree. In particular, participation in Both AP and DE appears to reduce time to degree completion by approximately one-fourth of a school year. The analysis shows no relationship between AP Only or DE Only and time to degree completion. Interestingly, students whose families fall in the highest income bracket also decrease their time to degree completion.

Table 28: Multiple Regression Comparisons of Time to Complete a Four-Year Degree for Students attending the University of Kansas Identified by High School Enrollment in any AP/DE Courses (N=420)

	MODEL I	**MODEL II**	**MODEL III**	**MODEL IV**
AP Only	-0.13	-0.05	0.06	0.05
DE Only	-0.24**	-0.23*	-0.10	-0.11
Both AP and DE	-0.50***	-0.40**	-0.25*	-0.26*
White	-0.12	-0.10	-0.12	-0.13
Male	0.17**	0.19**	0.09	0.10
ACT Composite‡		-0.02*	0.01	0.01
HS GPA‡			-0.42***	-0.42***
Less than $30,000				-0.14
$30,000 to $60,000				-0.02
$60,000 to $100,000				-0.03
More than $100,000				-0.21*
(Constant)	4.64***	4.58***	4.58***	4.66***
R^2	0.07	0.09	0.15	0.17

‡ GPA and ACT Composite are grand-mean centered.
* p < 0.05, ** p < 0.01, *** p < 0.001

Using the subset of data that is limited to students who completed Calculus in high school, Table 29 contains the results of another multiple regression analysis. All four models show no relationship between participation in the AP Calculus exam only, dual enrollment in Calculus, or Both and time to degree completion. In other words, after controlling for high school GPA, participation in AP Only, DE Only, or Both do not appear to decrease time to degree completion among students who complete high school Calculus.

Table 29: Multiple Regression Comparisons of Time to Complete a Four-Year Degree for Students attending the University of Kansas Identified by AP/DE Choice in High School Calculus (N=221)

	MODEL I	**MODEL II**	**MODEL III**	**MODEL IV**
AP Only	-0.02	0.03	0.14	0.14
DE Only	-0.15	-0.15	-0.03	-0.02
Both AP and DE	-0.40	-0.32	-0.05	-0.01
White	-0.10	-0.08	-0.15	-0.15
Male	0.19*	0.20*	0.03	0.02
ACT Composite‡		-0.03*	0.02	0.02
HS GPA‡			-0.65***	-0.65***
Less than $30,000				0.17
$30,000 to $60,000				-0.01
$60,000 to $100,000				0.00
More than $100,000				-0.17
(Constant)	4.37***	4.39***	4.55***	4.60***
R^2	0.05	0.07	0.19	0.20

‡ GPA and ACT Composite are grand-mean centered.
* p < 0.05, ** p < 0.01, *** p < 0.001

Using the subset of data that is limited to students who completed advanced senior English in high school, Table 30 contains the results my third multiple regression analysis on degree completion. The results indicate that there is a relationship between participation in DE Only and Both and reducing the time between high school graduation and completion of a four-year college degree. This analysis indicates that there may be some clear differences between student participation in AP, DE, Both, or Neither in an AP/DE English course. The results that appear under Model IV indicate that there is a relationship between participation in Both and reduced time to degree completion by nearly a full year (-0.97) compared to students to did not participate in AP or DE. The analysis also indicates that students who participated in dual enrollment reduced their time to degree completion by nearly one third of a year (-0.31). However, there is no relationship between participation in AP Only and time to degree completion compared to not participating in either AP or DE.

Table 30: Multiple Regression Comparisons of Time to Complete a Four-Year Degree for Students attending the University of Kansas Identified by AP/DE Choice in High School College Level English (N=189)

	MODEL I	MODEL II	MODEL III	MODEL IV
AP Only	-0.20	-0.17	-0.10	-0.12
DE Only	-0.38**	-0.42**	-0.31*	-0.31*
Both AP and DE	-0.86**	-0.84**	-0.87**	-0.97**
White	-0.15	-0.13	-0.17	-0.05
Male	0.13	0.18*	0.04	0.02
ACT Composite‡		-0.03*	0.00	0.00
HS GPA‡			-0.45***	-0.45***
Less than $30,000				1.11*
$30,000 to $60,000				-0.06
$60,000 to $100,000				-0.06
More than $100,000				-0.25*
(Constant)	4.60***	4.64***	4.75***	4.73***
R^2	0.09	0.12	0.20	0.26

‡ GPA and ACT Composite are grand-mean centered.
* p < 0.05, ** p < 0.01, *** p < 0.001

College Success in the First Year

Table 31 contains descriptive statistics for each of the variables used for examining the relationship between freshman GPA at KU and whether students participated in AP, DE, Both, or Neither. Table 31 serves as an introduction to the results that appear in subsequent tables. The first column contains data on all students who completed any high school courses that offer AP and DE. The second column contains statistics on students who completed high school Calculus, which is a specific example of a class that offers both AP and DE. The third column contains descriptive statistics on students who complete the advanced English 12 course, which offers both AP and DE. Mean values are listed with standard deviations in parentheses.

The KU freshman GPA of Shawnee Mission graduates who participated in one or more AP/DE courses is 2.93. 15% of these students participated in AP Only, 47% chose DE Only, 17% participated in a combination of both AP and DE, and 21% did not participate in either

program. This population of students is racially homogeneous with 90% White and evenly divided by gender at 50% male. Shawnee Mission graduates who participated in AP/DE courses earned an average high school GPA of 3.77 and an average ACT Composite score of 25.86. Approximately half (51%) reported annual family incomes of $60,000 or higher.

Among the subsets of students who completed Calculus or advanced senior English while in high school, the average KU freshman GPA's were 3.23 and 3.16 respectively. There are a few other notable statistics to observe prior to reviewing the analysis in upcoming tables. First, among the students in either the Calculus or English subsets, only a small percent (4%) of students participated in both AP and DE. In addition, unlike the equal balance of males and females among all students who participated in AP/DE courses, 55% of the Calculus students are male while only 42% of the advanced English students are male. Finally, high school GPA and ACT Composite averages are quite high at 4.0 and 27.6 respectively.

