GIVE ME SOME CREDIT(S): THE ROLE OF ACCELERATED LEARNING CREDITS ON GRADUATION AND TIME TO DEGREE

by

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(Under the Direction of Robert Toutkoushian)

ABSTRACT

Participation in accelerated learning programs (defined in this study as Advanced Placement, Dual Enrollment, and International Baccalaureate) continues to expand across the US. As such, it is important to better our understanding of the relationship among these three programs concerning measures of student postsecondary achievement. Prior scholarly evidence of the influence of accelerated learning programs on postsecondary educational outcomes is generally favorable. On average, students that participate in these programs perform better academically, persist to graduation at higher rates, and graduate earlier when entering college with accelerated learning credit. However, concerns over small sample sizes and limited inclusion of important control variables in prior research have caused some to question the external validity and applicability of the findings across institution types. This dissertation utilizes an existing dataset from a large, high-demand, land-grant, research I institution to investigate whether the relationship between accelerated learning credits earned and time to degree holds in this specific environment. I use multiple regression and multinomial logistic regression to explore the

relationship between graduation and time to degree and the three types of accelerated learning programs, including joint participation in more than one program.

The collective findings paint a clear and compelling portrait of the usage and applicability of accelerated learning credit at this particular institution. Holding all other variables equal, having any of the three types of accelerated learning credit is associated with a decrease in time to degree. However, when interpreting the results for each explanatory variable with an eye toward practical application, most findings do not amount to early graduation. Results indicate that entering college with accelerated learning credit is associated with a reduction in time to degree of less than one semester. A less than one semester reduction in time to degree does not amount to time or cost savings. Findings also suggest that entering college with accelerated learning credit is associated with an increase probability in graduating in four years and a decrease in probability of graduating in more than four years. It can be said that accelerated learning programs are most closely associated with on-time graduation, rather than early graduation.

INDEX WORDS: accelerated learning, advanced placement, international baccalaureate, dual enrollment, time to degree, graduation

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BS, University of Georgia, 2008

MPA, University of Georgia, 2011

A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2022

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December 2022

DEDICATION

This is dedicated to my children, whom I love more than anything in this world; to my husband, without whom I would not be able to do it all; and to my parents, who have instilled within me a passion for education.

ACKNOWLEDGEMENTS

To by husband, Bryan Parker, thank you for being my person. Thank you for encouraging me, supporting me, reassuring me, and pushing me. Thank you for all the sacrifices you have made so that I have been able to pursue my career and my education. It's been a long road to get here and I could not have reached this point without you. I love you.

To my children, Sadie and James, you are my entire world. You have taught me more about love, patience, and persistence than I could have ever imagined. Thank you for being my guideposts and my reasons for all that I do. I love you.

To my parents, Ann & Bobby Crowson, I cannot adequately express my thanks for all that you have done to get me across this finish line. You raised me to be curious, to be kind, to be strong, and to be brave. You have taught me to "suck it up" and keep going and you have also taught me to stop and pray. All of these skills have come in handy in life in general, but also in the completion of this degree. Thank you for being there to listen and encourage me. I love you both!

To my committee, Dr. Rob Toutkoushian, Dr. Jim Hearn, and Dr. Erik Ness, I know that I have been an IHE student for an incredibly long time now. Your collective kindness, expertise, and passion has kept me from quitting many times over. It's finally time for me to get out of your hair. Thank you for your patience and your graciousness.

To Dr. Manual Gonzalez-Canche, thank you for believing in me when I was unsure of my abilities as a researcher. Thank you for keeping me positive and for encouraging me along the way.

To my IHE cohort and friends – Jeff, Lucia, Doug, Rob, Erin, Nobel, Lindsay, Liz, Paul, Jason, Tiffany, and Phil – although classes have been completed for *many* years now, your friendships, knowledge, humor, and beverages kept me going. Jefe, thank you for being my cheerleader and my coach these last few months.

To my dearest friends, Maggie, Jen, and Lisa, words cannot describe what you mean to me. When life got hard, you were the ones who carried me and kept me moving. When I achieve the highest of highs, you are the ones who show up, ready to celebrate in style. My world is better because you are in it. I love you.

To my OAIE and UGA colleagues, I see you guys as often as I see my own family most weeks, and your encouragement and support has meant the world to me. Allan, I am incredibly thankful for all the advice, support, laughter, and guidance you have provided over the last 14 years. I am better at my job and a better person because of you.

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CHAPTER 1: INTRODUCTION

In the ever-changing educational environment, multiple pressures are put on K-12 systems and postsecondary institutions of higher education alike. Educators are expected to better prepare high school students for college, provide more opportunities for all students to gain college access, support students to ensure their persistence through college, and ensure timely completion of a college degree. As if this were not enough, there is more and more pressure to justify higher education costs, all the while making college more affordable. Offering programs with college-level curriculum to high school students is one mechanism by which high schools and colleges address these issues. Indeed, high school students can earn college credit in multiple ways, sometimes entirely within the high school setting. In other formats, students attend classes on a college campus. Prior literature has failed to establish consistent terminology to describe these types of programs. As such, this study defines any program that allows high school students to take college-level courses and potentially earn college credit as "accelerated learning programs." Specifically, this study focuses on the following accelerated learning programs; Advanced Placement (AP), Dual Enrollment (DE), and International Baccalaureate (IB).

In this chapter, I introduce the study with a brief overview of accelerated learning programs, an outline of key components of the research problem, and an articulation of the significance of this study within the broader educational research landscape. Finally, I define the specific research questions guiding this study.

Accelerated Learning Programs

Three of the most common accelerated learning programs available to high school students are the Advanced Placement (AP), Dual Enrollment (DE), and International Baccalaureate (IB) programs. With origins in serving the elite and advanced students, aiming to bridge the student transition from high school to college, these programs are rooted in the ability to provide more challenging and higher-level learning experiences for students who have exhausted their high school curriculum. However, as these programs continue to grow, so do the populations of students engaging with them. Due to strategic marketing from the programs themselves, students, parents, and postsecondary institutions now see accelerated learning programs as potential tools to aid students in the college admissions process, offset the growing expense of a college degree, and improve student graduation rates.

Students may opt to participate in each accelerated learning program for various reasons. Some take accelerated learning coursework to improve their chances of being admitted into more selective colleges. Some students may choose accelerated learning coursework to gain human capital and develop their academic skillset by replacing easier courses with more challenging ones. Some may even participate in these programs to save money once they get into college by potentially graduating and entering the workforce early. Understanding the intention behind student participation is important in understanding whether these programs are helping students achieve their goals. In addition, all of the differences among programs, how credits are earned, and the reasons and rationales for student participation must be considered when analyzing the relationship between these programs and student success.

Although these three accelerated learning programs (AP, IB, and DE) are often grouped together when discussing college preparation and high school curriculum rigor, there are, in fact, many differences among these programs. All three programs offer students opportunities to participate in more advanced coursework while enrolled in high school. However, each program's vision, mission, target populations, design, and cost may vary, offering unique opportunities (and challenges) for each population of students and within each participating institution. How college credit is earned and awarded to students is one primary distinction among programs. AP students must take and pass the AP exam in order to get college credit for that course, regardless of participation in an AP course. DE, on the other hand, awards credits to students passing the collegiate course they are enrolled in. IB students are enrolled in a diploma program, so they take a full suite of coursework and do not pick and choose their courses in the way that AP and DE students are able to. IB credit, however, is earned much the same as AP. Students take and pass IB courses but must also take subject matter tests and earn a high-enough score to receive college credit. The credits earned from these three programs are central to this study.

Accelerated learning programs continue to expand across the United States, and participation in each program continues to grow as the pressures and expectations mentioned above continue to increase for students, families, and colleges. As such, it is increasingly important to improve our understanding of the relationship between these programs and critical metrics of student success, specifically postsecondary student success. Despite the growing number of students participating in accelerated learning programs, a relatively limited number of studies have been able to

meaningfully examine the relationship between the use of earned accelerated learning credit and the respective postsecondary educational outcomes. This study begins to address this critical gap in the literature.

Statement of the Problem

The scholarly evidence of the relationship between AP, DE, and IB programs and postsecondary educational outcomes is generally favorable. Much of the prior research has indicated that students that participate in accelerated learning programs, on average, perform better in college (Ackerman et al., 2013; Allen & Dadgar, 2012; Flowers, 2008; Godfrey et al., 2014; Long et al., 2012) and graduate at higher rates (Ackerman et al., 2013; Klopfenstein, 2010; Mattern et al., 2009; Tai et al., 2010; Wyatt et al., 2015). These findings are in line with the often-marketed benefits of accelerated learning programs. Intentional- as well as word-of-mouth-marketing for these programs, suggest that participating in collegiate-level coursework while still in high school not only better prepares students for collegiate success, but also entering college with earned credit potentially allows a student to graduate earlier, maximizing the student's economic benefits. Students could potentially use their earned credits to graduate earlier and join the workforce earlier, thus decreasing costs and increasing time for potential earnings.

However, while many studies investigate collegiate outcomes such as retention and graduation, fewer investigate the time it takes students to graduate. For those studies that did examine the relationship between time to degree as well as other post-secondary educational outcomes and accelerated learning credit, there is insufficient evidence that these patterns of success would hold across different institution types (Allen & Dadgar, 2012; Giani et al., 2014; Karp et al., 2007). One common gap in the current research is

that few studies include multiple types of accelerated learning programs in their analysis. When they do, it is very rarely all three types described above. Studies that fail to include controls for all three types of accelerated learning credit stand to miss a critical component from their analysis.

Significance of the Study

In this study, I add to the existing literature in several critical ways. First, I present a study examining whether the relationship between accelerated learning credit and time to graduation in a unique collegiate environment supports the findings in prior studies. Using data from a singular institution, which has an increasingly competitive admissions process in which participation in accelerated learning in high school is a consideration, I hope to provide additional insight into the role of accelerated learning programs after a student is enrolled.

Prior studies on accelerated learning programs have focused on whether or not participating students were admitted and enrolled in college after high school. These study findings suggest that accelerated learning programs may provide a signaling effect to aid students in college admissions. This study takes the next step and looks at students who have already crossed that hurdle of getting admitted into college. Specifically, this study examines students who have already been admitted into a large, high-demand, public, land-grant, research I institution, where incoming students arrive increasingly more academically prepared and, on average, more economically advantaged, and where the majority of students enter with some accelerated learning credit. This study aims to move past the signaling effect of accelerated learning programs to investigate whether accelerated learning credits help students graduate more quickly once they enroll.

Another contribution of this study to the literature on accelerated learning programs is that all three accelerated learning program types are included in the analyses. This study examines the three types of accelerated learning credit earned, collectively and individually. The inclusion of all three types is an important consideration because students are not only taking increasingly more accelerated learning courses but students are also able to participate in multiple programs at the same time while still enrolled in high school.

As described in the next chapter, each program has different structures, costs, and benefits for students and schools. Students, families, schools, and policymakers alike need to better understand if one program is more successful than another regarding a particular outcome of interest, in this case, time to degree. To address the growing trend of students electing to participate in multiple accelerated learning opportunities while in high school, accumulating more and more credits before college, this study examines both the total amount of credits earned in accelerated learning programs and the relationship between participation in more than one acceleration program and time to degree.

In this study, I examine the differences in outcomes among these three types of accelerated learning programs while controlling for key student characteristics by utilizing a robust dataset that includes demographic, high school achievement, college-level metrics, and socioeconomic data, including data related to student socioeconomic status, which reflects another critical gap in the prior research on accelerated learning programs. Self-selection bias is a tremendous concern within research on accelerated learning programs. Students who participate in accelerated learning programs may be

quite different from those who do not participate based on unobservable characteristics like academic, economic, and social motivations. It is essential for studies on accelerated learning programs to include a robust set of variables to control for as much of the unobservable variable bias as possible, knowing that complete control is impossible. To mitigate this risk, the variable set used in this study represents a number of characteristics across a broad array of categories.

Research Questions

This study was developed to address the following overarching questions:

1. What is the association between accelerated learning credits and time to degree in college?
2. Does the association vary by number of credits?
3. Does the association vary by type of accelerated learning program?

To address specific nuances within the overarching questions, the following research questions are posed for this study:

RQ 1. Is having *any* accelerated learning credit associated with decreased time to degree?

RQ 2: Is having *a specific type* of accelerated learning credit associated with decreased time to degree?

RQ 3: Is the *amount* of accelerated learning credit associated with decreased time to degree?

RQ 4: Is the *amount of a specific type* of accelerated learning credit associated with decreased time to degree?

RQ 5: Is having *a specific combination* of accelerated learning credit type associated with decreased time to degree?

In the next chapter, I provide a history of each accelerated learning programs and outline prior studies that have investigated the relationship between these programs and collegiate-level student outcomes. Chapter 2 concludes with the conceptual framework for the study. Chapter 3 covers the data and methodology of the study, and the analysis findings are addressed in Chapter 4. Chapter 5 presents a discussion of the key findings along with implications for application and use, as well as the final limitations of the study.

CHAPTER 2: LITERATURE REVIEW & CONCEPTUAL FRAMEWORK

Accelerated learning programs such as Advanced Placement (AP), Dual Enrollment (DE), and International Baccalaureate (IB) are not new subjects of inquiry in the field of educational research. However, the empirical study of these programs and their intended impact has been more emergent in recent decades as participation in each program continues to rise. Students, parents, postsecondary institutions, and policymakers now often turn to accelerated learning programs to more formally bridge the gap between high school and college.

Participation in accelerated learning programs has increased dramatically during the past two decades, with its origins in the desire to provide more challenging coursework for high-achieving high school students shifting due to the increasing reliance on various accelerated learning program participation as a measure of college readiness. Highly selective colleges and universities have continued to place increasing assurance on the value of accelerated learning program course taking and credit earning as a part of their admission criteria (Breland et al., 2002; Geiser & Santelices, 2006; Klopfenstein & Thomas, 2009; Zarate & Pachon, 2006). Students and families are presented with accelerated learning programs as an opportunity for their students not only to increase their chances of being admitted into competitive colleges and universities, but also to succeed once enrolled, potentially offsetting the growing expense of a college degree by improving student graduation rates.

While these three accelerated learning programs (AP, IB, and DE) are often grouped together when discussing college preparation and high school curriculum rigor, there are, in fact, many differences among these programs. All three programs offer students opportunities to participate in more advanced coursework while enrolled in high school. However, there are distinctions within these programs to address while considering their potential impact. Each program's vision, mission, target populations, design, and cost may vary, offering unique opportunities (and challenges) for each population of students and within each participating institution.

To better understand the influence of each program on time to degree in postsecondary education, this chapter will first provide an overview of the literature surrounding each accelerated learning program. The overview will address the history, growth, and demographics of participating students. Following, I will describe previous research concerning the relationship between accelerated learning program participation and postsecondary student success, including a comparison of the three programs concerning student success, focusing mainly on time to degree. To conclude the chapter, I will summarize the status of scholarly research in this area, identify specific contributions of this study to the growing body of literature, and will end with a description of the conceptual framework that guides this study.

Overview of Accelerated Learning Programs

As previously stated, accelerated learning programs are mechanisms by which students can take collegiate-level coursework while still enrolled in high school and, in some cases, earn college credit for those studies. The following section describes the origins, growth, and current status of each of the three accelerated learning programs,

concluding with existing research on each program's association with postsecondary achievement.

Advanced Placement

Created in the late 1950s by the organization now known as The College Board, the Advanced Placement (AP) program grew out of early efforts to engage academically advanced high school students with college-level curriculum and to help students make a successful transition to college (Lacy, 2010; Nugent & Karnes, 2002). The AP program was initially available only to students who attended private, elite high schools, with approximately 900 high schools participating in the early years of the program (Klopfenstein & Thomas, 2009). Some researchers report that the AP program stemmed from concerns about the level of academic rigor available in the high school curriculum, a concern that still echoes half a century later in conversations around K-12 education (Lacy, 2010; Rothschild, 1999).

Stretching from the 1960s to the 1990s, the College Board continued to expand the AP program, launching many initiatives to increase teacher training and school curricular expansion. This increase in trained facilitators and offerings also increased the number of students who were able to enroll in AP courses and exams. Kisker (2006) reported that from the mid-1990s to the mid-2000s, participation in AP programs doubled, with more than 1.2 million students taking exams and over 15,000 high schools offering AP courses. A College Board report from 2009 echoed this trend, reporting that the number of AP course enrollments grew at a rate of around 9 percent over the last two decades while the number of students graduating from high school increased only 1 percent over that same time period, a dramatic difference (Sadler et al., 2010). A decade

later, College Board report stated that "1,178,256 U.S. public high school graduates in the class of 2021 (34.9%) took at least 1 AP Exam, up from 898,134 (28.6%) in the class of 2011" (College Board, 2021). Currently, College Board offers 38 different AP courses and exams, crossing multiple subject areas to include arts, English, history & social sciences, math and computer sciences, as well as world languages and cultures (College Board, 2022b). Of course, not every course is offered in every high school and disparities among and within schools continue to exist. To mitigate this disparity, individual states and some school systems continue to make efforts to increase offerings and participation in AP courses and exams.

State and federal-level policies and incentives implemented over the last 20 years have contributed to this increase in courses and have encouraged participation in the program. At the state level, the policies targeted schools and school districts as well as the students themselves. Examples of policies implemented include mandates for districts to offer AP courses at all high schools in order to provide greater access for low SES and minority students; providing funding for the development of programs in smaller schools as well as low SES schools; increasing and implementing performance-based financial incentives that provide funds for teacher training making funding available for students taking exams and; perhaps the most appealing benefits to many students, policies that ensure college credit awarded for significantly higher scores on the AP exams (Education Commission of the States, 2016).

There has also been an emphasis on policies to support AP programs and encourage participation at the national level. Where state policies tend to target students or schools, national-level policies tend to focus on the states themselves, typically in the

form of grants. The Higher Education Act of 1992 created a federal AP fee assistance program, and the program has awarded many grants to states specifically to help low-income students who cannot afford the AP exam fee (US Department of Education, 2016). Another nationally funded program was the Advanced Placement Incentive Program. Over a span of approximately 15 years, this program funded three-year grants to states in order to encourage and increase the participation of low SES students in the AP program. These grants were competitive and must be used for teacher training and development, curriculum development, and supplies and materials for creating new AP programs (US Department of Education, 2016).

One of the most critical distinctions between the AP program and other accelerated learning programs is that students must complete two steps to potentially earn college credit for their AP coursework. First, students must enroll in and complete an AP course. Then, students may opt to take an AP exam for that course's subject area. "Not all students who take an AP course in high school will sit for the AP exam for that course, [and] students who do not complete the exam are not eligible for college credit for the class" (Burns et al., 2019). A five-point scale is used to score the exams, with five being the highest score; a three typically constitutes the minimum qualifying score that may result in a student receiving collegiate course credit (College Board, 2022a). The decision to award course credit is at the discretion of the postsecondary institution and varies across institutions and course subjects. Some subject exams require higher scores to earn college credit, as determined by the college. Some institutions do not recognize AP exams for any purpose, although these are few and far between (College Board, 2022a). Students who do not complete the exam are not eligible for college credit for the course,

but they may still be recognized for taking a more challenging curriculum in high school via the institutions' admissions processes.

AP Participation and Access

In the decades since the development of the program, the goals of AP have advanced past their elite-centered origins. According to the College Board, the AP program can improve both college-ready skills and equality of opportunity in American high schools (College Board, 2014). There has been a large amount of research on the disparities of access, participation, and success of underrepresented communities in the AP program as its expansion continues (Conger et al., 2009; Corra et al., 2011; Ndura et al., 2003; Solorzano & Ornelas, 2004). However, the organization has released a variety of papers that are optimistic in their appraisals of the program's quick growth among previously underrepresented student groups and its success in preparing students for college (College Board, 2014; Hargrove et al., 2008). Although inequality still exists, the overall makeup of students participating in the AP program has begun to shift closer to the composition of student populations across the US. In recent decades, there have been improvements in access and enrollment of minorities in the AP program. These improvements are primarily fueled by state and national incentive policies as well as increased access.