Table 31: Descriptive Statistics on Variables for Analysis of Freshman Grade Point Average (GPA) for Students who enroll at the University of Kansas

	All AP/DE Courses Mean (SD) N=1200	**AP/DE Calculus Mean (SD) N=585**	**AP/DE English Mean (SD) N=496**
Freshman GPA	2.93 (0.87)	3.23 (0.72)	3.16 (0.80)
AP Only	0.15 (0.35)	0.22 (0.42)	0.20 (0.40)
DE Only	0.47 (0.50)	0.40 (0.49)	0.55 (0.50)
Both AP and DE	0.17 (0.38)	0.04 (0.20)	0.04 (0.19)
Neither AP Nor DE	0.21 (0.41)	0.35 (0.48)	0.20 (0.40)
White	0.90 (0.29)	0.92 (0.28)	0.91 (0.29)
Male	0.50 (0.50)	0.55 (0.50)	0.42 (0.49)
HS GPA	3.77 (0.55)	4.00 (0.50)	4.05 (0.50)
ACT Composite	25.86 (3.84)	27.59 (3.49)	27.65 (3.61)
Less than $30,000	0.09 (0.29)	0.08 (0.27)	0.08 (0.27)
$30,000 to $60,000	0.15 (0.36)	0.13 (0.34)	0.16 (0.36)
$60,000 to $100,000	0.26 (0.44)	0.25 (0.43)	0.27 (0.45)
More than $100,000	0.25 (0.43)	0.27 (0.45)	0.25 (0.43)
No Finance Level	0.25 (0.43)	0.27 (0.44)	0.25 (0.43)

Using the data set containing all students who participated in one or more AP/DE courses while in high school, Table 32 contains the results of a multiple regression analysis examining the effects of the predictor variables on KU freshman GPA. Model I shows that after controlling for student race and gender, AP Only, DE Only, and Both all have significant positive effects on freshman GPA at KU compared to students who did not participate in AP or DE. The effects are similar in Model II despite the introduction of the control for ACT Composite scores. Another observation is that in both of these models, being male is a significant factor that decreases student GPA at KU.

The results indicate that, after controlling for high school GPA and family income, there is no relationship between participation in AP, DE, Both, or Neither and freshman GPA at KU. In addition, being male corresponds to decreased freshman GPA while White and HS GPA correspond to increased freshman GPA at KU. Like the results found in other models, introducing controls for family income has no notable effects on the analysis model.

Table 32: Multiple Regression Comparisons of Freshman Grade Point Average for Students attending the University of Kansas Identified by High School Enrollment in any AP/DE Courses

	MODEL I	**MODEL II**	**MODEL III**	**MODEL IV**
AP Only	0.55***	0.27**	0.04	0.03
DE Only	0.43***	0.35***	0.06	0.05
Both AP and DE	0.75***	0.45***	0.07	0.06
White	0.12	0.03	0.15*	0.15*
Male	-0.22***	-0.28***	-0.08*	-0.08*
ACT Composite‡		0.08***	0.01	0.01
HS GPA‡			0.92***	0.92***
Less than $30,000				-0.04
$30,000 to $60,000				-0.04
$60,000 to $100,000				-0.13*
More than $100,000				-0.03
(Constant)	2.53***	2.76***	2.78***	2.83***
R^2	0.10	0.21	0.41	0.42

‡ GPA and ACT Composite are grand-mean centered.
* p < 0.05, ** p < 0.01, *** p < 0.001

Table 33 contains the results of a multiple regression analysis examining the effects of the predictor variables on KU freshman GPA using the subset of students who completed Calculus while in high school. The results indicate that, after controlling for high school GPA, race, and gender, there is no relationship between participation in AP Calculus, DE Calculus, or Both and freshman GPA at KU compared to students completing Calculus, but not participating in either of these programs. Interestingly, being male corresponds to a decreased freshman GPA while White and HS GPA correspond to increased freshman GPA at KU.

Table 33: Multiple Regression Comparisons of Freshman Grade Point Average for Students attending the University of Kansas Identified by AP/DE Choice in High School Calculus (N=585)

	MODEL I	**MODEL II**	**MODEL III**	**MODEL IV**
AP Only	0.24**	0.14	-0.03	-0.01
DE Only	0.23**	0.21**	0.01	0.01
Both AP and DE	0.47**	0.32*	0.03	0.01
White	0.11	0.07	0.15	0.17*
Male	-0.32***	-0.35***	-0.13*	-0.13**
ACT Composite ‡		0.07***	0.01	0.01
HS GPA ‡			0.86***	0.85***
Less than $30,000				0.06
$30,000 to $60,000				-0.11
$60,000 to $100,000				-0.14*
More than $100,000				-0.05
(Constant)	3.14***	3.11***	2.94***	2.98***
R^2	0.09	0.20	0.41	0.42

‡ GPA and ACT Composite are grand-mean centered.
* p < 0.05, ** p < 0.01, *** p < 0.001

Table 34 contains the results of a multiple regression analysis examining the effects of the predictor variables on KU freshman GPA using the subset of students who completed AP/DE English while in high school. Unlike the results found in Table 32 and Table 33, the final models show that, after controlling for ACT Composite scores and high school GPA, participation in AP Calculus, DE Calculus, or Both relate positively to increasing freshman GPA

at KU compared to completing AP/DE English, but not participating in either of these programs. The effects are strongest for students participating in Both (+0.43), followed by participation in AP Only (+0.34) and finally by participation in DE Only (+0.26). However, the evidence does not suggest whether Both, AP Only, or DE Only are significantly different from each other in predicting freshman GPA at KU. Appendix B contains further details regarding this point.

Table 34: Multiple Regression Comparisons of Freshman Grade Point Average for Students attending the University of Kansas Identified by AP/DE Choice in High School College Level English (N=496)

	MODEL I	**MODEL II**	**MODEL III**	**MODEL IV**
AP Only	0.63***	0.50***	0.34***	0.35***
DE Only	0.43***	0.51***	0.26***	0.26***
Both AP and DE	0.79***	0.73***	0.43**	0.43**
White	0.10	0.02	0.14	0.13
Male	-0.14*	-0.29***	-0.11	-0.11
ACT Composite ‡		0.09***	0.03**	0.02**
HS GPA ‡			0.91***	0.92***
Less than $30,000				-0.17
$30,000 to $60,000				-0.09
$60,000 to $100,000				-0.12
More than $100,000				-0.07
(Constant)	2.74***	2.68***	2.53***	2.61***
R^2	0.09	0.25	0.47	0.47

‡ GPA and ACT Composite are grand-mean centered.
* p < 0.05, ** p < 0.01, *** p < 0.001

Summary of Predictors of Persistence, Time to Completion, and Freshman GPA at KU

Table 35 offers a broad summary of the final part of the results chapter. Examining this table by the columns, the analysis indicates that a student's choice of participation in AP, DE, Both, or Neither in AP/DE English has relates to all three of the criterion variables at KU. The programs are listed within each cell in order of highest coefficient or factor to lowest. For example, students who complete the AP English exam and students who participate in English dual enrollment are more likely to persist to a third semester at KU compared to not participating

in either. In addition, the calculated factor for completing the AP exam is larger than the factor for participation in dual enrollment. Please note that this table does not imply whether the differences in effects are significant; rather, the significant predictors are merely listed in order from highest factor or coefficient to lowest.