Despite these improvements, inequality in access and participation still exists. During the period stretching from the mid-1990s to the mid-2000s, while the overall number of students taking AP exams grew by 111 percent, all ethnic groups began to share this growth: 105 percent increase for White students, 213 percent increase for Hispanic students, 177 percent increase for Black students, 124 percent increase for

American Indian students, and 114 percent increase for Asian students (Planty et al., 2007). However, not all groups increased similarly in percentages taking the AP exams. African American and Hispanic students continue to be considerably underrepresented in the AP exam population as compared to the population of eligible high school students, and they also score significantly lower on the examinations than other racial groups (Davis et al., 2013; Solorzano & Ornelas, 2004).

The disparity in participation in AP programs by lower SES students and students of marginalized backgrounds may be occurring due to a disparity in access to AP courses between middle and upper-income students and low-income students (Dougherty et al., 2006; Hallett & Venegas, 2011). Students from low-income communities who attend low-income schools are typically students of color and are, on average, less likely to take AP courses (due to access and environmental factors). In addition to less access, it has been found that when these low-SES students do take the AP courses and subsequent exams, they are less likely to pass (Zarate & Pachon, 2006). The disparity in participation and performance with regard to AP courses can also lead to a disparity in college attendance rates. With many colleges and universities now looking more favorably on AP curriculum and credit during the admissions process, this closer attention to AP scores disproportionately impacts students who do not have access. It is with these discrepancies in mind that policymakers and educators are continually looking to promote and encourage equal access to AP courses and exams for minority and low SES students. More recently, in alignment with their goal of increasing access to AP courses, College Board reported that in the decade from 2003 to 2013, the number of AP exam takers

doubled. In that same time period, the number of low-income students quadrupled (College Board, 2014).

Another area of recent positive action is that of availability of AP programs and courses for rural students. In a 2015 study, Gagnon and Mattingly (2015) investigated the "trends in access to, enrollment in, and success in AP coursework in relation to school district poverty, racial composition, and urbanicity" (p. 1). Their research found that 47% of rural districts in their population had no high school students enrolled in AP courses (p.1). Indeed, the number of AP programs has historically been most closely associated with the dominant socioeconomic status of the schools/communities. Large, high-density, high-SES areas and schools (often suburban areas) are most associated with offering a wider variety of AP courses and providing the most prepared teachers to instruct those courses (Klopfenstein, 2004). In the struggle to narrow the gap between students in wealthy and lower-SES communities, AP has expanded to both urban and rural schools through many of the incentives and grants discussed previously. However, research has shown that often some urban and some rural communities have very low AP exam scores despite increased participation, leaving school leaders with difficult decisions about resource allocations considering such limited results.

AP and Postsecondary Student Success

With the widespread adoption of and participation in the AP program, there is a growing body of literature and independent research on the academic benefits of the program. Warne (2017) comprehensive overview of research conducted on the benefits of Advanced Placement provides a much broader scope of research surrounding the impact of AP than is included here. My study will maintain a narrower lens, focusing on

reviewing prior research related to the use of AP collegiate credit (exam scores) and postsecondary student success.

For the first few decades of the AP program, most peer-reviewed articles that reported on the success of the AP program were descriptive in nature, operating under the assumption that the program was beneficial (Warne, 2017). Then, for the first decade of the 2000s, the majority of the research investigating the AP program was sponsored by College Board itself. Only recently has the number of independent, empirical studies focusing on this topic increased. The following discussion will include studies conducted on behalf of the College Board as well as those conducted by non-College Board researchers.

As one might predict, College Board studies have consistently found positive relationships between participation in the AP program and collegiate academic outcomes. For example, research funded by the College Board has found that AP students enroll in college at greater rates (Chajewski et al., 2011; Wyatt & Mattern, 2011), get higher grades overall (Hargrove et al., 2008; Morgan & Klaric, 2007; Patterson et al., 2011), are less likely to leave college early (Mattern et al., 2009; Wyatt & Mattern, 2011), and graduate from college at higher rates than non-AP students (Mattern et al., 2013; Smith et al., 2017). These studies utilized a range of straightforward methods of analysis, such as descriptive analyses, multiple regression, and logistic regression.

Researchers not affiliated with the College Board have attempted to address this issue by comparing AP students with non-AP students and using a number of analytical approaches. These efforts have also led to findings that show AP students perform better in a range of student achievement measures than their peers who do not. The collegiate-

level outcomes of AP students include; higher college entrance exam scores (Ackerman et al., 2013; Flowers, 2008), better college GPAs (Ackerman et al., 2013; Flowers, 2008; Long et al., 2012), and greater college graduation rates (Ackerman et al., 2013; Klopfenstein, 2010; Tai et al., 2010). The findings of these studies are largely consistent with those of previous College Board research and utilize a range of analytical methods, including descriptive statistics and logistic regression analysis, along with newer approaches in the field such as propensity score matching and survival analysis.

The majority of the above studies, however, do not control for a number of confounding variables that may also impact their outcomes of interest. Controlling for confounding variables has only recently become common in research concerning these issues. Scholars now know that participation and success in the AP program are often associated with other observable and unobservable factors. Students who take AP courses and exams, on average, tend to be from higher-income families and neighborhoods. They also are more likely to be White and are likely to be more academically prepared than non-AP students (Cisneros et al., 2014; Moore & Slate, 2008). Therefore, it is important to account for potentially confounding factors when making comparisons between the outcomes of AP students and non-AP students. The effect of the AP program on academic success may be greatly overestimated by researchers who do not account for confounding factors.

More studies are accounting for confounding factors to estimate the causal influence of the AP program in response to these issues. The majority of studies have discovered that accounting for these characteristics reduces or removes the apparent

benefit of the AP program on academic success (Geiser & Santelices, 2006; Klopfenstein & Thomas, 2010; McKillip & Rawls, 2013; Sadler et al., 2010; Warne et al., 2015).

AP and Time to Degree

It is important to acknowledge that the academic benefits of AP courses, exams, and credit must be weighed against the program's economic costs and benefits. The results of studies related to the benefits of all accelerated learning programs must be considered in conjunction with the costs that students, their families, school districts, and taxpayers may bear. In fact, one commonly held view that is advertised by the College Board itself is that earning AP credits through participation in AP courses and passing the corresponding AP exams will reduce a student's time to completion of a college degree. This decrease in time to degree would thus save students and their families money on college tuition (Klopfenstein & Thomas, 2010).

The validity of this claim is still being questioned, as the findings from prior research are mixed. As described above, there are numerous reports sponsored by the College Board-funded researchers. In general, those researchers find that participation in AP programs increases 4-year college graduation rates (Mattern et al., 2013). The results of non–College Board researchers are mixed. For example, in an effort to study AP exam performance on student postsecondary success at one Georgia university, Ackerman et al. (2013) found that for those who participated in AP exams, their time to graduation was reduced. Interestingly, however, they also found that non-AP program participants graduated at higher rates than those who took but failed their AP exams (Ackerman et al., 2013).

Using College Board and National Student Clearinghouse data, Smith et al. (2017) used regression discontinuity to estimate passing an AP exam at credit-granting thresholds and time to degree on a population of 4.5 million students. Their findings imply that simply receiving credit-granting scores in specific subjects relates to a one to two percentage point increase in the probability of earning a 4-year degree for certain. However, no effect was found on the 6-year graduation rate (Smith et al., 2017). Using survival analysis to estimate the effect of participating in AP courses on time to degree, Klopfenstein (2010) finds that passing an AP exam has no meaningful effect on graduating in four years. However, it does have a large and significant effect on the probability of graduating in three years. Klopfenstein reflects that this may be a product of, and only applicable to, students who enter college as sophomores through their earned AP credit (Klopfenstein, 2010).

Some student characteristics or metrics are stronger predictors of college success than others. According to studies that used multiple explanatory variables connected to AP programs and tests, the mean score on AP exams appears to have the most significant association with college achievement outcomes (Ackerman et al., 2013; Patterson et al., 2011). One interesting finding, however, is that simply the number of AP courses taken by a student appears to be unrelated to college success, implying that college admissions committees should prioritize individuals with AP exam results above those who just registered in a course (Ackerman et al., 2013; Geiser & Santelices, 2006).

Looking at the breadth of research around the AP program, research from both College Board and unaffiliated researchers find that, generally, participation in AP is associated with higher achievement in a number of student success metrics in college.

However, the significance and strength among relationships are less clearly matched when researchers control for potentially confounding variables and pre-existing differences.

Dual Enrollment

Sometimes referred to as dual credit or concurrent enrollment, dual enrollment courses have existed for almost half a century. Dual enrollment (DE) courses are "collaborative efforts between high schools and colleges, in which high school students (usually juniors and seniors) are permitted to take college courses" (Karp et al., 2007). One of the key aspects of DE courses is the potential to earn college course credit that could be applied toward a postsecondary degree (Karp et al., 2007; Mokher & McLendon, 2009). Historical research on dual enrollment has suggested that the first glimpse of DE can be traced back to the late 1800s. The John Hopkins' three-year college program and the University of Chicago's acceleration program are the precursors to the DE program we see today (Greenberg, 1988). Almost a century after its inception, the current form of DE began to take shape. Similar to the AP program, the impetus for the DE program was to provide students who were academically able an opportunity to take more challenging courses. In the mid-1960s, Simon's Rock College was created for any students who were interested in early college admission. As well, in the mid-1970s, California became the first state to establish dual enrollment programs via a state policy (Mokher & McLendon, 2009; Stoel, 1988). Minnesota legislators followed in 1985 by creating their state's first DE program/policy (Clark & Cambra, 2001; Greenberg, 1988).

Through the 1990s, dual enrollment saw significant expansion, especially as the focus on high school graduates' college preparedness and rates of postsecondary

attainment increased (Karp, 2012). Also, studies consistently showed a significant correlation between curricular preparation and postsecondary outcomes (Adelman, 1999, 2006). Unlike the early AP program, DE programs were not exclusive and often offered more direct exposure to college life and collegiate courses for high school students. The typical DE program allows high school students the opportunity to take college-level courses at two- and four-year institutions if they are eligible for admission into that postsecondary institution. Allowing high school students to take collegiate-level courses permits them to develop not only academically, preparing them for more rigorous coursework, but in some cases also prepares the student for the social and educational environment of college, while also receiving additional assistance from the high school. However, as is the case with decentralized policies, there is no one way in which students could participate in DE course. Some K-12 systems may have partnerships with colleges in their area to offer DE courses and some postsecondary institutions may offer DE courses to any student who meets the minimum criteria. Some courses may even be offered at the high school and taught by certified (by the college) high school teachers.

In the past twenty years, states across the U.S. have increasingly relied upon dual enrollment as a means of easing the transition from high school to postsecondary education and improving college completion rates (Hoffman et al., 2009; Mokher & McLendon, 2009). Today, almost all states have legislated policies regarding various aspects of DE programs (Borden et al., 2013; Karp et al., 2007). However, DE policies' "eligibility and tuition requirements, funding streams and program features vary widely from state to state" (Krueger, 2006). Some states have mandatory DE policies that explicitly state what is and is not available and who is responsible for funding. Others

have strictly voluntary policies that are decidedly vaguer and give discretion to the various actors in how the program is run. According to Borden et al. (2013), 16 states require that DE courses be offered to high school students, and 14 states have policies that highly encourage these opportunities.

DE was created, and remains to be, decentralized in its implementation, a very different format from AP programs. In the last 30 years, the DE program has widened its reach to allow students of all levels (average, underachieving, and high achieving) the opportunity to participate in DE programs, given they meet the minimum criteria for admission into the postsecondary institution (Clark & Cambra, 2001). A 75% increase in enrollment within DE programs between 2002 and 2010 highlights the rise in popularity of the programs (Borden et al., 2013). As of 2011, almost all states offer high school students the opportunity for some DE courses (Cassidy et al., 2010) and, as a result, more than two million students enrolled in dual enrollment courses (Thomas et al., 2013). Some researchers attribute this growth to the wide reach of the types of students that can participate in DE programs. The inclusion of the average achieving students is one way of encouraging college enrollment for those who may not have had any prior incentive and who had been previously excluded from other accelerated learning programs. Having these broader parameters for enrollment has no doubt contributed significantly to the approximately 80 percent of high schools that reported having students participate and to over 2 million enrollees in DE courses in 2010 (Thomas et al., 2013).

Depending on the specific state and financing model, obtaining college credit through dual enrollment could be tuition-free or highly discounted. This reduction or elimination in costs makes it a more economical choice than earning college credit as an

enrolled college student (Finken, 2003; O'Connor & Justice, 2008; Taylor et al., 2014). However, for areas or schools that do not have legislated funding models, students can be dissuaded from participating because the cost is prohibitive. Even knowing that they may save money down the road, the immediate costs are a deterrent for some populations of students. Using a critical incident analysis method, O'Connor and Justice (2008) and Mansell and Justice (2014) find that the cost of dual enrollment courses is a significant deterrent to participation in the program. Some students indicated that while they were unable to afford the costs of dual enrollment, they were able to afford the AP exam fee, which is much less than tuition for a full-cost college course (O'Connor & Justice, 2008). As students consider participation in accelerated learning programs, these factors weigh heavily upon their decisions.

As mentioned in the prior section, the way in which collegiate credit is earned and awarded varies among the three types of accelerated learning programs. Students earn course credit by taking and passing DE collegiate courses while still enrolled in high school. Unlike AP and IB courses, there is no additional exam taken to receive college credit for the passes course. In that spirit, DE credit is processed differently when being accepted by colleges, as it is actual college credit previously awarded. DE credit earned from completion of coursework from an institution different from the institution enrolled in for college is treated as transfer credit and must be matched against the institution's transfer equivalency table for inclusion on the student's record. An official transcript of earned DE credit must be presented to the institution prior to enrollment.

DE Participation and Access

As mentioned previously, there is no central organization to collect and process data concerning participation rates, grades, scores, etc., across DE programs. Much of the details involving DE programs are developed, agreed upon, and monitored by the individual high schools and partner colleges. The decentralized nature of DE programs has led to the lack of student-level, nationwide DE data, and has limited research across the program as a whole. While we have some limited information on the number of schools and states that participate in DE programs, there is relatively little data available on DE student demographics nationwide. The current information regarding the demographics of DE students is largely anecdotal or based on the analysis of specific DE programs.

DE programs are often tightly coupled geographically with postsecondary education institutions and with the preponderance being associated with community colleges. With approximately a third of community colleges being located in more rural and low-density areas, DE programs tend to be associated with students from those same areas (Provasnik & Planty, 2008). In the early 2000s, evidence suggested that DE programs were not adequately reaching low-income or underrepresented students, and according to the National Center for Education Statistics, in 2003, "schools with the highest minority enrollment were the least likely to offer dual enrollment courses when compared to schools with lower minority enrollment – 58% to 78%" (Krueger, 2006).

Dual enrollment programs originated out of the same desire to offer high-achieving students a rigorous curriculum option while still enrolled in high school (Tobolowsky & Allen, 2016). This intention is reflected in the participation data, in that

most DE research indicates that high-achieving students are more likely to participate in dual enrollment programs than students who perform academically at lower levels (Lochmiller et al., 2016).

With the exception of high-achieving students, white and high-SES students are traditionally more likely to participate in dual enrollment than low-SES students (Pierson et al., 2017). However, in the last twenty years, policymakers have focused efforts on extending dual enrollment opportunities to underserved student populations. State-level initiatives were developed to target and support underserved populations. For example, New York's "College Now" program specifically targeted low-income and underachieving students (Meade & Hofmann, 2007). Another example of state policy being implemented to aid in the diversification of access and enrollment is the State of Virginia's dual enrollment policy. It was amended in 2005 to better inform high school students about the prospects for dual enrollment and to remove barriers to enrollment for qualified 9th and 10th graders (Pretlow & Wathington, 2014).

There is some indication that initiatives to broaden DE access beyond these conventional groups have been successful. In the case of Virginia, data demonstrate that in the year after the introduction of this policy adjustment, Black student engagement increased by 21%, outpacing the 16% rise reported for white students (Pretlow & Wathington, 2014). In a Texas community college from 2005-2011, there was found to be an increase in DE participation for both White students (an increase of 74%) and Black students (39% increase) (Young et al., 2013). The enrollment of Hispanic students more than doubled, increasing from 6.7% to 17.4% during that same time period (Young et al., 2013). The introduction of DE-specific policies, coupled with the removal of

financial barriers to DE programs, seems to positively impact the participation of underrepresented students in the program.

DE and Postsecondary Student Success

Due to the decentralized nature of DE program data, most of the research on the postsecondary success of DE participants comes in the form of individual studies with fairly narrow-scoped research. An and Taylor (2019) compiled a thorough and expansive literature review of the empirical studies that investigate DE program impact. I will focus here on studies specifically related to postsecondary education success, more specifically on time to postsecondary degree. Similar to AP research, early research on the impact of DE programs focused largely on descriptive analyses, not addressing any of the unobservable (or observable) characteristics that may also influence student academic success (An, 2013). Fortunately, more recent studies on DE attempt to account for these differences.

The vast majority of studies on DE, regardless of sample type, analytical method, or outcome of interest, find that students who participate in DE courses fare better in postsecondary educational outcomes than students who do not, even when accounting for robust baseline differences. There are few empirical studies that investigate the relationship between DE and degree completion and even fewer regarding DE and the relationship to time to degree despite the relationship being a commonly advertised benefit of DE programs (Bailey & Karp, 2003; Hoffman et al., 2009). However, the research that has been done shows that, generally, student participation in DE increases the probability of completing a postsecondary degree.

Using a propensity score matching approach, Struhl and Vargas (2012) estimated that students in Texas who have completed at least one DE course have 1.77 times the chance of graduating from a four-year institution within six years when compared to those who have not. Also using propensity score matching to analyze data from high school graduates in Illinois, Blankenberger et al. (2017) found that students who entered college with DE credits were more likely to earn a bachelor's degree than their matched peers who did not take DE courses. Interestingly, they found that the improvement in postsecondary degree attainment was greater in students enrolled at community colleges than those enrolled in more selective colleges, although both had a positive effect on graduating (Blankenberger et al., 2017). An (2013), using national data from the National Education Longitudinal Study of 1988, also analyzed the relationship between dual enrollment and college degree attainment using propensity score matching. An found that students who participated in DE were seven percentage points more likely to earn a bachelor's degree than were students with no DE participation.

Moving beyond investigating indicators of college degree completion, there are a few studies that have highlighted specific time to degree results. For instance, Radunzel et al. (2014), using a large dataset from four Texas higher education institutions entering classes of 2005 or 2006, found that students who participated in DE courses in high school were more likely to complete their bachelor's degree in a shorter timeframe. In another example, conducting a regression analysis and a difference in differences model controlling for a wide range of demographic and student ability variables, Allen and Dadgar (2012) found that student participation in the College Now program (a DE

program out of New York City) reduces the student's time to degree and increases collegiate grade point averages.

Studies that use DE as a continuous variable have provided crucial insights into how these programs affect students' academic achievements as well as changes in policy. Karp et al. (2007) suggest that there may, in fact, be a max number of credits or courses that provide the most benefit. They find that taking extensive dual enrollment courses (five or more) has a minimal additional impact on outcomes like high school completion, postsecondary enrollment, college GPA, and retention after the first year. In fact, a moderate number of DE courses (one to two) may yield the most significant results (Karp et al., 2007). Using a large robust student dataset from the Texas Education Research Center, Giani et al. (2014) found that considering DE as a dichotomous indicator is still a significant predictor when they included a secondary variable that highlighted the total number of DE courses taken by each student.

In sum, dual enrollment involvement, on average, leads to more favorable and desired postsecondary educational outcomes, especially in studies that apply more complex statistical analysis. These findings are consistent across various studies, situations, and outcomes, with few exceptions.

International Baccalaureate

The International Baccalaureate (IB) Diploma Program differs in origin as well as format from both the AP and DE programs, but the expected end result of students taking more rigorous coursework in high school and potentially earning college credit is the same. International Baccalaureate Organization was founded in Geneva, Switzerland in 1968 and centered on a comprehensive curriculum that, when completed while students

are still enrolled in high school, leads to an IB diploma. The IB Program was developed to meet the academic needs of students who required academic credentials that would be accepted worldwide, such as children of diplomats and students likely to travel abroad extensively (Poelzer & Feldhusen, 1997). In addition to the pragmatic need, the organization also created the program to "develop inquiring, knowledgeable and caring young people who help create a better and more peaceful world through intercultural understanding and respect" (International Baccalaureate Organization, 2019d). The development of a standardized and rigorous IB curriculum was intended to allow students to receive a commonly recognized education that is accepted across geographic boundaries. The developed curriculum that later became labeled as the IB Programme created a shared academic experience and focused on fostering critical viewpoints and promoting tolerance and exploration of thought and international understanding while developing its students' cultural identities (International Baccalaureate Organization, 2019a).

The IB organization itself now offers a wide range of opportunities and educational programming that includes a program for elementary school-aged students (the IB Primary Years), middle school students (IB Middle Years), and high school students (IB Diploma) (International Baccalaureate Organization, 2019a). The IB Diploma Program not only includes the traditional educational curriculum, but also specific critical thinking classes and 150 hours of extracurricular activities and community service. The IB Diploma Program is the program of importance in this study.

The first IB World School in the United States opened in 1971, and over the last four decades, the program has grown and expanded throughout the US. As a result, the

program saw an increase from 268 IB schools in 1999 to 1,090 in 2009 and a subsequent increase to 1848 schools in 2018 (Bunnell, 2010; International Baccalaureate Organization, 2019c). In 2018 the number of schools across the US that offered at least the high-school diploma program had jumped to 948, almost tripling the number of participating schools in 15 years (International Baccalaureate Organization, 2019c). The growth seen in the US is also occurring worldwide. In June 2022, the IB Organization reported that IB programs were offered in 160 countries and over 5,000 schools and that over a five-year period (2016-2020) the number of IB programs offered has grown by 33.3% worldwide (International Baccalaureate Organization, 2019a).

Although there has been growth in this program, when compared to the other accelerated learning programs in the US, the number of high schools that offer IB curriculum is significantly smaller than the number of those offering AP and DE courses. This differential is largely due to the school application process and strict curricular guidelines required of schools given the IB designation. Schools that wish to offer the IB program must undergo a stringent application process that can last up to three years and cost thousands of dollars. It also includes an extensive school self-study, faculty and staff training, and curriculum development (Nugent & Karnes, 2002). In addition, each member school pays an annual membership fee of over $10,000; this fee serves to cover operational expenses such as curricular development and professional development trainings for teachers of IB courses. Rarely does the fee cover these costs completely. Students have to pay the individual enrolment fee as well as each of the six exams they must take (International Baccalaureate Organization, 2019b). These costs and time-consuming application processes likely play a role in keeping the numbers of IB schools

and, thus, IB students down. Despite the smaller numbers, interest from colleges and universities in enrolling IB students and offering college credit for tests and courses completed does promote the growth and interest in the program among students and schools. Credits earned via IB are often treated the same as AP and DE credit; therefore, the IB data are included in this analysis.

Students that participate in an IB Diploma Program are required to take courses in six subject areas: language and literature, language acquisition, individuals and societies, sciences, mathematics, and arts (International Baccalaureate Organization, 2019a). Each course can be offered at two levels: standard or higher, depending on the school. Upon completion of each subject area IB course, students take written exams. Students receive a score ranging from 1-7 for each subject exam. Many colleges offer college credit for students who have taken part in the IB program. At most colleges, credit earned is based on the scores for each individual subject area exam as opposed to the completion of courses or the IB diploma itself. Some select colleges only give credit for the completion of higher-level exams, but the majority have a scale for awarding credit for higher ranking scores on the standard-level exam as well. As with AP exam scores, this credit typically corresponds with entry-level courses at the institution (International Baccalaureate Organization, 2019a).

IB Participation and Access

Demographic information regarding participants in the IB Diploma Program is quite limited. One of the available IB reports, published in 2008, highlighted the demographics of students who had participated in the IB program and were eligible to take the tests to earn the diploma. The demographic breakdown of IB students is skewed

similarly to that of AP and DE programs. White (59.4%) and Asian (15.7%) students make up the largest demographic categories. However, the percentage of African American students participating in the IB program (9.8%) was higher than that of AP participation at the time of that study (International Baccalaureate North America, 2008).

The low percentage of traditionally underrepresented students participating in IB programs is likely tied to the type and location of IB schools and the demographics of the schools themselves. Given the individual financial burden, it is not surprising that the majority of IB institutions are private. Within the public sector, financing for the IB Diploma Program comes from the state, school districts, or parents. Because IB Diploma Programs are automatically selective due to academic prerequisites and financial commitments, the percentage of students pursuing the IB Diploma Program at public institutions is relatively low. Public funds designated for the IB Diploma Program are sometimes perceived as supporting only a limited set of pupils at the expense of other essential public educational programs.

In 2008, only 14% of the candidates from public IB schools in the US were eligible for free or reduced lunch. This indicates that affluence may play a role in the availability of and participation in IB programs (International Baccalaureate North America, 2008). The location of IB schools in the US primarily favors suburban (45%) and city (43%) public schools, with only 7.3% of IB schools being designated as rural (International Baccalaureate North America, 2008).

IB and Postsecondary Student Success

Empirical research on the relationship between IB program participation and postsecondary educational student achievement outcomes is incredibly limited. Similar to

the early research on AP, the vast majority of research on the collegiate-level outcomes of IB students has been commissioned by the International Baccalaureate Organization (Bergeron, 2015; Caspary & Bland, 2011; Shah et al., 2010). In fact, a review of the scholarly literature on the *Impacts of International Baccalaureate programmes on teaching and learning* by Dickson et al. (2018) described only two non-IB-sponsored studies that looked at any form of college-level outcome related to participation in IB. One study conducted by Saavedra (2011) in the Chicago Public School District was able to control for prior academic ability as well as additional background characteristics. Saavedra found that, even with the majority of students in the study representing low-income households, participation in the IB Diploma Program increased students' probability of graduating from high school, increased student performance on the ACT exam, and increased enrollment in postsecondary institutions within two years of graduating. The second study, using data from students who completed the IB Diploma Program in the United Kingdom, Green and Vignoles (2012) discovered that IB students were achieving higher university grades than those who did not enter university from IB programs. They were able to account for numerous student-level characteristics; however, they were unable to control for prior student academic achievement. The result was that the authors cautioned against the self-selection bias of their conclusions.

Studies commissioned and sponsored by the IB Organization also report positive relationships between IB participation and postsecondary student achievement. However, it is important to note that the majority of the studies that follow have not been peer-reviewed or published outside of the IBO commissioning and may not have undergone the same level of academic scrutiny.

Duevel (1999) investigated if earning an IB diploma in high school was a good indicator of future performance in postsecondary education. She discovered that 92% of IB Diploma holders from a selection of US colleges had earned bachelor's degrees, while 87% of those students earned their degree within five or fewer years. Shah et al. (2010) investigated the success of IB Diploma students enrolled at the University of California. Regression analysis was used to compare the group to both the entire student body of the University of California and a comparison group of similar non-IB students. They used key characteristics to compare the populations, including enrollment, family income, race, and high school performance as measured by GPA and highest SAT or ACT scores. The study revealed a favorable connection between IB participation and college achievement (after adjusting for socioeconomic status, ACT/SAT scores, and high school grade point average)(Shah et al., 2010). Caspary and Bland (2011) conducted a study of Florida IB students that enrolled at the University of Florida post-high school graduation. They discovered that students who achieved high scores on their IB subject tests also had higher college grades in courses of the same subjects.

In a study conducted on behalf of the IBO that investigated college enrollment, retention, and graduation outcomes for IB Diploma Program students in US high schools, Bergeron (2015) uses descriptive statistics to show that 98% of the students who attended public or private high schools in the US during the 2008-2014 time period, completed the IB examinations, and matriculated into higher education were retained after their first year. This is much higher than the 77% national retention rate.

Comparing Accelerated Learning Programs Based on Postsecondary Student Success

As stated throughout this paper, the intended goal of accelerated learning programs was to provide a more rigorous and academically challenging curriculum for high school students in order to better prepare them for collegiate learning. However, in recent years, parents, students, policymakers, and postsecondary institution administrators often turn to accelerated learning programs to help offset the growing expense of college for students and families by decreasing time to graduation rates (O'Keefe et al., 2010). Numerous studies have evaluated the efficacy of these programs individually, as described in earlier sections, and many of them have discovered a strong correlation between the completion of the more difficult curricula of accelerated learning programs and postsecondary degree achievement (Adelman, 1999; Duevel, 1999; Foust et al., 2009; Mattern et al., 2013; Saavedra, 2011; Sadler et al., 2010; Young et al., 2013). However, few studies have compared students who participated in AP, DE, and IB programs on postsecondary student success outcomes or have adequately controlled for important baseline differences between students.

Researchers have only recently begun to dig deeper and more critically analyze the relationship between participation in the various accelerated learning programs and postsecondary student success outcomes. Critical examination and research have increased due to the phenomenal growth of these programs and the almost ubiquitous application of providing college credit for either exam scores or course completion by postsecondary education institutions. The sections above highlight program-specific studies on postsecondary student success outcomes. In this section, I provide a synopsis

of studies and findings that begin to compare the impact of each of the three programs, AP, DE, and IB, on outcomes of student success in higher education, focusing most on the variable of interest for this study, time to degree. The majority of studies comparing outcomes of participants in accelerated learning programs focus on AP and DE programs and utilize a variety of analytical methods to measure the relationship.

In a technical paper that accompanies the chapter of the same name in the book*, A Critical Examination of the Advanced Placement Program* (Sadler et al., 2010), Klopfenstein (2010) goes into much greater detail about the analysis she conducted. Klopfenstein uses survival analysis and Cox's proportional hazard model to estimate the effect of AP courses on time to postsecondary graduation for students in Texas. While her predominant focus is on AP courses and exams, which she finds to have little probability of increasing the likelihood of college graduation, she does find that DE credit was associated with a 25% increase in the probability of graduating.

Using data from high school students in Florida, Speroni (2011) ran a multiple regression analysis with fixed effects for high school and controlled for a number of student and school characteristics. She found that both AP and DE were associated with favorable postsecondary outcomes. However, for some model specifications, the difference between AP and DE, in terms of degree achievement, was not statistically significant (Speroni, 2011). Godfrey et al. (2014), in a College Board-sponsored study using multiple regression analyses, found that AP students with high exam scores tend to have higher college GPAs than DE students who earned a course grade of B or higher. Moreover, they discovered that DE students with course grades of B or better typically

receive more college credits and complete their degrees more quickly than those with AP exam scores (Godfrey et al., 2014).

Wyatt et al. (2015), in another report sponsored by College Board, compared the outcomes of students who participated in either AP or DE classes while looking specifically at retention rates and 4- and 6-year college graduation rates. Wyatt et al. used a combination of logistic regression and linear regression to measure the impact of the dichotomous and continuous variables of interest. With the exception of four-year college enrollment, which was greatest for students who had taken a dual enrollment course associated with a four-year college, the data showed that AP students who achieved a three or higher on at least one AP Exam significantly outperformed on all outcomes.

Once researchers accounted for discernible differences between AP and DE students, some studies found less pronounced disparities in the benefits of DE and AP. Initial research indicates that AP students are more prepared for college and more likely to graduate than DE students. However, these findings highlight baseline distinctions between AP students and DE students in terms of student characteristics, which if not controlled for, could have potentially impacted the findings (An, 2013; An & Taylor, 2019; Speroni, 2011). Overall, the results of these studies demonstrate that dual enrollment is not inferior to AP when assessed and evaluated by bachelor's degree attainment. In fact, DE may be a viable alternative for students who do not gravitate toward AP courses or those who do not have adequate access to AP courses.

Time to Degree – Why it Matters

As described above, few prior studies on accelerated learning programs focus on the association between these programs and time to degree. Rather, educational researchers have primarily focused on understanding the relationship between various factors on degree completion (Adelman, 2006; Tinto, 2012). Over the last four decades, students, specifically those enrolled in non-selective public colleges, have begun taking longer to complete an undergraduate degree. In addition, research demonstrates that the longer students remain enrolled in a post-secondary education program past the average completion timeframe, the less likely they are to graduate (Bound et al., 2012). The collective information regarding increased time to degree and decreased probability of completion should raise the profile of time to degree as an outcome of interest for colleges and students alike.

In their 2016 report on time to degree, Shapiro et al. found that among four-year public colleges, only 37.5% of graduates earned their degree within four years. In fact, according to their national analysis of time-to-degree, bachelor's degree earners were enrolled for an average of 5.1 years (Shapiro et al., 2016). Bound et al. (2012) consider several potential explanations for these trends and can show that demographic characteristic changes or changes in college preparedness did not account for the observed increases in time to degree. In other words, something potentially systematic is shifting this timeframe up for all students. However, they find "declines in collegiate resources in the less selective public sector and increases in student employment as potential explanations for the observed increases in time to degree"(Bound et al., 2012).

A student taking longer to complete their bachelor's degrees is associated with an increased risk of non-completion. Therefore, shortening time-to-degree is a reasonable goal for students and institutions to improve overall completion rates. Identifying mechanisms by which policymakers, institutions, and students can potentially shorten time to degree, poses benefits to all constituencies.

Summary of Literature & Contributions of this Study

The studies highlighted in this chapter suggest that there continues to be a need to evaluate the relationship between accelerated learning programs and collegiate student success. With this need for more information, it is critical that researchers utilize robust data and analyses to attempt to control for as many observable and unobservable biases that are very likely present in the student population. High school students are taking more and more college-level coursework, potentially participating in multiple accelerated learning programs at a time, and are doing so earlier in their academic careers. As this trend continues, and as resources both at the family and school levels continue to flow into these accelerated learning programs, parents, students, and educators need further information as to whether participation in these programs has a significant impact on time to degree in postsecondary education and the difference in the outcomes by type of program.

While a growing body of literature suggests that students from accelerated learning programs outperform peers who do not participate in accelerated learning programs with respect to postsecondary outcomes, including time to degree, few studies compare the relative efficacy of the variations of accelerated learning programs such as Advanced Placement (AP), Dual Enrollment (DE) or International Baccalaureate (IB).

District leaders, school principals, and students must frequently choose between these options, yet little research has outlined the comparative benefits of the various accelerated learning programs.

The conclusions about the relationship between accelerated learning programs and postsecondary academic success are generally limited by issues of self-selection bias at both the school and student levels. With accelerated learning programs, the characteristics that convince students to self-select into the programs may also be found to be correlated with student success in college. One of the primary areas of limitation in existing studies is the inability to control for pre-existing characteristics that may contribute to the self-section process. Factors like motivation, location, predisposition, previous academic coursework, SES, race, etc., may not only significantly impact the availability of and selection into the programs, but also potentially the future academic success of that student (Bailey & Karp, 2003; Karp et al., 2007; Klopfenstein, 2004). This study aims to control for many of these factors using available data as proxies to control for self-selection bias.

In the next chapter, I discuss the independent variables that I use to control and account for many of these factors, then describe the multiple analyses proposed to examine accelerated learning credit's relationship with time to degree. But, first, I wish to provide a summary of the conceptual framework that guides this study.

Conceptual & Theoretical Framework

There are several theoretical perspectives that researchers have used to guide studies on accelerated learning programs. For this study, I built a conceptual framework based on prior research and supported by three theories to analyze the impact of accelerated learning credit on a student's postsecondary educational attainment. Specific student characteristics and backgrounds have repeatedly been found to impact postsecondary degree attainment (Pascarella & Terenzini, 1991; Tinto, 1993). Specifically, my study utilizes available independent variables that, according to prior research and theory, have a strong association with postsecondary student success and degree attainment. These variables, described in detail in Chapter 4, establish a robust set of controls for perceived differences among students. By centering my study on what has already been identified as associated with degree attainment and time to degree, I am able to introduce additional explanatory variables of interest to assert a relationship with my outcome of interest. The two sections below briefly describe the characteristics that have been found to be associated with attaining a college degree, then describe the theoretical frameworks used to guide this study.

Characteristics that Impact Time to Degree

College completion and time to degree receive a lot of attention in the higher education research community as well as from higher education administrators. The rate at which students enroll in and then complete degrees is often raised as one of the single most important metrics within institutions. As such, much research has been done around variables that may influence, both positively and negatively, student time to degree so that mitigation or support services can be developed at the institutional level. In

developing this study, it was important to acknowledge the many associated student characteristics that may have a strong association with postsecondary student success, graduation, and time to degree, according to prior research and theory. By identifying and including these characteristics in my conceptual framework, a set of variables is developed for inclusion as independent variables in my study to control for differences among students in hopes of minimizing omitted variable bias. The variables discussed below are not the focus of the study. Thus, a detailed review of each is not included. Rather, I briefly introduce each and explain the value of inclusion as an independent variable in my study. The specific breakdown of the data representing these characteristics is included in Chapter 4.

Demographic Characteristics

Sex. Males have historically had much higher college completion rates than their female counterparts. However, in recent decades, the graduation rates for women, particularly white women, have increased significantly, surpassing males. Recent research on gender (sex) as a determinant in student achievement discovered that females graduate more frequently than males and with higher completion rates (Astin, 1987; Bailey & DiPrete, 2016; Buchmann & DiPrete, 2006; DeAngelo et al., 2011; Goldin et al., 2006; Thomas, 1981; Tinto, 1993)

Race. Historically, race and ethnicity appear to be key predictors of college achievement. A number of studies have found that African-American and Hispanic students are less likely to persist to completion of their degrees (Astin, 1997; Hossler et al., 2013; Murtaugh et al., 1999; Terenzini & Pascarella, 1998). Despite an increase in

minority population enrollment, an ethnic divide is still persistent in college completion rates.

Socioeconomic Characteristics

Average Household Income. Income inequality has long been a problem, contributing to disparities in college completion rates. Even though college completion can help with upward social mobility, lower family income is associated with lower college completion probability (Astin & Oseguera, 2005; Dynarski, 2002; Goldrick-Rab et al., 2016). In fact, the association between household income and college completion is quite high. For those that do attend college, students that are low-income are at a higher risk of dropping out before completion (Alon, 2009; Bastedo & Jaquette, 2011; Choy, 2000; Haveman & Smeeding, 2006).

First Generation Status. Students who begin their college careers as first-generation students often face hardships that other students do not. A consistent definition of first-generation college students has not been adopted applied across the field of higher education research (Toutkoushian et al., 2018). However, the existing research has found that students whose parents have low or no postsecondary education experience are, in general, less likely to enroll in college and more likely to drop out of college once enrolled (Choy, 2000; Pascarella et al., 2004; Tinto, 1993).

Financial Aid: Need-based financial aid is commonly used by colleges and policymakers to promote equality in college outcomes. What is less consistently presented in research is whether the application of aid is consistently related to higher retention and graduation rates. Some studies have found that granting students financial

aid increases the likelihood that they will earn a bachelor's degree (Alon, 2007; DesJardins & McCall, 2010; Goldrick-Rab et al., 2016).