Table 35: Summary of Results by AP/DE Choice as Predictors of Persistence, Time to Completion, and Freshman GPA at the University of Kansas

Criterion at KU	**Any AP/DE Course**	**AP/DE Calculus**	**AP/DE English**
Persistence	No effect	No effect	AP Only DE Only
Time to Degree Completion	Both	No effect	Both DE Only
Freshman GPA	No effect	No effect	Both AP Only DE Only

The results of each of the three regression analyses on students who completed AP/DE English point to a relationship between persistence, time to degree completion, and freshman GPA, and whether students chose to participate in AP, DE, Both, or Neither. The results indicate that participation in either the AP English exam or dual enrollment in English is related to increased likelihood for persistence at KU, but participation in Both does not. Participation in dual enrollment in English or both AP and DE is related to decreases in time to degree completion. However, AP exam participation alone does not significantly decrease time to degree completion compared to students in AP/DE English not participating in either. Finally, the analysis indicates that students who participate in either AP, DE, or Both, are likely to earn a higher freshman GPA compared to students who did not participating in either of these programs while taking AP/DE English in high school. Among students who complete AP/DE English while in high school, participating in dual enrollment is the only common characteristic that is

associated with increasing likelihood to persist at KU, decreasing time to degree completion at KU, and increasing freshman GPA.

Moving from right to left in Table 35, I did not find a relationship between the criterion variables, and whether students completed the AP Calculus exam, participated in dual enrollment in Calculus, Both, or Neither. In addition, AP Only, DE Only, and Both were not significant predictors of persistence or time to degree completion in any of the four models used for these analyses. Finally, when using freshman GPA at KU as the criterion variable, the coefficients for AP Only, DE Only, and Both all lost significance after the introduction of high school GPA as a control.

Finally, among all the Shawnee Mission graduates who completed at least one AP/DE courses, participation in some combination of both AP and DE decreases time to degree completion. However, participation in AP, DE, or Both shows no significant effects on persistence at KU, or on KU freshman GPA. Predictors that appeared to be significant with few controls lost significance after introducing high school GPA as a control.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Overview

The purpose of this study was to examine whether participation in Advanced Placement (AP), dual enrollment, Both, or Neither provided a clear advantage to students in choosing better colleges after high school, staying enrolled in a college, achieving early college success, or graduating from college earlier. A second purpose was to examine the descriptive characteristics of students choosing to participate in AP, DE, Both, or Neither while enrolled in AP/DE courses. This study used a modified form of an Input-Environment-Outcomes (I-E-O) research model (Astin, 1999) to control for the possibility that the outcomes (persistence, college GPA, and time to degree completion) were influenced not only by the environment (student experiences with credit attainment options) but also by the inputs (race, gender, high school GPA, ACT score, and family income when ACT was completed).

Comparing whether students attended a four-year program immediately following high school graduation and the selectivity of four-year colleges among students who participated in AP, DE, Both or Neither were selected as reasonable measures of student success for college entry. In addition, comparing freshman GPA, persistence, and time to degree completion among students who enrolled at the University of Kansas (KU) and participated in AP, DE, Both, or Neither was selected as reasonable measures of success after college entry. Narrowing this college level analysis exclusively to students who enroll at KU further limited the scope of environmental variables students experience while in college. I also examined the research questions based on whether participation in specific AP/DE courses mattered. Besides examining the outcomes on all students who completed one or more AP/DE courses, I examined

the subsets of students who completed high school Calculus as well as the subset that completed advanced English.

This study investigated five basic questions about the effects of student participation in AP, DE, Both, or Neither: (1) What are the basic characteristics of students who choose Advanced Placement, dual enrollment, Both, or Neither as part of their high school coursework? (2) Is there a relationship between whether students chose a two-year or four-year college and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither? (3) What is the relationship between second year college persistence and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither? (4) What is the relationship between time to degree completion and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither? and (5) What is the relationship between freshman-year GPA, and whether students took high school coursework for dual credit, Advanced Placement, Both, or Neither?

Before proceeding on to the summary and discussion that follows, I must also reiterate how students were assigned to AP Only, DE Only, Both, and Neither. Students labeled as AP Only completed one or more AP/DE courses and complete one or more AP examinations in at least one of those courses. AP Only students did not pursue college credit through dual enrollment. Like AP Only students, DE Only students completed one or more AP/DE courses, but they pursued college credit in those courses only through dual enrollment. Students labeled as Both participated in AP and DE, but not necessarily in the same classes. For example, a student in Both may have pursued credit in AP/DE English through DE and pursued credit in Calculus by taking the AP exam. Of course, when I narrow the focus to students in a single subject such as Calculus, students categorized as Both actually pursued college credit by

participating in AP and DE in the same course. Finally, students in Neither completed at least one AP/DE course, but they did not seek college credit through either AP or DE.

Significant Findings and Discussion

(1) Basic Characteristics: Nearly half (44%) of all Shawnee Mission high school graduates complete at least one AP/DE course. In addition, students who completed one or more of these courses are among the top students in their class, with an average weighted high school GPA of 3.76. Descriptive and comparative analyses via Chi-Square tests show that the background characteristics and participation in Advanced Placement (AP), dual enrollment (DE), Both, or Neither are not independent. For example, students identified as DE Only were more likely to be White and female while students not participating in either AP or DE were more likely to be Non-White and male. The gender and racial divide among students who choose to participate in AP, DE, Both, or Neither is surprising. National trend data shows that the characteristics of students entering college is becoming more diverse (CollegeBoard, 2007). However, even among students who step up to the challenge of enrolling in one or more college predatory courses, gaps continue to exist among student groups and the differences in college credit-attainment participation may have implications for student success in college.

Measures of student ability are also not independent from participation in AP, DE, Both, or Neither. Students with the highest high school GPA and the highest ACT Composite scores participated in AP Only or Both while students with the lowest scores did not participate in either. Students who participated in DE Only had ACT and high school GPA averages ranking above students who did not participate in AP or DE, but below students who participated in AP or Both. The descriptive analysis supports the argument that students may weigh the risks and benefits of their college credit attainment choices based on their likelihood for attaining credit.

In other words, they are already applying Dutkowsky's (2009) economically minded framework, to the student level. Students with higher grade point averages and higher ACT scores may chose to participate in AP examinations because they feel more confident in their ability to earn a score that translates to college credit while students with lower GPA or ACT scores may feel less prepared and therefore select dual enrollment or neither.

Finally, there is a relationship between family income and a student's choice to participate in AP, DE, Both, or Neither. Among the students identified as AP Only or Both, participation was proportionally distributed across income levels. However, students identified as DE Only, had larger numbers of students at the higher income levels and less participation at the lower income levels. In contrast, students who did not participate in either AP or DE had larger numbers of students from lower income levels. The relationship between family income and college-credit attainment choices mirrors the costs of the respective programs. Tuition costs for dual enrollment are much higher than the fee for an AP examination, and of course, participating in Neither costs nothing.

The evidence supports the argument that cost is a factor, even among middle class families, for determining whether to participate in AP, DE, Both, or Neither. Families who can afford the higher cost of tuition (compared to AP) may also be purchasing assurances that their child will earn college credit. Interestingly, despite my criticisms of prior studies for leaving out family income as a control factor, family income was not a significant determinant of college success at KU in my analysis.

We might expect that families with higher incomes should have a better understanding of the how AP and dual enrollment credits translate into credits at four-year colleges and which choices offer the greatest academic and financial benefits. While tuition for dual enrollment is

far more expensive than the fee for AP testing, dual enrollment tuition at the local community college is far below the costs incurred at most four-year colleges. We might also expect that their choice of whether to participate in AP, DE, Both, or Neither would translate into higher levels of success in college including graduating earlier. That is not to say that families with higher incomes, choosing DE over AP or Neither, do not see other advantages. Perhaps success in college is often less of a concern to parents of students in college preparatory courses in relation to minimizing their college tuition expenses. I did not consider student debt after graduation, which is a variable situated beyond the scope of this study. Nevertheless, the findings from this study and future studies may help school staff and budget-conscious parents think about which courses might yield the greatest benefit from participating in AP, DE, Both, or Neither.

(2) College Selection and Selectivity: Like in the examination of basic characteristics of AP/DE groups, results comparing college selection and the selectivity of four-year colleges, and whether students participated in AP, DE, Both, or Neither, indicated that the factors are not independent. Students who participated only in AP examinations and students who participated in both AP and dual enrollment were the groups most likely to enroll in four-year colleges. In addition, students who participated in AP and Both enrolled in colleges that are more selective. In contrast, students who completed AP/DE courses but did not participate in AP or DE attended four-year colleges at lower-than expected rates and the colleges were generally not highly selective. The results following students who participated only in dual enrollment while in high school fell between the latter and former groups. College going and selectivity comparisons matched the results on student ability (GPA and ACT Composite), which rank students in AP

and Both at the higher levels, DE in the middle, and students who do not participate in either at the lower levels.

The literature review on college choice presented in this dissertation has shown that the interaction between college choice and the whether to participate in AP, DE Both, or Neither is complex as the two occur simultaneously (Hossler & Gallagher, 1987). Descriptive results on college choice and selectivity are not surprising. Students who participate in AP Only or Both enroll in four-year colleges at higher rates compared to similar peers, and they enroll in colleges that are more competitive. By comparison, students who do not participate in AP or DE enroll in four-year colleges at lower than expected rates among students who complete AP/DE courses in high school.

The results are also consistent with research showing that family economics is a determining factor for whether to attend a four-year college immediately after high school (Bergerson, 2009). The decision whether to participate in AP, DE, Both, or Neither depends on family income, with students in lower income families choosing to participate in Neither more often. Perhaps parents and school staff discourage (or fail to encourage) students not headed to a four-year college from participating in AP or DE. Lack of financial resources may also serve as a barrier to AP or DE participation that schools are unable to help students overcome. Unfortunately, leaving the financial barrier in place may reduce opportunities for students to attend a four-year college and become successful there. For example, the results indicate a positive relationship between participation in the AP English exam and freshman GPA at KU, student to persistence to a third semester, and reducing time to degree completion. While my research does not specifically follow students who begin at two-year institutions with the hope of

completing a four-year degree, encouraging students to participate in AP, DE, or Both at least in some subject areas seems to increase students' likelihood for success.

(3) College Persistence at KU: After controlling for student race, gender, ACT Composite scores, and high school GPA, my findings do not show a significant relationship between college persistence and whether students participated in AP, DE, Both, or Neither among all students who complete at least one AP/DE course. Interestingly, without the control for HS GPA, students participating in Advanced Placement, dual enrollment, or Both would have appeared to be more than twice as likely to persist at KU compared to students who completed AP/DE courses and did not participate in AP or DE. This result confirms findings from the literature suggesting that participation in rigorous academic curriculum, measured in this instance by the weighted high school GPA, is one of the strongest pre-college indicators of student momentum (Adelman, 1999, 2006).

When narrowing the focus to students who completed Calculus, my analysis finds no relationship between college persistence and whether students participated in AP, DE, Both, or Neither. Students who participated in the Calculus AP exam, dual enrollment in Calculus, or Both did not see an advantage over taking the course without participating in these programs even prior to controlling for high school GPA. Interestingly, my analysis indicated that high school GPA and being White increased Calculus students' chances of persisting at KU while gender and family income lacked any significant effect. While I am focusing primarily on the effects of AP and DE on postsecondary success, my analysis reveals other relationships that may be relevant for further study beyond the scope of this paper.

In contrast to the latter results on college persistence, my findings are different after narrowing the focus to students who completed AP/DE English. There is a relationship between

college persistence and whether students participated in AP, DE, Both, or Neither. Even after controlling for HS GPA, there is a positive relationship between participating in the AP English exam and increased chances for persisting at KU by a factor of 12. Similarly, after controlling for HS GPA, there is a positive relationship between pursuing English credit through dual enrollment and increased chances for persisting at KU by a factor of 4. Students who participated in both programs did not see a significant relationship with persistence. However, effects might be difficult to detect because only 4% of AP/DE English students participated in both programs.

(4) Time to Degree Completion of KU Students: After controlling for student race, gender, ACT Composite scores, and high school GPA, there is a relationship between time to degree completion and whether students participated in both AP and DE among all students who complete at least one AP/DE course. Students who participated in both AP and DE reduced their time to degree completion by one fourth of one year. In contrast, the analysis reveals no relationship between time to degree completion and whether students participated in AP Only, DE Only, or Neither. Prior to controlling for HS GPA, students who participated in dual enrollment completed a degree is less time compared to students who did not participate in either program. However, students who participated only in AP examinations did not see a significant effect in any of the models. Recall that while most students who participate in DE actually receive college credit, only about half the students who complete AP exams receive a passing score of 3 or higher and earn the same credit. It may be interesting to know whether students who earn credit from the AP exam graduate earlier compared to other AP participants after controlling for HS GPA. Future research on college credit attainment and degree completion may seek to narrow my analysis even further by separating AP participants by their scores.