High School Academic Performance

Over decades of research, a common finding related to college completion is that high school academic performance is a reliable predictor of college success, specifically persistence and completion. In fact, as proxies of academic performance*, high school GPA* and standardized test scores (*SAT/ACT scores)* have been found to be significant predictors of college student success, specifically degree attainment (Adelman, 2006; Astin & Oseguera, 2005; Attewell & Domina, 2008).

Theoretical Frameworks

In addition to prior research on student characteristics influencing the structure of this study, there are several existing theoretical frameworks useful for analyzing the relationship between accelerated learning credit and college degree completion, specifically time to degree. I utilize a combination to support the framework of this study. Human Capital Theory, cost-benefit analysis, and signaling theory each provide a critical lens for framing this study and interpreting the results.

A common theoretical framework used in the education field, Human Capital Theory refers to acquired skills and knowledge that impact one's future gains (e.g., the likelihood of gainful employment, future earnings, and overall well-being) (Becker, 1962). Education, specifically higher education, has often been viewed as the best investment for one to gain human capital, specifically concerning greater success and higher achievement in the labor market. Economic and educational research generally supports the claim that students who obtain a college education are more likely to receive

higher salaries than those with only a high school diploma, aligning skills and knowledge developed with increased earnings (Becker, 1962; Kane & Rouse, 1993; Murphy & Welch, 1989). Many of the proponents of accelerated learning programs claim that Human Capital Theory may explain why participation in accelerated learning programs are a good indicator of postsecondary education success (Klopfenstein & Thomas, 2009). Participation in more complex, rigorous curriculum in high school, such as accelerated learning program courses, may construct human capital in students and develop skills and abilities to learn at a higher level and persist through adversity. This human capital developed in high school prepares students for collegiate success and further capital building.

A second framework that serves to view student participation in accelerated learning programs is cost-benefit analysis. Participation in accelerated learning programs can lead to students earning and applying credit earned in high school toward their college degree. Cost-benefit analysis would presume that students are weighing the time, social, and monetary costs of participating in accelerated learning programs while in high school against the potential for future gains, most likely in the form of earned collegiate credit and the potential to apply that credit and graduate early. Much of the marketing behind the accelerated learning programs touts the benefits of time to degree and cost reduction, thus increasing the number of years during which participants can benefit from the earnings premium associated with a college education. According to cost-benefit analysis, this increases the probability that students will choose to participate in these programs and utilize the results (credits) to complete their college degree in a timely manner, both producing cost savings and increasing future earnings.

These two theoretical frameworks assume that students are considering the long-term outcomes of participation in the programs. An alternate, but not necessarily competing, theory by which to view earning accelerated learning credit is Signaling Theory (Weiss, 1995). Signaling Theory posits that earning accelerated learning credit and completing more rigorous coursework serves as a signal to colleges and universities about two traits and abilities that are difficult to measure: academic motivation and academic ability. Researchers have begun to explore the conceptualization that a student's participation in the programs might solely be to act as a signal to colleges that the students have not only the ability, but also the motivation to complete rigorous coursework. Rather than assuming, as does Human Capital Theory, that students participate in accelerated learning programs because they know it will help them succeed in college, signaling theory contends that students take the courses for more short-term returns. By signaling to college admissions offices what are often perceived as "unseen characteristics" (motivation, academic mindfulness, etc.), students believe it will increase their chances of being admitted to college, especially more competitive institutions. Research and practice support this claim, observing that admissions offices look more favorably at accelerated learning coursework when considering college admissions decisions (Klopfenstein, 2003). However, Klopfenstein and Thomas (2009) later warn that the use of signaling by colleges may no longer be useful if the number of students participating in accelerated learning programs continues to increase at such drastic rates. With increased numbers of students, the strength of the signal is highly diminished.

These three frameworks are not mutually exclusive, however. Students could be focused on the short-term (signal) and long-term (cost-benefit & human capital) when

choosing whether or not to participate in accelerated learning programs and which type. If signaling for college admissions is viewed as the primary motivator for student participation in accelerated learning programs, I expect to see little difference or change in the time to degree and graduation between participants and non-participants. If students participate in accelerated learning programs for more economic reasons, human capital gains, or for other benefits such as graduating early, I would expect to see differentiation in the success of the participants in college, particularly in the time it takes them to complete their undergraduate degree.

CHAPTER 3: DATA AND METHODS

This study investigates the relationship between earned accelerated learning credit and time to degree and graduation by conducting a quantitative, longitudinal, multi-cohort study in hopes of contributing to the ongoing conversation surrounding accelerated learning programs for students, institutions, and policymakers alike. This chapter will first provide an overview of the data, followed by a description of the construction of the dependent and independent variables for analysis. Following will be a description of the analytic models deployed in the study. The chapter finishes with a brief discussion of the limitations of this study.

Data Description

This study utilizes existing observational student data from a large, high-demand, public, land-grant, research I institution, where incoming students arrive, on average, increasingly more academically prepared, more economically advantaged, and where the majority of students enter with some accelerated learning credit. The institution also has historically recorded retention and graduation rates above its peer institutions. The dataset of first-time, full-time freshman cohorts enrolled in the institution beginning fall 2011 through fall 2015 includes demographic, enrollment, course load, and credit data for each student, creating a comprehensive and longitudinal dataset for each cohort. Analyses are limited to first-time, full-time freshman cohorts to allow for a streamlined look at time to degree. As will be discussed in the limitations section at the conclusion of this chapter,

this study excludes transfer students who enter the institution after their freshman cohort has already matriculated.

This dataset contains indicators of student demographics, high school preparation and achievement, financial status, collegiate enrollment and achievement data, and most relevant to this study–accelerated learning credit and time to degree. Of the total population across the five cohorts (N = 26,957), some cases were dropped from the analyses described below due to missing variables. See the tables below for the values for included and missing cases for each variable.

Construction of Variables

Dependent Variables

This study defines the primary dependent variable as time to degree, as measured by semesters. At this institution, each academic year contains three semesters/terms (summer, fall, spring). Colleges and universities often have multiple metrics by which they define completion or graduation. This study defines time to degree as the completion of (at least) a bachelor's degree, and the number of semesters it takes for that occurrence from the time of matriculation, regardless of whether a student enrolls in each term.

The time to degree variable (*TTD_Terms*) for this study is a numerical variable that ranges from four semesters to 31 semesters across the five cohorts of students, with a mean of 11.77 semesters, excluding the students that did not complete a degree at the institution. Of the total population across cohorts, 3,669 students dropped out or transferred before completing their degree. Degree completion was not reported in the *TTD_Terms* variable if the student finished their degree at another institution. Therefore, the interpretation of the mean is that, on average, of the students that complete their

degree at this institution, it took them approximately four years (11.77 semesters divided by three semesters per year).

Table 1: Descriptive Statistics - Dependent Variable TTD_Terms

Variable	Mean	Std Dev	Min	Max	N	Missing
Time to Degree *(in terms)*	11.77	1.98	4.00	33.00	23,288	3,669

An additional dependent variable related to time to degree is also explored as part of this study. The *Graduate* variable is categorical and includes the classifications: if a student did not graduate (0), graduated in three or fewer years (3), graduated in four years (4), graduated in five years (5), and graduated in six or more years (6+). I include this additional dependent variable in my study as a supplementary layer of inquiry and to aid in interpreting the results of the primary dependent variable, *TTD_Terms*. This dependent variable includes the population of students at the institution that did not complete their degree, a group that is not included in the *TTD_Terms* variable. Table 2 provides descriptive statistics of the additional dependent variable.

Table 2: Descriptive Statistics - Dependent Variable Graduate

Variable	Frequency	Percent	N	Missing
Graduate			26,957	0
Did Not Graduate	3,669	13.61%		
Graduated in 3 or fewer Years	719	2.67%		
Graduated in 4 Years	16,768	62.20%		
Graduated in 5 Years	4,804	17.82%		
Graduated in 6 Years	997	3.70%		

Explanatory Variables

Accelerated Learning Credit. The variable(s) of interest in this study include indicators of participation in and completion of accelerated learning programs. Specifically, this study looks at the academic credit assigned by this particular institution for students' completion of or achievement in Advanced Placement (AP), International Baccalaureate (IB), or Dual Enrollment (DE) programs and/or exams as described in the prior chapter. For this study, I did not consider participation in accelerated learning programs but rather the application of the earned credits, through passing courses and/or passing exams, at this particular institution.

At this institution, AP and IB credit are evaluated and awarded based on the AP and IB subject exam scores submitted by the student. Exam scores and the collegiate course credit equivalences are determined by the institution and are evaluated and updated regularly. Each exam score submitted is then translated into the equivalent number of credit hours for the institution. DE credit is processed differently, as it is actual college credit awarded. DE credit earned from completion of coursework from an institution different from the institution enrolled in for college is treated as transfer credit and must be matched against the institution's transfer equivalency table for inclusion on the students record. An official transcript of earned DE credit must be presented to the institution prior to enrollment in the first semester of their freshman year. As mentioned previously, this study does exclude transfer students from the population. Transfer students are defined as students that are admitted to the institution, but not as part of the first-time full-time cohort of freshman. Typically, transfer students start sometime after the completion of their freshman year elsewhere. However, students who enter the

institution as first-time full-time freshman with DE transfer credit are included in the study.

To dive deeply into the relationship between earned accelerated learning credits and time to degree, I created multiple variables to explore the relationship. The multiple explanatory variables are categorized in this study as any accelerated learning credit, the number of accelerated learning credit hours earned, and combinations of types of accelerated learning credit.

Any Accelerated Learning Credit. Four dichotomous variables were created to represent the presence of earned accelerated learning credit. To address research question number one, *any_accelerated* represents whether a student has earned any accelerated learning credit, regardless of type. The other three explanatory variables represent whether the student has any AP(*any_ap*), DE(*any_de*), or IB(*any_ib*) credit, regardless of the amount, and help to answer research question two.

Number of Accelerated Learning Credit Hours Earned. Four continuous variables were defined in relation to the number of accelerated learning credit hours earned by students. Representing a combination of all possible accelerated learning credit hours, regardless of type, the variable *all_accelerated* is designed to help address the third research question. The amount of each particular accelerated learning credit type earned is represented by *AP_Hours_Earned*, *DE_Hours_Earned*, and *IB_Hours_Earned*, and helps to answer research question four.

Combinations of Types of Accelerated Learning Credit. To answer the final research question of this study (5), the categorical variable *accelerated_combo* represents

all of the combinations of types of accelerated credit a student may enter the institution with. See Table 3 for the breakdown of variables and data definitions.

Table 3: Explanatory Variables Descriptions and Attributes

Any Accelerated Learning Credit Hours:	
any_ap	Received any AP credits Dichotomous 0 = Did not receive any credits from AP 1 = Received some credits from AP
any_ib	Received any IB credits Dichotomous 0 = Did not receive any credits from IB 1 = Received some credits from IB
any_de	Received any DE credits Dichotomous 0 = Did not receive any credits from DE 1 = Received some credits from DE
any_accelerated	Received any accelerated learning credits Dichotomous 0 = Did not receive any credits from AP, IB, or DE 1 = Received some credits from AP, IB, or DE
Number of Accelerated Learning Credit Hours Earned:	
AP_Hours_Earned	Number of AP credit hours received Continuous
IB_Hours_Earned	Number of IB credit hours received Continuous
DE_Hours_Earned	Number of DE credit hours received Continuous
all_accelerated	Total Number of all accelerated learning credit hours received Continuous *AP_Hours_Earned + IB_Hours_Earned + DE_Hours_Earned*
Combinations of Types of Accelerated Learning Credit:	
accelerated_combo	Categorical Combinations of types of accelerated learning credit *None* *AP only* *IB only* *DE only* *AP&IB* *AP&DE* *IB&DE* *AP, IB, & DE*

Table 4 presents descriptive statistics for each accelerated learning explanatory variable.

Table 4: Descriptive Statistics - Explanatory Variables

Variable	Mean	Std Dev	Min	Max	N	Missing
all_accelerated	13.60	11.14	0	146	26,957	0
AP_Hours_Earned	11.10	10.26	0	83	26,957	0
IB_Hours_Earned	0.44	2.41	0	39	26,957	0
DE_Hours_Earned	2.06	6.38	0	119	26,957	0

	Frequency	Percent	N	Missing
any_accelerated			26,957	0
0	3,506	13.0%		
1	23,451	87.0%		
any_ap			26,957	0
0	5,591	20.7%		
1	21,366	79.3%		
any_ib			26,957	0
0	25,774	95.6%		
1	1,183	4.4%		
any_de			26,957	0
0	22,383	83.0%		
1	4,574	17.0%		
accelerated_combo			26,957	0
None	3,506	13.0%		
AP only	17,722	65.7%		
IB only	634	2.4%		
DE only	13	5.3%		
AP&IB	521	1.9%		
AP&DE	3,108	11.5%		
IB&DE	13	0.05%		
All	15	0.06%		

Demographic Control Variables

This study utilizes independent variables that, according to prior research and theory, may have a strong relationship with postsecondary student success, graduation, and/or time to degree. Using these variables in this study establishes a set of controls for perceived differences among students and hopes to minimize omitted variable bias. Table

5 presents descriptive statistics for each of the independent variables of this study, and following is a more detailed description of the data.

Cohort Year. In an effort to minimize unobservable characteristics or potential environmental influences present in each cohort of students, I use *Cohort_Year* as a categorical control variable. This variable is defined as the year of the fall semester that a student matriculates at the institution. Table 5 shows the total N of each cohort.

Sex. As a demographic control variable, *Sex* is an important inclusion in the model as, historically, completion rates have shifted from males showing higher rates to, in more recent decades, females representing the higher degree completion rates (Astin, 1987; Bailey & DiPrete, 2016; Buchmann & DiPrete, 2006; DeAngelo et al., 2011; Goldin et al., 2006; Thomas, 1981; Tinto, 1993). Participation in accelerated learning programs can also vary by sex (Breland et al., 1994; Clark et al., 2012). The *Sex* designation in this study was self-reported student data at the time of admission to the institution (as gender) and included the three options of female, male, and not reported. For this study, due to the small n=3 for students who did not report, I define the *Sex* variable as dichotomous, with male = 1 and not male = 0. See the breakdown of students in the population for the independent variable *Sex* in Table 5.

Table 5: Descriptive Statistics - Independent Variables

Variable	Frequency	Percent	N	Missing
Cohort Year			26,957	0
2011	5,587	20.73%	26,957	0
2012	5,086	18.87%	26,957	0
2013	5,424	20.12%	26,957	0
2014	5,432	20.15%	26,957	0
2015	5,428	20.14%	26,957	0
Sex			26,957	0
Male	10,704	39.7%	26,957	0
Female	16,250	60.3%	26,957	0
Not Reported	3	0.0%	26,957	0

Ethnic Origin					26,957	0
White	19,227	71.3%			26,957	0
American Indian or Alaskan Native	23	0.1%			26,957	0
Asian	3,039	11.3%			26,957	0
Black or African-American	2,085	7.7%			26,957	0
Hawaiian or Other Pacific Islander	31	0.1%			26,957	0
Hispanic or Latino	1,454	5.4%			26,957	0
Not Reported	125	0.5%			26,957	0
Multiracial	973	3.6%			26,957	0
First Generation					26,957	0
No (0)	24,422	91.5%			26,957	0
Yes (1)	2,278	8.5%			26,957	0
Pell Recipient					26,957	0
No (0)	19,652	72.90%			26,957	0
Yes (1)	7,305	27.10%			26,957	0
Merit Aid Recipient					26,957	0
No (0)	11,957	44.36%			26,957	0
Yes (1)	15,000	55.64%			26,957	0

Variable	**Mean**	**Std Dev**	**Min**	**Max**	**N**	**Missing**
Average Household Income	80.56	29.37	14.95	248.24	24,978	1,979
High School GPA	3.77	0.26	1.69	4.40	26,914	43
SAT/ACT Performance	27.90	3.20	13	36	26,953	4
Majors	2.48	1.05	1	11	26,957	0
Major Count at Graduation	1.18	0.40	1	4	23,316	3,641

Ethnic Origin. Race and ethnicity also are important predictors of postsecondary degree attainment. Historically, studies have shown that certain minoritized populations, specifically African-American and Hispanic students, are less likely to persist to a degree (Astin, 1997; Hossler et al., 2013; Murtaugh et al., 1999; Terenzini & Pascarella, 1998). *Ethnic Origin* is used in this study as a categorical variable representing race and ethnicity data. This data is self-reported student data at the time of admission to the

institution. See Table 5 for the breakdown of students in the population for the independent variable *Ethnic Origin.*

Socioeconomic Control Variables

Family financial standing, can also be found to play a significant role in predicting college degree completion. This study uses two indicators as controls for students' family socioeconomic status: average household income in the zip code for which the family lives and first-generation status.

Average Household Income. Income inequality has long been identified as a critical issue that contributes to the disparity in degree completion rates. Prior research has found that low-income students are at a higher risk of not completing their college degrees. While family income data were not available for this study, family SES is a critical control variable for my analysis and one that is often cited as being a limitation of other studies when missing. To account for this, this study utilizes an average household income for the home zip code as a proxy for family SES. The average household income for zip code was calculated using information from the US Census Bureau, specifically the American Community Survey data from 2019 (United States Census Bureau, 2019). The *income* variable is a continuous numerical variable that represents the average household income for the zip code divided by 1,000. For this study, 1,979 cases were dropped from the analyses as a result of using *income* as a control variable due to missing or incomplete data. See Table 5 for the distribution of the variable.

First Generation Status. Students who begin their college careers as first-generation college students often face hardships that other students do not. Studies have

found that students raised by parents with lower levels of education are more likely to drop out of college or struggle academically (Pascarella et al., 2004). First-Generation status at this institution is calculated based on self-reported information collected on the undergraduate application for admissions. For the purpose of this study, first-generation is defined as no parental education past high school, or only partial parental education past high school, without the completion of a postsecondary credential. This study utilizes a dichotomous variable (*first_gen)* where 0 = not a first-generation student and 1 = a student whose parents either had no or partial college experience.

Financial Aid Variables

Pell Grant Indicator. This study uses Pell Grant recipient status as an additional marker for socioeconomic status as well as an indicator for financial aid receipt. *PELL_Ind* is a dichotomous variable indicating whether or not a student received a Pell grant at any point during their college career, with yes = 1 and no = 0.

Broad-Based Merit Aid Indicator. This study utilizes recipient status of a broad-based merit aid program as an additional marker related to financial aid. This particular merit aid program is available to state residents that demonstrate high academic achievement. The aid provides money to assist students with a portion of the tuition at an eligible college or university. In this study, *Merit_Ind* is a dichotomous variable of whether or not the student received the aid at any point during their college career, with yes=1 and no=0.

High School Performance Control Variables

Numerous studies have found that student achievement and ability are strong predictors of college degree completion (Adelman, 2006; Astin & Oseguera, 2005;

Attewell & Domina, 2008). This study utilizes high school GPA and SAT/ACT scores to control for high school academic ability.

High School GPA. For this study, including high school GPA as a numerical variable was essential to control for high school academic ability, which, as demonstrated in prior research, has a significant relationship to college completion.

ACT/SAT Comparisons. Like high school GPA, SAT and ACT scores have been used as a comparable benchmark for academic ability. Students at the institution of interest in this study were able to submit SAT and/or ACT scores for admissions. In order to easily use these scores as a control for student ability for this study, a new variable was created using the concordance table provided by College Board and the ACT in 2015 (ACT Research & Policy, 2009). For this variable, all SAT scores were converted to ACT scores according to the concordance table range. If a student also had an ACT score, the higher of the two scores was recorded under the new numerical variable *SAT_ACT_High_Comp*.

Collegiate Academic Control Variables

Majors. When discussing time to degree at the collegiate level, it is important to acknowledge that student course-taking patterns may have an impact. For this reason, I include a variable that is a proxy for the number of different majors a student has recorded while enrolled in their degree program. The numerical variable *Majors* represents the number of distinct majors recorded at the beginning of each semester for each student. In other words, this metric represents the number of different, discrete, declared majors that a student has over the course of their collegiate career. This data does not take into account any major changes that occur during the semester, rather only

what is loaded in the student's file as of the start of each semester. While imperfect, this variable serves as an important proxy and control that could also account for an increased time to degree.

Major Count. As a final layer of control for collegiate patterns, it would be remiss not to acknowledge that having more than one declared major may also contribute to additional semesters of enrollment. This study includes *Major_Count* as a numerical control variable that includes the number of majors the student has at the time of graduation.

In the next section, I will describe the models used to analyze the relationship between the above independent variables with the defined dependent variables.

Multiple Regression Models

This study first uses multiple regression analysis to answer each of the five research questions. Multiple regression analysis is widely used in social science research for examining the separate and collective influence of one or more independent variables on explaining the variability of a dependent variable. Multiple regression analysis aims to find the best combination of independent variables that can predict or explain the variance in the dependent variable with some degree of accuracy and precision.

All five primary models in this study follow the standard empirical formula for multiple regression analysis,

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_K X_K + \varepsilon$$

where *k* equals the number of independent variables in the model and the β_k equals the change in Y due to a one-unit change in X_k, holding constant all the other variables in the equation.

In each of the models below (1-5), the dependent variable (*TTD_Terms*) and all control variables will remain the same. Each model will introduce a different explanatory variable related to accelerated learning credit earned.

RQ 1. Is having *any* accelerated learning credit associated with decreased time to degree?

$$\begin{aligned} TTD\_Terms = \beta_0 &+ \beta_1 Cohort\_Year + \beta_2 Sex + \beta_3 Ethnic\_Origin \\ &+ \beta_4 income + \beta_5 first\_gen + \beta_6 PELL\_Ind \\ &+ \beta_7 HOPE\_Ind + \beta_8 High\_School\_GPA \\ &+ \beta_9 SAT\_ACT\_High\_Comp + \beta_{10} majors \\ &+ \beta_{11} Major\_Count + \beta_{12} any\_accelerated + \varepsilon \end{aligned} \quad (1)$$

RQ 2: Is having *a specific type* of accelerated learning credit associated with decreased time to degree?

$$\begin{aligned} TTD\_Terms = \beta_0 &+ \beta_1 Cohort\_Year + \beta_2 Sex + \beta_3 Ethnic\_Origin \\ &+ \beta_4 income + \beta_5 first\_gen + \beta_6 PELL\_Ind \\ &+ \beta_7 HOPE\_Ind + \beta_8 High\_School\_GPA \\ &+ \beta_9 SAT\_ACT\_High\_Comp + \beta_{10} majors \\ &+ \beta_{11} Major\_Count + \beta_{12} any\_ap + \beta_{13} any\_ib \\ &+ \beta_{14} any\_de + \varepsilon \end{aligned} \quad (2)$$

RQ 3: Is the *amount* of accelerated learning credit associated with decreased time to degree?

$$\begin{aligned} TTD\_Terms = \beta_0 &+ \beta_1 Cohort\_Year + \beta_2 Sex + \beta_3 Ethnic\_Origin \\ &+ \beta_4 income + \beta_5 first\_gen + \beta_6 PELL\_Ind \\ &+ \beta_7 HOPE\_Ind + \beta_8 High\_School\_GPA \\ &+ \beta_9 SAT\_ACT\_High\_Comp + \beta_{10} majors \\ &+ \beta_{11} Major\_Count + \beta_{12} all\_accelerated + \varepsilon \end{aligned} \quad (3)$$

RQ 4: Is the *amount of a specific type* of accelerated learning credit associated with decreased time to degree?

$$TTD\_Terms = \beta_0 + \beta_1 Cohort\_Year + \beta_2 Sex + \beta_3 Ethnic\_Origin + \beta_4 income + \beta_5 first\_gen + \beta_6 PELL\_Ind + \beta_7 HOPE\_Ind + \beta_8 High\_School\_GPA + \beta_9 SAT\_ACT\_High\_Comp + \beta_{10} majors + \beta_{11} Major\_Count + \beta_{12} AP\_Hours\_Earned + \beta_{13} IB\_Hours\_Earned + \beta_{14} DE\_Hours\_Earned + \varepsilon \quad (4)$$

RQ 5: Is having *a specific combination* of accelerated learning credit type associated with decreased time to degree?

$$TTD\_Terms = \beta_0 + \beta_1 Cohort\_Year + \beta_2 Sex + \beta_3 Ethnic\_Origin + \beta_4 income + \beta_5 first\_gen + \beta_6 PELL\_Ind + \beta_7 HOPE\_Ind + \beta_8 High\_School\_GPA + \beta_9 SAT\_ACT\_High\_Comp + \beta_{10} majors + \beta_{11} Major\_Count + \beta_{12} accelerated\_combo + \varepsilon \quad (5)$$

As an additional check on the above models and in an effort to minimize unobservable characteristics or potential environmental influences present in each cohort of students, I also ran each of the five models above for each cohort year individually. Cohort-specific models are defined below, where *Cohort_Year* is removed from the control variables and instead used to define the population for the analysis.

$$TTD\_Terms_{Cohort} = = \beta_0 + \beta_1 Sex + \beta_2 Ethnic\_Origin + \beta_3 income + \beta_4 first\_gen + \beta_5 PELL\_Ind + \beta_6 HOPE\_Ind + \beta_7 High\_School\_GPA + \beta_8 SAT\_ACT\_High\_Comp + \beta_9 majors + \beta_{10} Major\_Count + \beta_{11} any\_accelerated + \varepsilon \quad (6\text{-}10)$$

Note: Cohort equals 2011, 2012, 2013, 2014, and 2015 student populations.

$$TTD\_Terms_{Cohort} = \beta_0 + \beta_1 Sex + \beta_2 Ethnic\_Origin + \beta_3 income + \beta_4 first\_gen + \beta_5 PELL\_Ind + \beta_6 HOPE\_Ind + \beta_7 High\_School\_GPA + \beta_8 SAT\_ACT\_High\_Comp + \beta_9 majors + \beta_{10} Major\_Count + \beta_{11} any\_ap + \beta_{12} any\_ib + \beta_{13} any\_de + \varepsilon \quad (11\text{-}15)$$

Note: Cohort equals 2011, 2012, 2013, 2014, and 2015 student populations.

$$TTD\_Terms_{Cohort} = \beta_0 + \beta_1 Sex + \beta_2 Ethnic\_Origin + \beta_3 income + \beta_4 first\_gen + \beta_5 PELL\_Ind + \beta_6 HOPE\_Ind + \beta_7 High\_School\_GPA + \beta_8 SAT\_ACT\_High\_Comp + \beta_9 majors + \beta_{10} Major\_Count + \beta_{11} all\_accelerated + \varepsilon \quad (16\text{-}20)$$

Note: Cohort equals 2011, 2012, 2013, 2014, and 2015 student populations.

$$TTD\_Terms_{Cohort} = \beta_0 + \beta_1 Sex + \beta_2 Ethnic\_Origin + \beta_3 income + \beta_4 first\_gen + \beta_5 PELL\_Ind + \beta_6 HOPE\_Ind + \beta_7 High\_School\_GPA + \beta_8 SAT\_ACT\_High\_Comp + \beta_9 majors + \beta_{10} Major\_Count + \beta_{11} AP\_Hours\_Earned + \beta_{12} IB\_Hours\_Earned + \beta_{13} DE\_Hours\_Earned + \varepsilon \quad (21\text{-}25)$$

Note: Cohort equals 2011, 2012, 2013, 2014, and 2015 student populations.

$$TTD\_Terms_{Cohort} = \beta_0 + \beta_1 Sex + \beta_2 Ethnic\_Origin + \beta_3 income + \beta_4 first\_gen + \beta_5 PELL\_Ind + \beta_6 HOPE\_Ind + \beta_7 High\_School\_GPA + \beta_8 SAT\_ACT\_High\_Comp + \beta_9 majors + \beta_{10} Major\_Count + \beta_{11} accelerated\_combo + \varepsilon \quad (26\text{-}30)$$

Note: Cohort equals 2011, 2012, 2013, 2014, and 2015 student populations.

Multinomial Logistic Regression Models

The previous models analyzing the dependent variable *TTD_Terms,* only include students who earned a credential or graduated from the institution. Students who enrolled but never graduated were excluded from the analysis and yet represent an important segment of the population. To add a supplementary layer of inquiry and to aid in interpreting the results of the primary dependent variable, I also investigate a dependent variable, *Graduate. Graduate* is a categorical variable with five levels; did not graduate (0), graduated in three or fewer years (3), graduated in four years (4), graduated in five years (5), and graduated in six or more years (6+). The inclusion of this dependent variable in addition to time to degree will allow me to discuss whether accelerated learning credit helps students graduate as well as whether it helps them graduate in less time. Given the categorical nature of the dependent variable, I ran multinomial logistic regression models using the same independent and explanatory variables described above. I report the results in the next chapter as marginal effects so that they could be interpreted as the probability of change in the dependent variable, given any changes to the independent variable(s).

Each multinomial regression model follows the standard formula,

$$ln(\frac{P_j}{1-P_j}) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_K X_K + \varepsilon$$

where, $ln\left(\frac{P_j}{1-P_j}\right)$ equals the relative log odds of being in one category of the dependent variable over the comparison category, P_j equals the probability of the j[th] outcome, β_0 equals the probability of all coefficients are 0 (intercept), k equals the number of

independent variables in the model and β_k equals the likelihood associated with those independent variables, holding constant all the other variables in the equation.

Defined below are the five multinomial logistic regression models used to analyze the Graduate dependent variable.

$$Graduate_j = \beta_0 + \beta_1 Cohort\_Year + \beta_2 Sex + \beta_3 Ethnic\_Origin + \beta_4 income + \beta_5 first\_gen + \beta_6 PELL\_Ind + \beta_7 HOPE\_Ind + \beta_8 High\_School\_GPA + \beta_9 SAT\_ACT\_High\_Comp + \beta_{10} majors + \beta_{11} Major\_Count + \beta_{12} any\_accelerated + \varepsilon \quad (31)$$

$$Graduate_j = \beta_0 + \beta_1 Cohort\_Year + \beta_2 Sex + \beta_3 Ethnic\_Origin + \beta_4 income + \beta_5 first\_gen + \beta_6 PELL\_Ind + \beta_7 HOPE\_Ind + \beta_8 High\_School\_GPA + \beta_9 SAT\_ACT\_High\_Comp + \beta_{10} majors + \beta_{11} Major\_Count + \beta_{12} any\_ap + \beta_{13} any\_ib + \beta_{14} any\_de + \varepsilon \quad (32)$$

$$Graduate_j = \beta_0 + \beta_1 Cohort\_Year + \beta_2 Sex + \beta_3 Ethnic\_Origin + \beta_4 income + \beta_5 first\_gen + \beta_6 PELL\_Ind + \beta_7 HOPE\_Ind + \beta_8 High\_School\_GPA + \beta_9 SAT\_ACT\_High\_Comp + \beta_{10} majors + \beta_{11} Major\_Count + \beta_{12} all\_accelerated + \varepsilon \quad (33)$$

$$Graduate_j = \beta_0 + \beta_1 Cohort\_Year + \beta_2 Sex + \beta_3 Ethnic\_Origin + \beta_4 income + \beta_5 first\_gen + \beta_6 PELL\_Ind + \beta_7 HOPE\_Ind + \beta_8 High\_School\_GPA + \beta_9 SAT\_ACT\_High\_Comp + \beta_{10} majors + \beta_{11} Major\_Count + \beta_{12} AP\_Hours\_Earned + \beta_{13} IB\_Hours\_Earned + \beta_{14} DE\_Hours\_Earned + \varepsilon \quad (34)$$

$$Graduate_j = \beta_0 + \beta_1 Cohort\_Year + \beta_2 Sex + \beta_3 Ethnic\_Origin + \beta_4 income + \beta_5 first\_gen + \beta_6 PELL\_Ind + \beta_7 HOPE\_Ind + \beta_8 High\_School\_GPA + \beta_9 SAT\_ACT\_High\_Comp + \beta_{10} majors + \beta_{11} Major\_Count + \beta_{12} accelerated\_combo + \varepsilon \quad (35)$$

Limitations

This analysis focuses strictly on accelerated learning credit hours earned and applied at this institution. This view of accelerated learning credits does not take into account students who may have taken accelerated learning coursework and not taken or have not passed the exams. It also does not consider the score on the examinations taken, if applicable. I focus solely on credit awarded by the institution for the submitted scores and transcripts of the students to create a common comparison tool amongst the different pathways/programs for achieving accelerated learning credit. For example, AP exam scores may result in different credit hour awards, depending on the college or university that receives them, whereas DE credits are already collegiate academic credits and are not as subjective.

In addition, one challenge in isolating the relationship between accelerated learning programs and collegiate academic success is the potential for self-selection bias. Students who participate in accelerated learning programs may be quite different than students who do not participate based on any number of unobservable characteristics like academic, economic, and social motivations. It is then plausible that AP, IB, and DE students are highly motivated and high-achieving students and that they may also have intangible characteristics that influence their postsecondary success that are not accounted for in my demographic and achievement data. Tangentially related to self-selection bias is access to programs. This study does not consider access to accelerated learning programs or eligibility criteria set within each program across the state and country. This study focuses strictly on the application of credit hours earned once a

student is already enrolled at this institution, ignoring access to and availability of the opportunities where the student came from.

The next chapter will walk through the findings of each of the analytical models described above.

CHAPTER 4: FINDINGS

The previous chapter defined the dependent variables of interest, explanatory variables, independent variables, and analytical models used to investigate the research questions put forward in this study. The following sections present the findings of the analytical models and frame the results in relation to the defined research questions.

Multiple Regression Analysis Findings

Table 6 includes the findings for multiple regression Models 1-5, as discussed below. Model 1 includes the explanatory variable of any accelerated learning credit (0,1). The multiple regression analysis results show that holding all else equal, having any amount of accelerated learning credit, regardless of the type (AP, IB, and DE), is associated with a decrease in time to degree by 0.58 academic terms/semesters. Model 2, which breaks out participation by type of accelerated learning credit, also showed that having specifically AP, IB, and DE credit were associated with having a decrease in time to degree by 0.33, 0.21, and 0.41 semesters respectively.

Table 6: Multiple Regression Results for Time To Degree

	Model 1	Model 2	Model 3	Model 4	Model 5
Accelerated Learning Credit					
Any Accelerated Learning Credit Hours:					
AP, IB, or DE Credit (0, 1)	-0.58 ***				
	(0.04)				
AP Credit Hours (0, 1)		-0.33 ***			
		(0.04)			
IB Credit Hours (0, 1)		-0.21 **			
		(0.06)			
DE Credit Hours (0, 1)		-0.41 ***			
		(0.03)			
Number of Accelerated Learning Credit Hours Earned:					
Total Accelerated Learning Credit Hours Earned			-0.03 ***		
			(0.00)		
AP Credit Hours Earned				-0.02 ***	
				(0.00)	
IB Credit Hours Earned				-0.03 ***	
				(0.00)	
DE Credit Hours Earned				-0.05 ***	
				(0.00)	
Combinations of Types of Accelerated Learning Credit:					
AP Credit Hours Only					-0.51 ***
					(0.04)
IB Credit Hours Only					-0.44 ***
					(0.09)
DE Credit Hours Only					-0.83 ***
					(0.07)
AP & IB Credit Hours					-0.60 ***
					(0.10)
AP & DE Credit Hours					-0.79 ***
					(0.06)
IB & DE Credit Hours					-0.84
					(0.58)
AP, IB, & DE Credit Hours					-1.27 *
					(0.51)
Cohort Year					
2012	-0.09 *	-0.09 *	-0.08 *	-0.08 *	-0.09 *
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
2013	-0.16 ***	-0.16 ***	-0.12 **	-0.12 **	-0.15 ***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
2014	-0.11 **	-0.10 *	-0.05	-0.05	-0.10 *
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
2015	-0.15 ***	-0.14 ***	-0.12 **	-0.11 **	-0.14 ***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)

Sex						
	Male	0.55 ***	0.56 ***	0.59 ***	0.58 ***	0.56 ***
		(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Ethnic Origin						
	American Indian or Alaskan Native	0.22	0.29	0.34	0.38	0.26
		(0.45)	(0.45)	(0.44)	(0.44)	(0.45)
	Asian	0.16 ***	0.16 ***	0.26 ***	0.23 ***	0.15 ***
		(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
	Black or African-American	0.16 **	0.16 **	0.23 ***	0.21 ***	0.15 **
		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
	Hawaiian or Other Pacific Islander	-0.09	-0.11	0.00	-0.02	-0.12
		(0.38)	(0.38)	(0.37)	(0.37)	(0.38)
	Hispanic or Latino	0.17 **	0.16 **	0.24 ***	0.22 ***	0.16 **
		(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
	Not Reported	0.42 *	0.42 *	0.48 **	0.46 *	0.41 *
		(0.18)	(0.18)	(0.18)	(0.18)	(0.18)
	Two or more races	0.21 **	0.20 **	0.24 ***	0.23 ***	0.20 **
		(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Socioeconomic Indicators						
	Income	-0.00***	-0.00 ***	-0.00 ***	-0.00 ***	-0.00 ***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	First Generation Student	0.06	0.06	0.08	0.07	0.05
		(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Financial Aid						
	PELL Recipient	0.33 ***	0.32 ***	0.33 ***	0.33 ***	0.32 ***
		(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
	Merit Aid Recipient	0.37 ***	0.37 ***	0.34 ***	0.34 ***	0.37 ***
		(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
High School Performance						
	High School GPA	-0.60 ***	-0.59 ***	-0.47 ***	-0.48 ***	-0.57 ***
		(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
	SAT ACT Comp Score	0.00	-0.00	0.04 ***	0.03 ***	-0.00
		(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Collegiate Level Control						
	Major Changes	0.34 ***	0.34 ***	0.31 ***	0.32 ***	0.34 ***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
	Major Count at Grad	-0.09 **	-0.09 **	0.03	0.01	-0.09 **
		(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
N		21564	21564	21564	21564	21564
R2		0.11	0.11	0.13	0.13	0.12

Notes: *** p < 0.001; ** p < 0.01; * p < 0.05.

When looking at the number of credit hours earned instead of the dichotomous expression of the variables, we continue to see that accelerated learning credit is associated with a decrease in time to degree. Model 3, which has the explanatory variable defined as the total number of accelerated learning credit hours, regardless of type, found that a one credit hour increase in hours earned is associated with a decrease in time to degree of 0.03 semesters. The association of time to degree for the number of AP, number of IB, and number of DE credits individually (Model 4) also displayed a decrease in time to degree for all three types. Specifically, a one-credit hour increase in AP credit was associated with a reduction of 0.02 semesters in time to degree, IB credit, a reduction of 0.03 semesters, and DE credit, a 0.05-semester reduction in time to degree.

To aid in the interpretation of these findings, I conceptualize that most collegiate courses are composed of a minimum of three credit hours. Also, the majority of accelerated learning credits earned start at a minimum of three credit hours. Therefore, using the above associations and parameters, for every three accelerated learning credit hours a student enters college with (approximately equivalent to one college course), students could reasonably expect their time to degree to decrease by 0.06 semesters, 0.09 semesters, and 0.15 semesters for AP, IB, and DE, respectively.

To extend this example further, an average credit hour course load for students at this institution is 15 credit hours per semester. Therefore, if a student enters this institution with 15 accelerated learning credits, the Table 7 outlines the expected reduction in time to degree for those credits relative to those with none.