When narrowing the focus to students who completed Calculus, my analysis found no significant relationship between time to degree completion and whether students participated in AP, DE, Both, or Neither. Students who participated in the Calculus AP exam, DE Calculus or Both did not see an advantage over taking the course without participating in these programs even prior to controlling for high school GPA. The results of the multiple regression analysis on Calculus students' time to degree completion matches the results of the logistic regression discussed above on persistence at KU.

When narrowing the focus to students who completed AP/DE English, there is a relationship between time to degree completion and whether students participated in AP, DE, Both, or Neither. Even after controlling for HS GPA, students who either pursued credit through dual enrollment, or completed both the AP exam and dual enrollment completed their degree earlier than students who did not participate in either program. Students who participated in both programs decreased their time to degree completion by nearly a full year while DE students decreased their time by nearly one third of a year. Participation in the English AP examinations alone had no significant effect on time to degree completion in any of the models.

Interestingly, this is the only part of my analysis that implicates a clear separation between participation in DE compared to AP. This distinction may be in the ability for students to earn college credits. We know from the literature that students who participate in dual enrollment are more likely to earn college credit compared to students who take the AP exam (Dutkowsky et al., 2009; Waits et al., 2005). Perhaps the goal of earning credits and graduate as soon as possible in order to save money may be paying off among students who complete AP/DE English and earn college credit through dual enrollment.

(5) Freshman GPA at KU: After controlling for student race, gender, ACT Composite scores, and high school GPA, there is no relationship between freshman GPA at KU and whether students participated in AP, DE, Both, or Neither among all students who complete at least one AP/DE course. Interestingly, prior to controlling for HS GPA, participation AP, DE, or Both could each be used to predict higher freshman GPA at KU. This secondary finding confirms the need to control for student ability in further research, particularly with the high school GPA.

When narrowing the focus to students who completed Calculus, there is no relationship between freshman GPA at KU and whether students participated in AP, DE, Both, or Neither. The results of the multiple regression analysis on Calculus students' freshman GPA matches the results of the logistic regression discussed above on persistence at KU as well as the multiple regression analysis on time to degree completion. Interestingly, my results also show that male students have a lower freshman GPA at KU compared to the overall mean while White students have a higher GPA among KU students from Shawnee Mission who completed Calculus.

When narrowing the focus to students who completed AP/DE English, there is a relationship between reducing the time to degree completion and whether students participated in AP, DE, Both, or Neither. Even after controlling for HS GPA, students who completed the AP English exam, pursued English credit through dual enrollment, or completed both the AP exam and dual enrollment significantly saw higher freshman GPA's at KU compared to students who did not participate in either AP or DE. Students who participated in both programs saw the largest advantage with a freshman GPA difference of 0.43 points. AP Only students saw a difference of 0.35 points and DE students saw a difference of 0.26 points. Finally, like the results from most other analyses shown, family income had no significant relationship to KU freshman GPA.

Some of the results of this study are consistent with the literature review suggesting that high school students who complete AP/DE courses do not receive additional advantages at a particular college such as KU by choosing to participate in AP or DE (Adelman, 1999, 2006; Duffy, 2009; Geiser & Santelices, 2004; Klopfenstein & Thomas, 2006). However, my results do indicate that students who participated in AP/DE courses and completed some combination of both AP examinations and dual enrollment may graduate earlier at KU compared to peers who graduated from KU, but participate in only AP, only dual enrollment or Neither. Perhaps students who participate in both AP and DE while in high school have a better understanding of how credits transfer into the various college departments.

Among the analyses where I found no differences between AP, DE, Both, and Neither, any differences that appeared prior to applying controls for student characteristics disappeared after controlling for high school GPA. In other words, a student's overall performance in high school, as measured by GPA, overshadows many other student characteristics in predicting freshman GPA at KU, whether students will persist to a third semester, and the time needed to complete a four-year degree. In addition, I was surprised to see that the ACT Composite score was less often a predictor of the dependent variables compared to the high school GPA. Perhaps the critical difference between the two values is that high school GPA reflects an accumulation of student ability and perseverance over a four-year period while the ACT score reflects a mere snapshot of student performance at the single moment that the student completed the exam.

The mixed results indicate that the benefits of participating in AP, DE, Both, or Neither may differ across specific courses. Participation in AP, DE, or Both provided no distinct advantages among Calculus students while students who participated in AP, DE, or Both in English saw significant advantages. The findings also indicate that among students who

participate in one or more AP/DE courses, those who participate in some combination of both AP and DE seem likely to complete their degree earlier. Again, these students may not necessarily participate in both programs within the same course. Rather, they may be choosing AP in one course and DE in another.

There is a stark difference in the outcomes for students who completed AP/DE English in relationship to those who completed Calculus. The results do not point to whether students should or should not take Calculus or any other AP/DE course in high school. Among the students who completed Calculus in Shawnee Mission and enrolled at KU, those participating in AP, DE, or Both saw no clear advantage in increasing persistence, decreasing time to degree completion, or increasing freshman GPA. The literature review clearly supports the benefits of participating in rigorous college preparatory courses in high school (Adelman, 1999, 2006; Horn et al., 2001). Indeed, the results may actually support the argument that Calculus classes in Shawnee Mission are accomplishing their mission of preparing students for college courses regardless of whether students choose to pursue college credit through AP or dual enrollment. Perhaps we could not detect any benefits of participating in AP or DE because Calculus students are already the brightest students in their graduating class.

In contrast, students who completed AP/DE English and participated in AP exams, dual enrollment, or Both saw greater success at KU across multiple measures compared to students who participated in neither AP nor DE. Most notably, students who completed AP/DE English and pursued college credit through dual enrollment at Johnson County Community College had a higher GPA at KU, were more likely to persist to a third semester, and graduated earlier than students in AP/DE English who did not pursue college credit. Finding this effect in English, but not in Calculus could be a topic for future study. For example, I am curious whether many of the

students who participate in AP or DE in English also completed Calculus. Perhaps the detected benefits of AP or DE participation in English may actually be attributable to enrollment and success in other courses.