Table 7: Credit Hour and Time To Degree – Conversion

	One Credit Hour Reduction in TTD	Three Credit Hour Reduction in TTD	15 Credit Hours Reduction in TTD
AP Credit	-0.02	-0.06	-0.3
IB Credit	-0.03	-0.09	-0.45
DE Credit	-0.05	-0.15	-0.75

Extrapolating the results from one credit hour increase in credit to a full-load 15 credit hours, demonstrates that AP and IB credits are associated with approximately only one-third and one-half of the time to degree savings of that associated with DE credits. Even so, DE time-savings do not equate to more than a semester reduction in time to degree.

Model 5 includes an explanatory categorical variable with eight levels representing various combinations of accelerated learning credit students may have, including no accelerated learning credit; AP credit only; IB credit only; DE credit only; AP & IB credit; AP & DE credit; IB & DE credit; and AP, IB, and DE credit. All findings for this analysis are interpreted as being in relation to the comparison factor level, which is having no accelerated learning credit. Table 8 includes a crosstabulation of the frequency with which students fall into these eight categories.

Table 8: Descriptive Statistics - Combinations of Accelerated Learning Credit

Variable	Frequency	Percentage
Accelerated Learning Combo		
None	3,506	13.0%
AP only	17,722	65.7%
IB only	634	2.4%
DE only	13	5.3%
AP&IB	521	1.9%
AP&DE	3,108	11.5%
IB&DE	13	0.05%
All	15	0.06%
Total	26,957	100%

The inclusion of Model 5 in this study is intended to highlight whether a particular accelerated learning credit combination has a marked advantage over the others. This is particularly important as students and families explore which programs to invest in and commit to. Model 5 findings indicate that all else equal, all but one combination of accelerated learning credit types was found to be significantly associated with a decrease in time to degree. AP credit only, as compared to no accelerated learning credit, was associated with a decrease in time to degree by 0.51 semesters; IB credit was associated with a 0.44 decrease in semesters; and DE credit was associated with a 0.83-semester decrease in time to degree. Consistent with prior models, DE exhibits the most considerable associated reduction in time to degree thus far. When comparing the outcome of different accelerated learning credit types combinations, AP and IB credits were associated with a decrease in time to degree of 0.60 semesters. Having AP and DE credit hours also represented a decrease in time to degree of 0.79 semesters. Finally, the combination of having all three types of credit, compared to not having any accelerated learning credit, was associated with a 1.27-semester decrease in time to degree. The IB and DE combination did not produce a statistically significant coefficient.

To control and account for any environmental or unobservable factors associated with each cohort, I ran the same logistic regression models for each cohort year individually. The tables for cohort-specific models (Models 6-30) are provided in Appendices A-E. The findings across cohort models reflected no change in the direction of the relationship of the explanatory variables in the models and approximately the same level of association. Only the levels of significance related to IB-specific variables changed.

Given the specific findings related to the five models and research questions discussed above, it is also important to discuss the findings of the overarching questions posed at the beginning of this study. Table 9 provides a quick summary of the findings related to the three overarching questions of this study.

Table 9: Multiple Regression Findings - Research Questions Summary

Any	Amount	Combination
• Having any of the three accelerated learning credit types is associated with a decrease in time to degree by 0.58 semesters. • Having specific credit types is associated with the following decreases in time to degree: AP - 0.33 semesters IB - 0.21 semesters DE - 0.41 semesters	• A one credit hour increase of any accelerated learning credit is associated with a decrease in time to degree of 0.03 semesters. • A one credit hour increase is associated with a decrease in time to degree for the following types of credit: AP - 0.02 semester IB - 0.02 semesters DE - 0.05 semesters	• All combinations of accelerated learning credit are associated with a decrease in time to degree. AP Only -0.51 IB Only -0.44 DE Only -0.83 AP & IB -0.60 AP & DE -0.79 IB & DE -0.84 (not sig) AP, IB, & DE -1.27 • The only combination of accelerated learning credit that is associated with at least one full-semester decrease in time to degree is the combination of all three (n=15).

Holding all other variables equal, having any accelerated learning credit is associated with a decrease in time to degree. In each model, explanatory variables related to accelerated learning credit were found to be associated with a decrease in time to degree, with a significance at the 0.001 level. The exceptions are *any_ib,* which was significant at the 0.01 level, *Combo_All,* which was significant at the 0.05 level, and *Combo_IB&DE,* which is the only explanatory variable found not to be significant in determining association with time to degree.

Looking across the models that differentiate by type of accelerated learning credit (Model 2, Model 4, Model 5), there is a clear distinction. Across related variables, DE credit appears to be associated with a greater decrease in time to degree compared to the other two accelerated learning credit types. Having DE credit, regardless of the amount of credit, is associated with a decrease in time to degree of 0.41 semesters, where AP is 0.33 and IB is 0.21. Similarly, looking at combinations of types of credit, DE credit is associated with the most significant decrease in time to degree variables; DE only (-0.83 semesters), AP & DE (-0.79 semesters), and All three (-1.27 semesters). Having AP credit is associated with the second highest coefficients across these variables. While still associated with a decrease in time to degree, IB represents the lowest decrease in time to degree across the explanatory variables.

Multinomial Logistic Regression Findings

As outlined in the previous chapter, in addition to the primary dependent variable, time to degree, I also defined models that analyze the same exploratory and independent variables on the categorical variable *Graduate.* Time to degree only includes students who graduated from the institution. Students who enrolled but never graduated were excluded from the analyses yet represent an important population segment. The *Graduate* dependent variable categorizes students into six possible outcomes: including a student did not graduate (0), graduated in three or fewer years (3), graduated in four years (4), graduated in five years (5), and graduated in six or more years (6+). Including this dependent variable in addition to time to degree allows me to investigate whether accelerated learning credit helps students graduate and whether it helps them graduate in less time.

Models 31-35 include this dependent variable as a supplementary analysis to aid in interpreting the results of time to degree. For each model, I interpret the coefficients as average marginal effects so that they can be understood as the effect of each variable on the probability of the given graduation timeframe. Results from Model 31 (Table 10) and Model 32 (Table 11) illustrate that overall accelerated learning credit is associated with an average marginal increase in the probability of graduating in three and four years. However, it is associated with an average decrease in the probability of graduating in five or six or more years compared to not graduating at all.

Having any accelerated learning credit, regardless of type, indicates an average marginal increase of 3.3% in the probability of graduating in three years and 10.0% in the probability of graduating in four years compared to the effect of accelerated learning credit on the probability of not graduating (0.01%). Alternatively, having accelerated learning credit indicates an average marginal decrease in the probability of graduating in five years of 10.7% and an average marginal decrease in the probability of graduating in six or more years of 2.7%.

When looking at each type of credit individually across the different levels of the dependent variable (Table 11), there is similarly an average marginal increase in the probability of graduating in four years and an average marginal decrease in the probability of graduating in five or six or more years for AP and IB credit. Notably, the average marginal effect of AP credit on graduating in four years represents an increase of ten percentage points over not graduating and IB 5.1%. DE credit is not found to be significant for graduating in four years but is for three years with an average marginal increase of 5.2%. These findings align with the multiple regression analyses above that

associate earned accelerated learning credit with shortened time to degree, with students that have accelerated learning credit more likely to fall into the shorter graduation timeframe buckets than the longer ones.

Table 10: Multinomial Logistic Regression Results for Graduation – Any Accelerated Learning Credit

	Dependent Variable:				
Variables	(0) Did not Graduate	(3) Graduated in 3 Years	(4) Graduated in 4 Years	(5) Graduated in 5 Years	(6+) Graduated in 6+ Years
Accelerated Learning Credit					
Any Accelerated Learning Credit Hours					
AP, IB, or DE Credit (0,1)	0.001***	0.033***	0.100***	-0.107***	-0.027***
	(0.000)	(0.001)	(0.011)	(0.010)	(0.005)
Cohort Year					
2012	-0.001***	0.003	0.017	-0.015	-0.004
	(0.000)	(0.004)	(0.009)	(0.008)	(0.004)
2013	-0.001*	0.010**	0.014	-0.018*	-0.006
	(0.000)	(0.004)	(0.009)	(0.008)	(0.004)
2014	-0.001	0.008*	0.011	-0.024**	0.005
	(0.00)	(0.004)	(0.009)	(0.008)	(0.005)
2015	0.001	0.004	0.015	-0.009	-0.010*
	(0.001)	(0.004)	(0.009)	(0.009)	(0.004)
Sex					
Male	-0.001***	-0.018***	-0.119***	0.109***	0.030***
	(0.001)	(0.002)	(0.006)	(0.006)	(0.003)
Ethnic Origin					
American Indian or Alaskan Native	-0.001***	0.058	0.069	-0.199***	0.072
	(0.000)	(0.079)	(0.100)	(0.003)	(0.068)
Asian	0.001	0.003	-0.043***	0.026**	0.012**
	(0.001)	(0.004)	(0.010)	(0.009)	(0.005)
Black or African-American	0.000	0.008	-0.026*	0.014	0.004
	(0.000)	(0.006)	(0.012)	(0.010)	(0.005)
Hawaiian or Other Pacific Islander	-0.001***	-0.030***	0.006	0.064	-0.038***
	(0.000)	(0.001)	(0.085)	(0.085)	(0.002)
Hispanic or Latino	0.001**	0.000	-0.025	0.006	0.018**
	(0.000)	(0.005)	(0.013)	(0.012)	(0.007)
Not Reported	-0.001***	0.008	-0.136**	0.103*	0.027
	(0.000)	(0.018)	(0.047)	(0.044)	(0.023)
Two or more races	-0.001***	-0.006	-0.038*	0.036*	0.009
	(0.000)	(0.006)	(0.016)	(0.015)	(0.008)
Socioeconomic Indicators					
Income	0.000	0.000***	0.001***	-0.001***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

First Generation Student	-0.001***	0.002	-0.007	0.002	0.004
	(0.000)	(0.005)	(0.011)	(0.010)	(0.005)
Financial Aid					
PELL Recipient	0.000	0.004	-0.055***	0.019**	0.032***
	(0.001)	(0.003)	(0.008)	(0.007)	(0.004)
Merit Aid Recipient	0.001	-0.002	-0.097***	0.075***	0.024***
	(0.000)	(0.003)	(0.006)	(0.006)	(0.003)
High School Performance					
High School GPA	-0.004***	0.013*	0.078***	-0.051***	-0.036***
	(0.001)	(0.006)	(0.013)	(0.011)	(0.005)
SAT ACT Comp Score	0.000	0.003***	-0.003*	-0.003*	0.002***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Collegiate Level Control					
Major Changes	0.000	-0.017***	-0.049***	0.051***	0.015***
	(0.000)	(0.001)	(0.003)	(0.002)	(0.001)
Major Count at Grad	-0.003***	-0.007*	0.006	0.031***	-0.028***
	(0.000)	(0.003)	(0.008)	(0.007)	(0.005)

Note: Coefficients are reported as average marginal effects and sum to zero. Any discrepancy is the product of rounding. *p<.05. **p<.01. ***p<0.001

Table 11: Multinomial Logistic Regression Results for Graduation – Type of Accelerated Learning Credit

	Dependent Variable:				
Variables	(0) Did not Graduate	(3) Graduated in 3 Years	(4) Graduated in 4 Years	(5) Graduated in 5 Years	(6+) Graduated in 6+ Years
Accelerated Learning Credit					
Any Accelerated Learning Credit					
AP Credit (0, 1)	0.001	-0.004	0.101***	-0.076***	-0.021***
	(0.000)	(0.004)	(0.009)	(0.008)	(0.004)
IB Credit (0, 1)	0.001*	-0.004	0.051***	-0.032**	-0.016***
	(0.001)	(0.006)	(0.013)	(0.012)	(0.005)
DE Credit (0, 1)	0.000	0.052***	0.009	-0.053***	-0.009*
	(0.001)	(0.005)	(0.008)	(0.007)	(0.003)
Cohort Year					
2012	-0.001**	0.003	0017	-0.015	-0.004
	(0.000)	(0.004)	(0.009)	(0.008)	(0.004)
2013	-0.001*	0.010**	0.015	-0.018*	-0.006
	(0.000)	(0.004)	(0.009)	(0.008)	(0.004)
2014	-0.001	0.006	0.011	-0.023**	0.006
	(0.001)	(0.004)	(0.009)	(0.008)	(0.005)
2015	0.001	0.001	0.016	-0.007	-0.010*
	(0.001)	(0.003)	(0.009)	(0.009)	(0.004)
Sex					
Male	-0.001	-0.019***	-0.121***	0.110***	-0.029***
	(0.000)	(0.002)	(0.006)	(0.006)	(0.003)
Ethnic Origin					
American Indian or Alaskan Native	-0.001***	0.040	0.081	-0.199***	0.078
	(0.000)	(0.064)	(0.092)	(0.003)	(0.072)
Asian	0.001	0.006	-0.045***	0.026**	0.012**
	(0.001)	(0.004)	(0.010)	(0.009)	(0.005)
Black or African-American	0.000	0.009	-0.027*	0.014	0.004
	(0.000)	(0.006)	(0.012)	(0.010)	(0.005)
Hawaiian or Other Pacific Islander	-0.001***	-0.030***	0.004	0.065	-0.038***
	(0.000)	(0.001)	(0.085)	(0.085)	(0.002)
Hispanic or Latino	0.000	0.004	-0.029*	0.006	0.018**
	(0.000)	(0.006)	(0.013)	(0.012)	(0.007)
Not Reported	-0.001***	0.010	-0.140**	0.104*	0.027
	(0.000)	(0.019)	(0.047)	(0.044)	(0.023)
Two or more races	-0.001***	-0.005	-0.040*	0.037*	0.009
	(0.000)	(0.006)	(0.016)	(0.015)	(0.008)
Socioeconomic Indicators					
Income	0.000	0.000*	0.001***	-0.001***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
First Generation Student	-0.001***	0.004	-0.009	0.001	0.004
	(0.000)	(0.005)	(0.011)	(0.010)	(0.005)
Financial Aid					
PELL Recipient	0.000	0.005	-0.055***	0.017*	0.032***
	(0.001)	(0.003)	(0.008)	(0.007)	(0.004)
Merit Aid Recipient	0.001	-0.003	-0.096***	0.074*	0.024***
	(0.000)	(0.003)	(0.006)	(0.006)	(0.003)

High School Performance					
High School GPA	-0.004***	0.009	0.081***	-0.050***	-0.037***
	(0.001)	(0.006)	(0.013)	(0.011)	(0.005)
SAT ACT Comp Score	0.000	0.004***	-0.003**	0.003**	0.002***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Collegiate Level Control					
Major Changes	0.000	-0.017***	-0.049***	0.051***	0.015***
	(0.000)	(0.001)	(0.003)	(0.002)	(0.001)
Major Count at Grad	-0.002**	-0.007*	0.006	0.031***	-0.028***
	(0.000)	(0.003)	(0.008)	(0.007)	(0.005)

Note: Coefficients are reported as average marginal effects and sum to zero. Any discrepancy is the product of rounding. *p<.05. **p<.01. ***p<0.001

Models 33 (Table 12) and 34 (Table 13) introduce the number of accelerated learning credit hours earned collectively and then by credit type. The coefficients for the total number of credit hours, regardless of type, indicate an average marginal increase of 0.3% in the probability of graduating in four years and are not found to be significant for graduating in three or fewer years. Keeping with the above findings, the same change in credit hours earned indicates an average marginal decrease in the probability of graduating in five years (0.5%) and of graduating in six or more years (0.1%) (Table 12). There was no significant relationship between the change in credit hours earned and not graduating and graduating in three years.

The results of Model 34 (Table 13) show that for each of the individual types of accelerated learning credit, the coefficients (average marginal effects) only differ by .01 from the marginal effects of the collective number and maintain the same directional impact. However, an increase of one credit hour for each of the three types of accelerated learning credit does indicate an average marginal increase in the probability of graduating in three years with a 0.001 significance level for all three types.

Table 12: Multinomial Logistic Regression Results for Graduation – Total Number of Accelerated Learning Credit Hours Earned

	Dependent Variable:				
Variables	(0) Did not Graduate	(3) Graduated in 3 Years	(4) Graduated in 4 Years	(5) Graduated in 5 Years	(6+) Graduated in 6+ Years
Accelerated Learning Credit					
Number of Accelerated Learning Credit Hours Earned					
Total Accelerated Learning Credit Hours Earned	0.000	0.000	0.003***	-0.005***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cohort Year					
2012	-0.001**	-0.001**	0017	-0.013	-0.004
	(0.000)	(0.000)	(0.009)	(0.008)	(0.004)
2013	-0.001*	-0.001*	0.016	-0.014	-0.006
	(0.000)	(0.000)	(0.009)	(0.008)	(0.004)
2014	-0.001	-0.001	0.013	-0.017*	0.006
	(0.001)	(0.001)	(0.009)	(0.008)	(0.005)
2015	0.001	0.001	0.015	-0.004	-0.010*
	(0.001)	(0.001)	(0.009)	(0.008)	(0.004)
Sex					
Male	-0.001*	-0.001*	-0.124***	0.115***	-0.031***
	(0.000)	(0.000)	(0.006)	(0.006)	(0.003)
Ethnic Origin					
American Indian or Alaskan Native	-0.001***	-0.001***	0.095	-0.196***	0.085
	(0.000)	(0.000)	(0.086)	(0.003)	(0.075)
Asian	0.001	0.001	-0.046***	0.039***	0.014**
	(0.001)	(0.001)	(0.010)	(0.010)	(0.005)
Black or African-American	0.000	0.000	-0.028*	0.023*	0.006
	(0.000)	(0.000)	(0.012)	(0.011)	(0.005)
Hawaiian or Other Pacific Islander	-0.001***	-0.001***	-0.005	0.077	-0.038***
	(0.000)	(0.000)	(0.087)	(0.087)	(0.002)
Hispanic or Latino	0.000*	0.000*	-0.028*	0.016	0.019**
	(0.000)	(0.000)	(0.013)	(0.012)	(0.007)
Not Reported	-0.001***	-0.001***	-0.142**	0.113*	0.030
	(0.000)	(0.000)	(0.047)	(0.045)	(0.024)
Two or more races	-0.001***	-0.001***	-0.038*	0.041**	0.009
	(0.000)	(0.000)	(0.016)	(0.015)	(0.008)
Socioeconomic Indicators					
Income	0.000	0.000	0.001***	-0.001***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
First Generation Student	-0.001***	-0.001***	-0.006	0.004	0.004
	(0.000)	(0.000)	(0.011)	(0.010)	(0.005)
Financial Aid					
PELL Recipient	0.000	0.000	-0.053***	0.019**	0.032***
	(0.001)	(0.001)	(0.007)	(0.007)	(0.004)
Merit Aid Recipient	0.001	0.001	-0.091***	0.069***	0.023***
	(0.000)	(0.000)	(0.006)	(0.006)	(0.003)
High School Performance					
High School GPA	-0.003***	-0.003***	0.090***	-0.039***	-0.037***
	(0.001)	(0.001)	(0.013)	(0.011)	(0.005)

SAT ACT Comp Score	0.000	0.000	-0.002	0.002	0.002***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Collegiate Level Control					
Major Changes	0.000	0.000	-0.051***	0.048***	0.015***
	(0.000)	(0.000)	(0.003)	(0.002)	(0.001)
Major Count at Grad	-0.002***	-0.002***	0.001	0.047***	-0.026***
	(0.000)	(0.000)	(0.008)	(0.007)	(0.005)

Note: Coefficients are reported as average marginal effects and sum to zero. Any discrepancy is the product of rounding. *p<.05. **p<.01. ***p<0.001

Table 13: Multinomial Logistic Regression Results for Graduation – Number of Accelerated Learning Credit Hours Earned

	Dependent Variable:				
Variables	(0) Did not Graduate	(3) Graduated in 3 Years	(4) Graduated in 4 Years	(5) Graduated in 5 Years	(6+) Graduated in 6+ Years
Accelerated Learning Credit					
Number of Accelerated Learning Credit Hours Earned					
AP Credit Hours Earned	0.000	0.002***	0.004***	-0.005***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.00)	(0.000)
IB Credit Hours Earned	0.000	0.002***	0.003**	-0.004**	-0.002*
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
DE Credit Hours Earned	0.000	0.003***	0.002**	-0.004***	-0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
Cohort Year					
2012	-0.001**	0.001	0.017	-0.013	-0.004
	(0.000	(0.004)	(0.009)	(0.008)	(0.004)
2013	-0.001*	0.005	0.016	-0.014	-0.006
	(0.000	(0.004)	(0.009)	(0.008)	(0.004)
2014	-0.001	-0.002	0.013	-0.017*	0.006
	(0.001	(0.003)	(0.009)	(0.008)	(0.005)
2015	0.000	-0.002	0.017	-0.005	-0.010*
	(0.001	(0.003)	(0.009)	(0.008)	(0.004)
Sex					
Male	-0.001*	-0.020***	-0.126***	0.116***	0.030***
	(0.000)	(0.002)	(0.006)	(0.006)	(0.003)
Ethnic Origin					
American Indian or Alaskan Native	-0.001***	0.011	0.101	-0.196***	0.084
	(0.000)	(0.040)	(0.083)	(0.003)	(0.075)
Asian	0.001	-0.007*	-0.048***	0.040***	0.014**
	(0.001)	(0.003)	(0.010)	(0.010)	(0.005)
Black or African-American	0.000	-0.001	-0.029*	0.024*	0.006
	(0.000)	(0.005)	(0.012)	(0.011)	(0.005)
Hawaiian or Other Pacific Islander	-0.001***	-0.032***	-0.008	0.079	-0.038***
	(0.000)	(0.001)	(0.087)	(0.087)	(0.002)
Hispanic or Latino	0.000*	-0.005	-0.031*	0.016	0.020**
	(0.000)	(0.005)	(0.013)	(0.012)	(0.007)
Not Reported	-0.001***	0.001	-0.144**	0.114*	0.031
	(0.000)	(0.015)	(0.047)	(0.045)	(0.024)
Two or more races	-0.001***	-0.010*	-0.039*	0.041**	0.009
	(0.000)	(0.005)	(0.016)	(0.015)	(0.008)
Socioeconomic Indicators					
Income	0.000	0.000	0.001***	-0.001***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
First Generation Student	-0.001***	-0.001	-0.007	0.004	0.005
	(0.000)	(0.004)	(0.011)	(0.010)	(0.005)

Financial Aid					
PELL Recipient	0.000	0.003	-0.054***	0.019**	0.032***
	(0.001)	(0.003)	(0.007)	(0.007)	(0.004)
Merit Aid Recipient	0.001	-0.003	-0.090***	0.069***	0.023***
	(0.000)	(0.003)	(0.006	(0.006)	(0.003)
High School Performance					
High School GPA	-0.003***	-0.009	0.089***	-0.039***	-0.037***
	(0.001)	(0.006)	(0.013)	(0.011)	(0.005)
SAT ACT Comp Score	0.000	-0.001*	-0.003*	0.002	0.002***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Collegiate Level Control					
Major Changes	0.000	-0.012***	-0.051***	0.048***	0.014***
	(0.000)	(0.001)	(0.003)	(0.002)	(0.001)
Major Count at Grad	-0.002***	-0.019***	-0.001	0.048***	-0.026***
	(0.000)	(0.003)	(0.008)	(0.007)	(0.005)

Note: Coefficients are reported as average marginal effects and sum to zero. Any discrepancy is the product of rounding. *p<.05. **p<.01. ***p<0.001

Finally, when reviewing the effect of each combination of accelerated learning credit (Model 35), the greatest average marginal effect was found for having all three credit types and graduating in four years (27.4%). In contrast, average marginal decreases in probability were high for this group of graduating in 5 years (20.8%). The remaining findings in Table 14 align with the results of the multiple regression analysis in that students are more likely to fall into the shorter graduation timeframe buckets than the longer ones, only to varying degrees of increased probability. DE credit is associated with an average marginal increase of 12.0% for graduating in three years when taken by itself and a 10.7% average marginal increase for graduating in four years when combined with AP credit hours. AP credit hours alone indicate a 10.5% average marginal increase in graduating in four years, and when combined with IB credits, it increases to 11.9% for four years.

Table 14: Multinomial Logistic Regression Results for Graduation – Accelerated Learning Credit Combinations

	Dependent Variable:				
Variables	(0) Did not Graduate	(3) Graduated in 3 Years	(4) Graduated in 4 Years	(5) Graduated in 5 Years	(6+) Graduated in 6+ Years
Accelerated Learning Credit					
Combinations of Types of Accelerated Learning Credit:					
AP Credit Hours Only	0.001**	0.023***	0.105***	-0.103***	-0.027***
	(0.000)	(0.001)	(0.011)	(0.011)	(0.005)
IB Credit Hours Only	0.002**	0.013*	0.092***	-0.080***	-0.027**
	(0.001)	(0.006)	(0.021)	(0.020)	(0.009)
DE Credit Hours Only	-0.001***	0.120***	0.019	-0.115***	-0.024**
	(0.000)	(0.011)	(0.017)	(0.015)	(0.008)
AP & IB Credit Hours	-0.001***	0.027***	0.119***	-0.106***	-0.040***
	(0.000)	(0.007)	(0.023)	(0.021)	(0.009)
AP & DE Credit Hours	0.002*	0.061***	0.107***	-0.139***	-0.030***
	(0.001)	(0.005)	(0.013)	(0.012)	(0.006)
IB & DE Credit Hours	0.000*	0.118	-0.013	-0.040	-0.065***
	(0.000)	(0.103)	(0.155)	(0.137)	(0.005)
AP, IB, & DE Credit Hours	0.000***	0.000***	0.274**	-0.208*	-0.065***
	(0.000)	(0.000)	(0.084)	(0.084)	(0.005)
Cohort Year					
2012	-0.001**	0.003	0017	-0.015	-0.004
	(0.000)	(0.004)	(0.009)	(0.008)	(0.004)
2013	-0.001	0.010**	0.014	-0.018*	-0.006
	(0.000)	(0.004)	(0.009)	(0.008)	(0.004)
2014	-0.001	0.005	0.012	-0.023**	0.006
	(0.001)	(0.004)	(0.009)	(0.008)	(0.005)
2015	0.001	0.001	0.016	-0.007	-0.010*
	(0.001)	(0.003)	(0.009)	(0.009)	(0.004)
Sex					
Male	-0.001	-0.018***	-0.119***	0.109***	-0.010***
	(0.001)	(0.002)	(0.006)	(0.006)	(0.004)
Ethnic Origin					
American Indian or Alaskan Native	-0.001***	0.038	0.090	-0.199***	0.072
	(0.000)	(0.062)	(0.090)	(0.003)	(0.069)
Asian	0.001	0.006	-0.044***	0.025**	0.012**
	(0.001)	(0.004)	(0.010)	(0.009)	(0.005)
Black or African-American	0.000	0.012*	-0.028*	0.012	0.004
	(0.000)	(0.006)	(0.012)	(0.010)	(0.005)
Hawaiian or Other Pacific Islander	-0.001***	-0.300***	0.003	0.066	-0.038***
	(0.000)	(0.001)	(0.086)	(0.085)	(0.002)
Hispanic or Latino	0.000*	0.004	-0.028*	0.005	0.018**
	(0.000)	(0.006)	(0.013)	(0.012)	(0.007)
Not Reported	-0.001***	0.008	-0.137**	0.101*	0.029
	(0.000)	(0.018)	(0.047)	(0.044)	(0.024)

Two or more races	-0.001***	-0.004	-0.038*	0.035*	0.009
	(0.000)	(0.006)	(0.016)	(0.015)	(0.008)
Socioeconomic Indicators					
Income	0.000	0.000	0.001***	-0.001***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
First Generation Student	-0.001***	0.004	-0.009	0.001	0.004
	(0.000)	(0.005)	(0.011)	(0.010)	(0.005)
Financial Aid					
PELL Recipient	0.000	0.005	-0.055***	0.018**	0.032***
	(0.001)	(0.003)	(0.008)	(0.007)	(0.004)
Merit Aid Recipient	0.001	-0.003	-0.097***	0.075***	0.024***
	(0.000)	(0.003)	(0.006	(0.006)	(0.003)
High School Performance					
High School GPA	-0.004***	0.006	0.080***	-0.047***	-0.036***
	(0.001)	(0.006)	(0.013)	(0.011)	(0.005)
SAT ACT Comp Score	0.000	0.004***	-0.004**	0.003*	0.002***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Collegiate Level Control					
Major Changes	0.000	-0.017***	-0.049***	0.051***	0.015***
	(0.000)	(0.001)	(0.003)	(0.002)	(0.001)
Major Count at Grad	-0.002***	-0.007*	0.005	0.031***	-0.027***
	(0.000)	(0.003)	(0.008)	(0.007)	(0.005)

Note: Coefficients are reported as average marginal effects and sum to zero. Any discrepancy is the product of rounding. *p<.05. **p<.01. ***p<0.001

Descriptive Analysis Findings

The findings of the multiple regression models on time to degree and the multinomial logistic regressions on the time frame in which students graduate tell much of the same story. Earning accelerated learning credits when enrolling in this particular institution is associated with a decreased time to degree. However, that decrease does not necessarily translate to graduating earlier. Indeed, comparing these analytical findings to more descriptive representations of the data makes this picture clearer.

Table 15 illustrates descriptively where these same cohorts of students fall regarding graduating the spring semester of their senior (fourth) year, often the mark for "on time" graduation. It is clear, descriptively, that students, in general, are not

graduating early in overwhelming numbers without advanced coursework. However, the percentage of students with accelerated learning credit graduating early is also relatively low. Only 9.12% of students who entered college with accelerated learning credits graduated early, compared to the total percentage of students who entered with these credits (86.99%).

Table 15: Descriptive Statistics – On-Time Graduation

Graduation Timeline	No Accelerated Learning Credit	Some Accelerated Learning Credit	TOTAL
More than 1 Year Early	1 (0.03%)	69 (0.29%)	70 (0.26%)
1 Year Early	1 (0.03%)	430 (1.83%)	431 (1.60%)
2 Semesters Early	60 (1.71%)	337 (1.44%)	397 (1.47%)
1 Semester Early	36 (1.03%)	1305 (5.56%)	1341 (4.97%)
On-Time	1122 (32.00%)	12179 (51.93%)	13301 (49.34%)
1 Semester Late	271 (7.73%)	1542 (6.58%)	1813 (6.73%)
2 Semesters Late	490 (13.98%)	2161 (9.21%)	2651 (9.83%)
1 Year Late	355 (10.13%)	1525 (6.5%)	1880 (6.97%)
More than 1 year late	322 (9.18%)	1082 (4.61%)	1404 (5.21%)
Did Not Graduate	848 (24.19%)	2821 (12.03%)	3669 (13.61%)
TOTAL	3506 (13.01%)	23451 (86.99%)	26957 (100%)

CHAPTER 5: DISCUSSION AND CONCLUSION

In this final chapter, I look back at the study beginning with my research questions and why this topic is critical to examine. I then discuss the results that emerged from my research and what they mean for students, families, schools, and policymakers alike as decisions continue to be made regarding the prevalence and influence of accelerated learning programs in high schools and college campuses. Finally, I will conclude with suggestions for future research on this topic and its role in the postsecondary educational landscape.

Accelerated learning programs such as AP, DE, and IB continue to expand across the United States and participation in each program continues to grow. As such, it is increasingly important for students, families, schools, and colleges to better understand the relationship between participation in these various programs and student success, specifically postsecondary student success. Despite the growing number of students participating in accelerated learning programs, a relatively limited number of studies have been able to meaningfully examine the relationship between the use of earned accelerated learning credit and the respective postsecondary educational outcomes. This study begins to address this critical gap in the literature.

Three overarching research questions framed my analysis. First, is there an association between earned accelerated learning credits and time to degree in college? Second, does the association vary by the number of credit hours earned? And finally, does the association vary by type or combination of accelerated learning programs?

Specifically, I examined whether the presence of any accelerated learning credit, a specific type or combination of credit, and the amount of credit have differing associations with time to degree and graduation and whether, in this particular postsecondary environment–a large, research I, highly selective, and highly competitive institution–accelerated learning credit has the same association with graduation as has been reported in prior research.

Summary of Findings

Time to Degree

Findings from each of the five primary analytical models suggest that there is an association between having any of the three types of accelerated learning credit, specifically AP, IB, and DE credit, and a decrease in time to degree at this particular institution. However, when interpreting the results for each category of explanatory variable with an eye toward practical application, most findings do not amount to a meaningful decrease. At first glance, the association of statistically significant decreases in time to degree across variables appears promising. However, in practice, partial semesters in college do not exist. If a student requires additional credits to complete their degree, they will be required to enroll for the semester of coursework, which requires paying tuition, fees, room and board, etc. Partial semester and time savings do not necessarily equate to actual savings for the student as the cost of enrolling in an additional semester may be the same, regardless of how many credits you actually need to complete.

Only one metric, out of the nine explanatory variables related to accelerated learning programs, was associated with a time to degree decrease that equaled or was

greater than one semester, and with an n=15, those findings are not widely applicable. The time to degree findings suggest that having any of these types of credit, regardless of amount or combination, is not closely related to completing a college degree any quicker than students without the earned credit.

Another interesting takeaway from the time to degree findings is that they collectively seem to contradict what is often perceived concerning the importance of the type of accelerated learning credit earned, specifically the prominence placed on AP courses and credit. In these analyses, DE credit exhibits a stronger relationship than AP credit across all models with regards to reduction in time to degree. In fact, when looking at credit hours earned and applied at this institution, point estimates for DE credit suggest more than double the reduction in time to degree than AP credit. In fact, the presence of DE credit, whether by itself or in combination with another type of credit, appears to be associated with a greater decrease in time to degree than any of the other categories. AP credit combinations result in the second highest coefficients across these categories, and IB, while still associated with a decrease in time to degree, represents the lowest decrease in time to degree across the explanatory variable categories. While these findings are positive in that each combination of credit is associated with a decrease in time to degree, the application of these findings is still rather limited. As with all other explanatory variables in Models 1-5, the expected time savings in the time to degree findings do not equate to a full semester, with the exception of the combination of all three types, which has limited applicability.

Graduation

The results from the second set of analytical models focused on the change in probability of graduating earlier, on time, later, or not at all, given the accelerated learning credit earned. The findings of those models indicate that accelerated learning credit is associated with a higher probability of students graduating within four years and an average decrease in the probability of graduating in five years or six or more years when compared to not graduating at all. In fact, the findings indicate that it is the condition of having earned credit, not necessarily the amount of credit earned, that is associated with the greatest average marginal change in the increased probability of graduating in three or four years. The findings in Tables 10-14 align with the results of the multiple regression analysis (Table 6) in that students are more likely to fall into the shorter or on-time graduation timeframe categories than the longer ones, with varying degrees of increased probability.

Interestingly, the presence (not amount) of DE credit indicated that it was more closely associated with a higher increase in the probability of graduating in three years rather than four years. However, it is important to keep in mind that the number of students who were able to graduate in three years or less is n=719 or 2.67% of the students across all cohorts. In contrast, 62.2% (16,768) of the students in the population of this study graduated in four years.

On-Time Graduation

Finally, the common thread identified by the two sets of analyses above was confirmed by simple descriptive statistics related to on-time graduation, defined for this study as graduating the spring semester of your senior year (or exactly at four years).

When broken down further by semester, the data reveal that far fewer students with accelerated learning credit are graduating before the spring of their senior year. Using these simple descriptive statistics to consider graduation term by semester, it is clear that, on average, students who enter this institution with any accelerated learning credit, regardless of type or amount, graduate on time (as defined as in four years) but not early. The percentage of students with accelerated learning credits that did graduate early, defined as before the spring semester of their senior year, is low (9.12%) compared to the population of students who entered college with accelerated learning credits (86.99%).

These three different sets of analyses together paint a clear and compelling portrait of the usage and applicability of accelerated learning credit at this particular institution. More likely, students will graduate in four years, which is considered on time, and not early, for most bachelor's degrees. Indeed, it appears that while having earned accelerated learning credits does not ensure early graduation, it does seem to be associated with on-time graduation. Rather, it can be said that accelerated learning programs are most closely associated with on-time graduation, which is also a valuable marketing strategy specifically for schools and colleges that are interested in these student achievement metrics.

Implications

This study was developed and framed in a way to not only potentially add to the growing body of literature around the impact of accelerated learning programs, but also to provide actionable information for families and practitioners alike as they navigate the ever-changing and expanding accelerated learning program landscape. The ability to compare all three types of accelerated learning credit on their association with a common

outcome fills a critical void of information in the research field. As schools continue to offer more and more accelerated learning options and students are able to take more and multiple types of courses, they have different structures, costs, and benefits for students and schools. Policymakers, as well as students and schools, will want to understand which produces the best results and which to invest in moving forward.

Students, Families, and Colleges

It is clear both in this study's findings and in prior research that there are postsecondary education benefits to earning accelerated learning credit. Yet, the degree to which those benefits have applicable outcomes is dependent on what the student aims to achieve by participating in a particular program. This study corroborates the findings of many scholars that AP, IB, and DE each offer an advantage when it comes to graduating from college. Specifically, having earned accelerated learning credit is associated with graduating college in a timely manner, not necessarily early, but on time. As access to these programs continues to grow, students and families will be faced with the decision of which programs to invest their time and money into. This study indicates that while there are some slight advantages to choosing dual enrollment or all three options if a student is hoping to graduate earlier from college, families can be secure in choosing any of the programs, as none of them appear to be a detriment to graduating.

Given the findings of this paper, it will be important for families to consider not only the costs and benefits associated with these programs, but also the intended goals they (and their students) wish to achieve. This study utilized three different theoretical frameworks to attempt to identify why students might elect to participate in any of the accelerated learning programs. The findings of this study suggest that perhaps instead of

tapping into the human capital or cost-benefit frameworks for their decision-making around these programs-at least as they pertain to graduating earlier-students that wish to attend this particular institution, may be making decisions based on the signaling power of accelerated learning programs on college admissions.

Colleges and universities across the country are seeing increasing numbers of students arriving on campus with even larger amounts of accelerated learning credits. The findings of this study indicate that accelerated learning credit does aid in students graduating within four years, a common metric used for college rankings and achievement metrics. For colleges, when looking narrowly at graduation rates and time to degree, as this study has done, there appears to be no downside to accepting accelerated learning credit from incoming students. However, if there is continued efforts to increase high school participation in accelerated learning programs, and if students are then using those programs as signals to colleges for admissions, there is potential for there to be an oversaturation of the pool, thus making that determinant method less effective. This will be an important area of research to monitor moving forward for students, colleges, and policymakers alike.

Future Research

The results of this study suggest that there is an association between accelerated learning credit, specifically AP, IB, and DE credit, and time to degree at this particular institution, but that relationship is relatively small and does not have great practical application for early graduation. This study has a limited but important scope related to the impact of accelerated learning programs credit on time to degree, and while the

findings are important for understanding one benefit of the accelerated learning program, it by no means covers the gamut of needed exploration.

The area of research that I believe to be the most important to explore is the use of accelerated learning programs and earned credit in the college admissions process. As mentioned previously, this study was framed with the idea that perhaps students are participating in these programs to increase their human capital by developing skills and knowledge that will set them up for success in college, to gain some sort of benefit from participation, which could be earlier graduation and earlier entry into the workforce Alternatively, students may be using these credits as a signal to colleges for entry into postsecondary institutions. For the institution considered in this study, it appears that perhaps accelerated learning credit is used by students to get into college, not necessarily to get out. This finding runs contrary to the historically-advertised benefits of accelerated learning programs, which associate the programs with earlier graduation and entry into the workforce. Further investigation is needed in this area.