There may be important differences between the populations of students who complete Calculus and AP/DE English that my analysis did not consider. For example, students must meet a series of prerequisites in order to enroll in Calculus that includes passing a sequence of five other courses beginning with PreAlgebra in middle school. In addition, Calculus is not specifically required for high school graduation. Students who may struggle in Calculus or do not feel ready for the course may drop it or not enroll without penalty. By comparison, Shawnee Mission students are required to complete four years of English courses to meet graduation requirements. Students already enrolled in AP/DE English have fewer options to change their schedule because they must still complete an English course. Given this context, perseverance among Calculus students may be more homogenous compared to AP/DE English students.

Perhaps a visual inspection of the tables of descriptive data in Chapter 4 would provide some insight into the different outcomes between the Calculus students and the AP/DE English students. For instance, the persistence rate at KU among students who completed Calculus prior to graduating from a Shawnee Mission high school is 94% (Table 23). The comparable rate among AP/DE English students is 92%. In addition, the KU freshman GPA among Calculus students is 3.23 compared to 3.16 for AP/DE English students (Table 31). Given that students who complete Calculus in high school are already quite successful at KU, there appears to be less room for detecting additional benefits from participation in Advanced Placement or dual enrollment.

Implications for Students and their Families

Advanced Placement and dual enrollment can be valuable assets to motivated high school students (Bailey & Karp, 2003; Williams, 2010). However, it is critical that students and their families gather the right information before deciding whether to participate in either AP or DE, Both, or Neither. In particular, students and parents need to investigate the policies on Advanced Placement and dual enrollment transfer credits ahead of time with their institutions of choice as well as with the programs of interest within those institutions. Understanding how types of credits transfer at various institutions may also serve as a means for closing the apparent gap between college requirements and student qualifications (Roderick et al., 2008).

Students with stronger academic abilities may feel more confident in their ability to attain college credit through an AP exam, while students with weaker abilities may feel that they are maximizing their likelihood for attaining college credit by participating in dual enrollment. Research shows that earning college credits while in high school can help students to build academic momentum that diminishes the time necessary to complete a degree program (Swanson, 2008). My findings indicate that participation in combinations of both AP and dual enrollment may serve as the best option for reducing the time to degree completion even further. Perhaps students who participate in both AP and DE not only earn a number of college credits, but they earn credit and receive course placements that approach the most ideal fit between their goals, abilities, and their program of study in college. Choosing dual enrollment exclusively over Advanced Placement or visa verse may not be a useful strategy for achieving this match. My findings indicate that the decision whether to participate in AP, DE, Both, or Neither in Calculus has different implications for college success than the same decision for AP/DE English. Students need to consider the decision whether to participate in AP, DE, Both, or

Neither on a course-by-course basis and in the context of their future college and degree program requirements.

A primary concern among proponents of Advanced Placement is that earning college credit through dual enrollment may inadequately represent whether students are ready to be exempt from freshman courses (CollegeBoard, 2009). In particular, students earning credit through dual enrollment, who would otherwise score a 1 or 2 on the AP exam, are thought to be not ready for the next level. If this idea were true, then we should expect to find that students earning credits through dual enrollment to be generally less prepared for college and more likely to take longer to complete their degree. The literature contains some evidence to indicate that students who earn college credit by achieving a 3 or higher on the AP exam outperform their peers in the respective second level course (Richards, 2006). One strategy to explore is whether students should take the Advanced Placement exam in instances where they expect to take the next level course in college and use dual enrollment to earn credit in courses where no subsequent course is required. In any case, students earning credit through dual enrollment do not appear to be at a disadvantage compared to peers with similar academic abilities.

Implications for High Schools

Understanding the basic characteristics of students in AP/DE courses who choose to participate in AP, DE, Both, or Neither will help secondary and post-secondary staff as well as policymakers to better understand how students make their college credit attainment choices. For example, knowing that family income is related to the AP/DE/Both/Neither decision may spark a discussion of how school districts can support students who want to pursue college credit but lack the resources. Perhaps if family income were not a significant factor in deciding

whether to participate in AP or DE, that more students would be able to take advantage of and benefit from both programs.

On a similar note, I was surprised to find that AP/DE students who participated in only dual enrollment were disproportionately White and female while AP/DE students who did not participate in either AP or DE were disproportionately non-White and male. The results in this study confirm with other research that students who participate in AP, DE, or Both have some advantages in college compared to similar peers who do not participate (McCauley, 2007 for example). Like with family income, promoting both programs to underrepresented groups and reducing barriers such as costs for tuition or exam fees could help to close gaps in college success among demographic and economic groups. In return, perhaps high schools would receive the recognition they deserve in their added efforts to prepare students for success in college.

High school staffs also share responsibility with students and families for keeping up to date on how colleges and their respective academic departments handle Advanced Placement and dual enrollment transfer credits. They also have the responsibility for ensuring that students understand the benefits for participating in AP or DE beyond the value of just earning college credit at reduced cost. If based on my findings, that students only start to see significant benefits from AP or DE by participating in both, and that the benefits may depend on each student's course of study, then high school counseling and academic advising are critical to each student's transition plan from high school to college.

Implications for KU and Postsecondary Schools

The findings from this study support, at least partially, practices at KU and other postsecondary institutions for continuing to grant credit for both AP test scores and transfers of

credit earned through dual enrollment. The results of this study indicate that, compared to each other, AP and DE may not provide any particular advantage over one another in terms of increased college GPA at KU, increased likelihood for persisting to a third semester at KU, or decreased time to degree completion. While students may be more likely to earn credits through dual enrollment compared to AP, the results indicate that AP and DE students who complete AP/DE courses in high school and earn similar grades in high school are equally prepared for their coursework in college.

The findings from this study support encouragement of college level courses in high school in other ways as well. In particular, students who participated in a combination of both AP and DE decreased their time to degree completion, and students who participated in either AP or DE in AP/DE English saw increased success compared to similar students who did not take advantage of either program. While this study does not delve directly into the causes for these differences, we might speculate that positive experiences with AP or DE may affect or reinforce student attitudes that support student perseverance through college (Hossler, 2006). Postsecondary institutions may want to differentiate incoming freshman by who has or has not earned credits while in high school as an indicator for targeting students who may require extra encouragement to become involved and engaged in campus life (Tinto, 1999).