In addition, this study intentionally did not consider the efficacy of AP, IB, or DE credit in terms of helping to prepare students for student success in particular subject-matter courses. I focused completely on the completion of a college degree, not the level of success along the way. Each student may have different benefits or end goals in mind that they weigh when deciding whether or not to participate in accelerated learning programs and, if so, which ones. If success in particular courses or within particular majors is the goal for taking certain curriculum in high school, it would be helpful for students and families to better understand the association between the accelerated learning program and those outcomes. Additional studies should investigate metrics of

student success in college related to performance among different content courses to determine if there are any content knowledge benefits to support or dissuade participation in accelerated learning programs and courses.

Also, the particular context of this study is an important addition to the scholarly work and helps to better understand the implications of these programs for students who attend highly selective colleges. Future research should expand this study to colleges and universities of various types, sizes, and scopes that serve a variety of different student populations. Understanding the relationship between accelerated learning credits and time to degree would benefit state systems of colleges and universities as well. Answering the questions posed in this study for each institution and for the system overall could help better serve a state's students. A particularly meaningful future study would be a system-wide analysis that controls for institution type as well as details about the population of students that each institution serves. The results of such a study could inform policymakers and inform a larger population of students and families about the relationship between accelerated learning credit and time to degree in different collegiate settings. Pairing that information with the availability and access data of AP, IB, and DE programs across the state could be a powerful tool for policymakers to identify and alleviate potential barriers to equity and access for the students of a state.

Another critical component to discussions of AP, IB, and DE programs centers around costs for the students, families, schools, and colleges. This study largely excluded costs from the discussion, with the exception of including financial aid data as control variables in the models. Additional research that dives deeply into the cost of these programs to offer and participate in, in relation to findings of this study and others that

highlight the benefit of the programs, would provide a critical piece of information for families, institutions, and policymakers when deciding about these programs.

Limitations

This study has a few key limitations that should be noted. The analyses described in this study only include cohorts of students from one institution. Students self-select into the institution of their choice, and in conjunction with a competitive institution's admission processes, the majority of students who enroll in the institution are already predisposed to be high-achieving and academically able. Thus, the external validity of the findings is diminished. Omitted variable bias is another limitation of this study as there are likely variables that I am unable to account for in this study that may impact the student's ability to attain a degree in a quicker timeframe. Unknown biases in the estimation of statistical models might result from the failure to include additional pertinent variables.

Another limitation is related to the use of accelerated learning credit itself. This study also only includes students who *earned* the credit hours associated with their accelerated learning program. Particularly with the AP program, this study only accounted for the credit awarded to a student who took the AP course and then took and passed the AP exam for a given subject. It does not account for students who took an AP class but then did not take the AP exam or if a student took the exam but scored lower than the threshold for the given institution to grant credit. This parameter excludes a growing number of students who take the advanced curriculum but do not receive college credit and is a limitation of this study. Further research could include indicators of accelerated learning participation rather than solely credit earned.

Conclusion

The purpose of this study was to investigate the relationship between Advanced Placement, International Baccalaureate, and Dual Enrollment credit on student achievement as assessed by time to graduation. Findings indicate that entering college with earned accelerated learning credit is associated with a decreased time to degree (in numbers but not in practical application) and an increased probability of graduation on time (within four years). In fact, in almost all cases, it was found that having some accelerated learning credit had a positive relationship with graduating on time, an encouraging sign for the millions of students who participate in each program, although incongruent with common messaging around these programs related to early graduation. According to the findings, K-12 administrators should feel comfortable offering a range of accelerated learning programs to students, and students should have confidence that participating in these programs will contribute to their on-time graduation. However, more research is needed to determine if postsecondary institutions of various sizes, scopes, and missions could replicate the findings of this study about the influence of accelerated learning programs on time to degree.

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APPENDICIES

APPENDIX A: Multiple Regression Models for Time To Degree – 2011 Cohort

	Model 1	Model 2	Model 3	Model 4	Model 5
Accelerated Learning Credit					
Any Accelerated Learning Credit Hours:					
AP, IB, or DE Credit (0, 1)	-0.47***				
	(0.09)				
AP Credit Hours (0, 1)		-0.26**			
		(0.08)			
IB Credit Hours (0, 1)		-0.36*			
		(0.16)			
DE Credit Hours (0, 1)		-0.43***			
		(0.09)			
Number of Accelerated Learning Credit Hours Earned:					
Total Accelerated Learning Credit Hours Earned			-0.03***		
			(0.00)		
AP Credit Hours Earned				-0.03***	
				(0.00)	
IB Credit Hours Earned				-0.05***	
				(0.01)	
DE Credit Hours Earned				-0.06***	
				(0.00)	
Combinations of Types of Accelerated Learning Credit:					
AP Credit Hours Only					-0.39***
					(0.10)
IB Credit Hours Only					-0.61**
					(0.21)
DE Credit Hours Only					-0.76***
					(0.16)
AP & IB Credit Hours					-0.57*
					(0.25)
AP & DE Credit Hours					-0.66***
					(0.14)
IB & DE Credit Hours					-0.28
					(1.20)
AP, IB, & DE Credit Hours					-0.86
					(1.04)
Sex					
Male	0.68***	0.69***	0.72***	0.72***	0.69***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Ethnic Origin					
American Indian or Alaskan Native	-0.89	-0.80	-0.65	-0.47	-0.81
	(0.93)	(0.93)	(0.92)	(0.92)	(0.93)
Asian	0.11	0.11	0.19	0.16	0.10
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Black or African-American	0.14	0.15	0.23	0.22	0.13

	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Hawaiian or Other Pacific Islander	-0.95	-0.96	-0.94	-0.97	-0.98
	(1.47)	(1.47)	(1.46)	(1.46)	(1.47)
Hispanic or Latino	0.04	0.03	0.14	0.10	0.03
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Not Reported	-0.72	-0.73	-0.44	-0.52	-0.74
	(0.79)	(0.79)	(0.78)	(0.78)	(0.79)
Two or more races	0.39*	0.38*	0.34	0.33	0.37*
	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)
Socioeconomic Indicators					
Income	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
First Generation Student	0.11	0.11	0.13	0.13	0.10
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Financial Aid					
PELL Recipient	0.36***	0.35***	0.37***	0.36***	0.36***
	(0.08)	(0.08)	(0.07)	(0.07)	(0.08)
Merit Aid Recipient	0.36***	0.35***	0.32***	0.33***	0.36***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
High School Performance					
High School GPA	-0.75***	-0.74***	-0.64***	-0.64***	-0.72***
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
SAT ACT Comp Score	0.02*	0.02	0.06***	0.05***	0.02
	(0.01)	(0.01)	(0.01	(0.01)	(0.01)
Collegiate Level Control					
Major Changes	0.39***	0.40***	0.37***	0.37***	0.40***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Major Count at Grad	-0.21**	-0.21**	-0.10	-0.12	0.21**
	(0.08)	(0.07)	(0.08)	(0.08)	(0.08)
N	4548	4548	4548	4548	4548
R2	0.11	0.11	0.13	0.13	0.12

Notes: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

APPENDIX B: Multiple Regression Models for Time To Degree – 2012 Cohort

	Model 1	Model 2	Model 3	Model 4	Model 5
Accelerated Learning Credit					
Any Accelerated Learning Credit Hours:					
AP, IB, or DE Credit (0, 1)	-0.63***				
	(0.10)				
AP Credit Hours (0, 1)		-0.51***			
		(0.09)			
IB Credit Hours (0, 1)		-0.01			
		(0.17)			
DE Credit Hours (0, 1)		-0.40***			
		(0.09)			
Number of Accelerated Learning Credit Hours Earned:					
Total Accelerated Learning Credit Hours Earned			-0.03***		
			(0.00)		
AP Credit Hours Earned				-0.03***	
				(0.00)	
IB Credit Hours Earned				-0.02	
				(0.01)	
DE Credit Hours Earned				-0.05***	
				(0.01)	
Combinations of Types of Accelerated Learning Credit:					
AP Credit Hours Only					-0.61***
					(0.10)
IB Credit Hours Only					-0.18
					(0.26)
DE Credit Hours Only					-0.67***
					(0.17)
AP & IB Credit Hours					-0.54*
					(0.25)
AP & DE Credit Hours					-0.92***
					(0.13)
IB & DE Credit Hours					-----

AP, IB, & DE Credit Hours					-1.13
					(1.90)
Sex					
Male	0.57***	0.57***	0.61***	0.61***	0.57***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Ethnic Origin					
American Indian or Alaskan Native	4.00**	4.36**	4.02**	4.03**	4.28**
	(1.34)	(1.34)	(1.33)	(1.33)	(1.34)
Asian	0.12	0.11	0.24*	0.21*	0.11
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)
Black or African-American	-0.03	-0.01	0.08	0.07	-0.02

	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
Hawaiian or Other Pacific Islander	-0.15	-0.16	-0.03	-0.06	-0.16
	(0.67)	(0.67)	(0.67)	(0.67)	(0.67)
Hispanic or Latino	0.28*	0.28*	0.32*	0.31*	0.28*
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Not Reported	1.67	1.60	1.51	1.56	1.66
	(1.10)	(1.09)	(1.09)	(1.09)	(1.10)
Two or more races	-0.12	-0.09	-0.08	-0.09	-0.10
	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)
Socioeconomic Indicators					
Income	-0.00*	-0.00	-0.00*	-0.00*	-0.00*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
First Generation Student	0.26*	0.25*	0.26*	0.26*	0.25*
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Financial Aid					
PELL Recipient	0.20**	0.19*	0.22**	0.22**	0.19*
	(0.08)	(0.08)	(0.07)	(0.07)	(0.08)
Merit Aid Recipient	0.35***	0.34***	0.32***	0.33***	0.35***
	(0.07)	(0.07)	(0.06)	(0.06)	(0.07)
High School Performance					
High School GPA	-0.54***	-0.52***	-0.43***	-0.43***	-0.51***
	(0.12)	(0.13)	(0.13)	(0.13)	(0.13)
SAT ACT Comp Score	-0.01	-0.02	0.02	0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Collegiate Level Control					
Major Changes	0.42***	0.42***	0.40***	0.40***	0.42***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Major Count at Grad	-0.15*	-0.14	-0.01	-0.03	-0.14
	(0.08)	(0.76)	(0.08)	(0.08)	(0.08)
N	4112	4112	4112	4112	4112
R2	0.13	0.13	0.14	0.14	0.13

Notes: *** p < 0.001; ** p < 0.01; * p < 0.05.

APPENDIX C: Multiple Regression Models for Time To Degree – 2012 Cohort

	Model 1	Model 2	Model 3	Model 4	Model 5
Accelerated Learning Credit					
Any Accelerated Learning Credit Hours:					
AP, IB, or DE Credit (0, 1)	-0.69***				
	(0.10)				
AP Credit Hours (0, 1)		-0.41***			
		(0.09)			
IB Credit Hours (0, 1)		-0.46**			
		(0.15)			
DE Credit Hours (0, 1)		-0.42***			
		(0.08)			
Number of Accelerated Learning Credit Hours Earned:					
Total Accelerated Learning Credit Hours Earned			-0.03***		
			(0.00)		
AP Credit Hours Earned				-0.02***	
				(0.00)	
IB Credit Hours Earned				-0.03**	
				(0.01)	
DE Credit Hours Earned				-0.05***	
				(0.01)	
Combinations of Types of Accelerated Learning Credit:					
AP Credit Hours Only					-0.62***
					(0.10)
IB Credit Hours Only					-0.68**
					(0.21)
DE Credit Hours Only					-0.93***
					(0.16)
AP & IB Credit Hours					-0.93***
					(0.24)
AP & DE Credit Hours					-0.88***
					(0.13)
IB & DE Credit Hours					-2.31*
					(1.08)
AP, IB, & DE Credit Hours					-1.75
					(0.94)
Sex					
Male	0.48***	0.48***	0.53***	0.52***	0.47***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Ethnic Origin					
American Indian or Alaskan Native	-2.63	-2.28	-2.30	-1.91	-2.42
	(1.87)	(1.87)	(1.85)	(1.85)	(1.87)
Asian	0.14	0.12	0.23*	0.20*	0.12
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)
Black or African-American	0.25*	0.25*	0.28*	0.26*	0.22

	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Hawaiian or Other Pacific Islander	-0.21	-0.30	-0.38	-0.40	-0.27
	(0.93)	(0.93)	(0.93)	(0.92)	(0.93)
Hispanic or Latino	0.10	0.08	0.16	0.12	0.09
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
Not Reported					
Two or more races	0.19	0.20	0.28	0.28	0.19
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Socioeconomic Indicators					
Income	-0.00***	-0.00***	-0.00***	-0.01***	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
First Generation Student	-0.07	-0.07	-0.03	-0.03	-0.07
	(0.12)	(0.12)	(0.11)	(0.11)	(0.12)
Financial Aid					
PELL Recipient	0.47***	0.46***	0.46***	0.45***	0.46***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Merit Aid Recipient	0.33***	0.32***	0.28***	0.29***	0.33***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
High School Performance					
High School GPA	-0.79***	-0.80***	-0.70***	-0.71***	-0.77***
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
SAT ACT Comp Score	0.00	0.00	0.04**	0.02*	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Collegiate Level Control					
Major Changes	0.26***	0.26***	0.22***	0.23***	0.26***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Major Count at Grad	-0.02	-0.02	0.09	0.07	-0.02
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
N	4407	4407	4407	4407	4407
R2	0.11	0.11	0.12	0.13	0.11

Notes:*** p < 0.001; ** p < 0.01; * p < 0.05.

APPENDIX D: Multiple Regression Models for Time To Degree – 2014 Cohort

	Model 1	Model 2	Model 3	Model 4	Model 5
Accelerated Learning Credit					
Any Accelerated Learning Credit Hours:					
AP, IB, or DE Credit (0, 1)	-0.56***				
	(0.10)				
AP Credit Hours (0, 1)		-0.28***			
		(0.08)			
IB Credit Hours (0, 1)		-0.16			
		(0.13)			
DE Credit Hours (0, 1)		-0.44***			
		(0.07)			
Number of Accelerated Learning Credit Hours Earned:					
Total Accelerated Learning Credit Hours Earned			-0.03***		
			(0.00)		
AP Credit Hours Earned				-0.02***	
				(0.00)	
IB Credit Hours Earned				-0.04***	
				(0.01)	
DE Credit Hours Earned				-0.05***	
				(0.00)	
Combinations of Types of Accelerated Learning Credit:					
AP Credit Hours Only					-0.48***
					(0.10)
IB Credit Hours Only					-0.52*
					(0.21)
DE Credit Hours Only					-0.81***
					(0.15)
AP & IB Credit Hours					-0.48*
					(0.19)
AP & DE Credit Hours					-0.82***
					(0.12)
IB & DE Credit Hours					-----

AP, IB, & DE Credit Hours					-1.04
					(1.25)
Sex					
Male	0.56***	0.56***	0.58***	0.57***	0.55***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Ethnic Origin					
American Indian or Alaskan Native	-0.90	-1.01	-0.88	-0.93	-0.98
	(0.88)	(0.88)	(0.86)	(0.86)	(0.88)

Asian	0.20*	0.19*	0.31***	0.29**	0.18*
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
Black or African-American	0.09	0.08	0.17	0.16	0.07
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Hawaiian or Other Pacific Islander	-0.18	-0.08	0.13	0.14	-0.10
	(0.79)	(0.79)	(0.77)	(0.77)	(0.79)
Hispanic or Latino	0.14	0.12	0.24	0.22	0.12
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
Not Reported	0.66**	0.65**	0.75**	0.72**	0.63*
	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)
Two or more races	0.07	0.06	0.10	0.08	0.05
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
Socioeconomic Indicators					
Income	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
First Generation Student	0.10	0.09	0.10	0.10	0.09
	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
Financial Aid					
PELL Recipient	0.42***	0.41***	0.41***	0.41***	0.41***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Merit Aid Recipient	0.48***	0.49***	0.46***	0.46***	0.49***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
High School Performance					
High School GPA	-0.56***	-0.53***	-0.35**	-0.37**	-0.52***
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
SAT ACT Comp Score	-0.00	-0.01	0.04***	0.03**	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Collegiate Level Control					
Major Changes	0.34***	0.35***	0.32***	0.31***	0.34***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Major Count at Grad	-0.01	0.00	0.15*	0.13	0.00
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
N	4235	4235	4235	4235	4235
R2	0.13	0.13	0.16	0.17	0.14

Notes:*** p < 0.001; ** p < 0.01; * p < 0.05.

APPENDIX E: Multiple Regression Models for Time To Degree – 2015 Cohort

	Model 1	Model 2	Model 3	Model 4	Model 5
Accelerated Learning Credit					
Any Accelerated Learning Credit Hours:					
AP, IB, or DE Credit (0, 1)	-0.60***				
	(0.09)				
AP Credit Hours (0, 1)		-0.26***			
		(0.07)			
IB Credit Hours (0, 1)		-0.05			
		(0.11)			
DE Credit Hours (0, 1)		-0.35***			
		(0.06)			
Number of Accelerated Learning Credit Hours Earned:					
Total Accelerated Learning Credit Hours Earned			-0.03***		
			(0.00)		
AP Credit Hours Earned				-0.03***	
				(0.00)	
IB Credit Hours Earned				-0.01	
				(0.01)	
DE Credit Hours Earned				-0.04***	
				(0.00)	
Combinations of Types of Accelerated Learning Credit:					
AP Credit Hours Only					-0.53***
					(0.10)
IB Credit Hours Only					-0.22
					(0.16)
DE Credit Hours Only					-0.95***
					(0.13)
AP & IB Credit Hours					-0.65***
					(0.18)
AP & DE Credit Hours					-0.74***
					(0.11)
IB & DE Credit Hours					-0.20
					(0.78)
AP, IB, & DE Credit Hours					-1.67
					(1.09)
Sex					
Male	0.47***	0.49***	0.50***	0.50***	0.48***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Ethnic Origin					
American Indian or Alaskan Native	1.25	1.22	1.33	1.32	1.25
	(0.69)	(0.69)	(0.68)	(0.68)	(0.69)

Asian	0.23**	0.22**	0.30***	0.28***	0.21**
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Black or African-American	0.37***	0.35***	0.39***	0.38***	0.33***
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)
Hawaiian or Other Pacific Islander	0.38	0.31	0.43	0.35	0.25
	(0.69)	(0.69)	(0.68)	(0.68)	(0.69)
Hispanic or Latino	0.34***	0.32**	0.39***	0.36***	0.31**
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)
Not Reported	0.35	0.35	0.35	0.36	0.33
	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)
Two or more races	0.45***	0.42***	0.49***	0.47***	0.44***
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Socioeconomic Indicators					
Income	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
First Generation Student	-0.12	-0.14	-0.11	-0.12	-0.12
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Financial Aid					
PELL Recipient	0.18**	0.18**	0.19**	0.20**	0.17**
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Merit Aid Recipient	0.34***	0.34***	0.32***	0.32***	0.34***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
High School Performance					
High School GPA	-0.18	-0.14	-0.04	-0.03	-0.12
	(0.13)	(0.13)	(0.12)	(0.12)	(0.13)
SAT ACT Comp Score	0.00	-0.01	0.03**	0.02	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Collegiate Level Control					
Major Changes	0.27***	0.27***	0.26***	0.26***	0.27***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Major Count at Grad	-0.02	-0.03	0.09	0.08	-0.02
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
N	4262	4262	4262	4262	4262
R2	0.11	0.11	0.13	0.13	0.11

Notes: *** p < 0.001; ** p <0.01; * p < 0.05.