One of the benefits for offering both Advanced Placement and dual enrollment to students in high school college preparatory courses is that there may be an added level of quality control in the course curriculum. While the college course curriculum through dual enrollment partnerships may be different from the AP curriculum, teachers are challenged to marry the two in order to provide students with the best of both worlds. School staffs have the added benefit of being able to receive training or support from both the local college as well as through the

College Board. Policymakers at the University of Kansas and other postsecondary institutions can be reassured that, while AP scores are perceived to be more accurate measures of student ability to do college level work, students who participate in AP do not appear to have a significant advantage over students who acquire credits through dual enrollment with Johnson County Community College. In other words, the courses themselves are rigorous and they prepare high school students for college level work.

Implications for Policymakers

States and their respective agencies promote dual enrollment, Advanced Placement, and other college level programs in high schools for a variety of reasons. Reasons include building relationships between high schools and colleges, ensuring that students have access to rigorous college-preparatory curriculum, and reducing the number of students who require remediation in college (Bailey & Karp, 2003; CollegeBoard, 2009). Whatever the reason, policymakers take different approaches to encourage student participation in these programs. For example, Florida and Minnesota offer financial incentives for students to participate in dual enrollment by subsidizing the cost for tuition (Krueger, 2006). While these policies may promote student access to college-credit attainment programs, states need to consider the impact of providing incentives that favor one program at the expense of others. The results from this study indicate that students are likely to benefit from having the option to participate in both dual enrollment and Advanced Placement. Students should be encouraged to choose a combination of college level attainment programs that best matches their abilities, interests, and postsecondary pursuits.

Recommendations for Additional Study

The results of this study suggest that high school students who complete AP/DE courses may earn their four-year degree earlier if they participate in some combination of both Advanced

Placement exams and dual enrollment. However, my results do not show that participation only in Advanced Placement or only dual enrollment provide additional benefits in increasing freshman GPA, decreasing time to degree completion, or increasing likelihood to persist to a third semester at KU. Rather, high school GPA has a significant effect on college outcomes that nearly completely overshadows the benefits of AP or DE. The results also suggest that the benefits of participating in AP, DE, or Both may vary depending on the specific AP/DE course. Further research should extend the latter finding by examining the relationship between success in college and whether students chose to participate in AP, DE, Both, or Neither in specific combinations of high school courses. For example, it would be interesting to know if there is a relationship between student participation in AP or DE in English and whether they are more likely to participate in a rigorous course of study in math and science.

This study examined student participation in Advanced Placement or dual enrollment without further separating student groups by their performance on the respective programs or exams. Determining whether students actually received credit for a specific course comes with additional challenges because students do not always transfer or claim these credits as entering freshman. Future research should further examine and control for the relationship between student performance on the AP exams as well as the grade received through dual enrollment. For example, while participating in AP, DE, or Both in Calculus do not appear to yield a significant advantage in college success among AP/DE Calculus students at KU, further study may examine whether earning Calculus credit with an AP score of 3 or higher provides an advantage to overall college success compared to other pathways for earning Calculus credit.

Some researchers propose that completing a rigorous course of study may be adequate, and spending money on AP exams or tuition for dual enrollment is not necessary for setting

students up for success in college (Adelman, 1999, 2006; Duffy, 2009; Geiser & Santelices, 2004; Klopfenstein & Thomas, 2006). My results generally confirm the idea that among students who participate in AP/DE courses, their overall success in all courses, as indicated by high school GPA, is very important. However, my findings also suggest that there may be additional benefits to participating in AP and DE even after controlling for student abilities while not showing preference for one program over the other. Ongoing research should continue to evaluate the role of credit attainment programs in providing rigorous college preparatory courses in high school. While providing the college preparatory courses may be adequate for college success for many students, maintaining the quality of these courses may not be possible without the link that gives students the opportunity to earn credit if they choose to pursue it. Perhaps the Advanced Placement exam scores and the income generated by these exams are inseparable from the need to maintain high quality, rigorous courses on a large scale. Similarly, perhaps credit attainment through dual enrollment is essential for the strong partnerships between secondary schools and their college collaborators.

Connecting high school experiences to college outcomes can be very challenging without strong and ongoing partnerships between secondary education institutions and colleges. Developing effective college credit-attainment programs for high schools require high schools and colleges to work in concert at a variety of levels to align curricular standards across secondary and postsecondary systems. Dual enrollment may be much closer to this level of alignment and communication at a local level while Advanced Placement allows separation, but operates on a national level. In either case, high school-college partnerships often omit an ability to study the effects of college preparatory programs in detail. While some of the most widely cited research on student success in college deals with student “involvement” (Astin, 1999; Kuh,

Schuh, Whitt, et al., 1991), “engagement” (Kuh, 2001; Kuh, Schuh, & Whitt, 1991), or “integration” (Tinto, 1993) in college, secondary and postsecondary institutions are failing to work together to ensure that students have the supports they need to ensure a seamless transition that leads from success in high school to success in college. Further research needs to bridge the gap that gives high schools the tools they need to better prepare students for college, and gives colleges the tools to understand better the needs of their incoming students.

Concluding Thoughts

Many believe that students who successfully complete college level courses demonstrate their ability to do college-level work (Dutkowsky et al., 2009). This research compared combinations of two vehicles that students use to demonstrate that they have mastered college-level content: Advanced Placement and dual enrollment. While Advanced Placement and dual enrollment Both provide opportunities for students to pursue college credit while in high school, the programs compete against each other for student attention in courses that offer both options.

This dissertation confirmed some outcomes that were expected, but it also left some questions unresolved. It was not surprising that, in general, after controlling for high school GPA, that among students who take one or more AP/DE courses, participation in AP Only, DE Only, Both, or Neither did not improve freshman GPA or likelihood for persisting to a third semester. However, students who participate in a combination of AP and dual enrollment complete a four-year degree earlier their peers in the other three groups. In addition, students who participate in AP or DE in AP/DE English appear to be more successful compared to peers of similar ability who do not participate, while parallel findings do not exist in Calculus. This dissertation contains quality evidence that contributes to an important decision that students, parents, and school administrators have to contend with each year as they prepare students for

college: Which college credit attainment option should students pursue that will maximize their likelihood for success in college? The answer is, “it depends…”

There is little doubt that credit-based transition programs such as Advanced Placement and dual enrollment play a significant role in the development and academic preparation of students for post-secondary study. The information provided in this dissertation gives students, educators, parents, and policymakers an objective look at the background characteristics, the college-going characteristics, and directly compares college success variables of those who choose AP, DE, Both, or Neither. It is my hope that the information presented in this dissertation promotes dialog among representatives of secondary and post-secondary institutions that leads to improving student success in college and expedites degree completion.

APPENDIX A

Table A1: List of Variables in the Data Set

Name	Description
StudentID	SMSD Student ID
LastName	Student Last Name
FirstName	Student First Name
MI	Student Middle Initial
Birthdate	Student Date of Birth
Classof	Year of Graduation
ACTID	ACT School ID Number
ACTComp	ACT Composite Score
ACTFinanceLevel	ACT Family Income Level ID
RaceEthnicitytxt	Student Race/Ethnicity
White	1=White;0=Non-White
Gender	1=Male;0=Female
GPA	High School Grade Point Average
DE_APClasses	1=Yes;0=No (Enrolled in at least one class offering DE and AP)
DEStudent	1=Yes;0=No (Enrolled at JCCC prior to HS Grad)
APStudent1	1=Yes;0=No (Has at least one AP Score from AP_DE courses)
APStudent2	1=Yes;0=No (Has at least one AP Score among all courses)
DE_APCalculusStudent	1=Yes;0=No (Enrolled in Calculus AB or BC)
APCalculusStudent	1=Yes;0=No (Has a Calculus AB or BC Score)
APCalculusScore	Score on AP Calculus Exam
DE_APEnglishStudent	1=Yes;0=No (Enrolled in English 12 H)
APEnglishStudent	1=Yes;0=No (Has English Literature AP Score)
APEnglishScore	Score on AP English Exam (English Literature & Composition)
CollegeCode	Clearinghouse College Code - First College in Fall following HS graduation
CollegeGoing	1=Yes;0=No (as identified in the clearinghouse data)
CollegeFormat	1=4Year; 0=2Year or Other
PublicPrivate	1=Public; 0=Private
CollegeSelectivity05	Level representing selectivity of the college using Barron's 2005
CollegeSelectivity12	Level representing selectivity of the college using Barron's 2012
KUStudent	1=Yes;0=No (Entered KU first year after HS per Clearinghouse file)
PersistSameCollege	1=Yes;0=No (enrolled in a third semester - Same College)
PersistDifferentCollege	1=4-Year;0=No; 2=2-Year (enrolled in a third semester - ANY College)
GraduateFromFormat	1=4Year; 0=2Year or Other or not graduated yet
YearstoCompletion	Years to degree completion (fall graduation counts as half year)
KUStudent2	attended KU as a first-time freshmen in fall following graduation (1 = attended)
KUDEEnglishStudent	total JCCC ENGL transfer hours for terms PRIOR to high school graduation (3=ENGL 101; 6=ENGL 101 and 102)
KUDEMathStudent	total JCCC MATH (calculus) transfer hours for terms PRIOR to high school graduation (3=MATH 115; 5=MATH 121; 10=MATH 121 and 122)
KUDEAnyCourse	total JCCC transfer hours for terms PRIOR to high school grad (numeric; 0 = Math 002)
KUEnglishAPCredit	total credits awarded based on ENGL AP test scores (3=ENGL 105; 6=ENGL 105 and 205; 0=no credit but higher placement for first KU course)
KUMathAPCredit	total credits awarded based on MATH AP test scores (3=MATH 115; 5=MATH 121)
KUAnyAPCredit	total credits awarded based on AP test scores (numeric; 0 = higher placement for first KU course)
KUFreshmanGPA	cumulative KU GPA as of fall graded snapshot (numeric; 0.0-4.0; missing=no GPA credit awarded (withdrew or all ESL))
KUCreditsEarned	total KU credit hours as of fall graded snapshot (numeric; missing=no GPA credit awarded (withdrew or all ESL))
KUTransferTest	total transfer and test credit hours as of fall graded snapshot (numeric; includes all transfer and test credit as of end of first fall)

Table A2: Identified Shawnee Mission School District AP/DE Courses

Course Category	SMSD Course	AP Exam	JCCC Course
English	English 12 H/AP	English Literature & Composition	Composition I/II
Calculus	Calc AB/BC H/AP	Calculus BC	Calculus I/II
	Calc AB H/AP	Calculus AB	Calculus I
Other	Advanced Computer Science H/AP	Computer Science A / Computer Science AB	Basic Programming Structures
	Analytic Geo & Calc H/AP	Calculus AB	Calculus I
	Statistics H/AP	Statistics	Statistics
	United States History H/AP	US History	US History [to 1877/since 1877]
	US Comparative Government H/AP	Government & Politics: Comparative	American National Government
	US Government and Politics H/AP	Government US	American National Government
	Microeconomics H/AP	Economics: Micro	Economics II
	Macroeconomics H/AP	Economics: Macro	Economics I
	Psychology H/AP	Psychology	Intro to Psychology
	Biology 2 H/AP	Biology	Principles of Cell and Molecular Biology
	Chemistry 2 H/AP	Chemistry	Chemistry I
	Environmental Systems H/AP	Environmental Science	Environmental Science
	French 5 H/AP	French Language	Intermediate French
	Latin 4 H/AP	Latin	Latin I
	Spanish 5 H/AP	Spanish Language	Intermediate Spanish I
	Chinese Lang. and Culture H/AP	Chinese Language	Chinese II
	Japanese Lang. and Culture H/AP	Japanese Language	Japanese II

APPENDIX B

Table B1 contains the results of a multiple regression analysis examining the effects of the predictor variables on KU freshman GPA using the subset of students who completed AP/DE English while in high school. This subset is limited to students who participated in AP, DE, or Both. Students who did not participate in either program are excluded. The results of Model I indicate that after controlling for student race and gender, AP Only, and Both have significant positive effects on freshman GPA at KU compared to students who participated in DE Only. However, the differences between AP, DE, and Both lose significance after controlling for student ability in the form of ACT Composite scores and high school GPA.

Table B1: Multiple Regression Comparisons of Freshman Grade Point Average for Students attending the University of Kansas Identified by AP/DE Choice in High School College Level English Excluding Students from Neither (N=395)

	MODEL I	**MODEL II**	**MODEL III**	**MODEL IV**
AP Only	0.20*	0.01	0.10	0.10
Both AP and DE	0.37*	0.24	0.19	0.18
White	0.01	-0.03	0.11	0.10
Male	-0.12	-0.24***	-0.09	-0.09
ACT Composite ‡		0.08***	0.02*	0.02*
HS GPA ‡			0.82***	0.82***
Less than $30,000				-0.20
$30,000 to $60,000				-0.16
$60,000 to $100,000				-0.12
More than $100,000				-0.11
(Constant / DE Only)	3.24***	3.23***	2.84***	2.95***
R^2	0.03	0.19	0.41	0.42

‡ GPA and ACT Composite are grand-mean centered.
* p < 0.05, ** p < 0.01, *** p < 0.001

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