Trying Again:

Completion Outcomes of Non-First-Time Undergraduate Students

A Dissertation

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Dedication

This dissertation is dedicated to my first educator, Donna Sorenson, who fueled my love for reading and inspired my curiosity about all things. I am the educator and researcher I am today because of you. I love you, mom.

Abstract

Non-first-time students make up a large portion of higher education nationally, particularly in the two-year institution sector, and yet their completion outcomes are largely unstudied. Unfortunately, higher education as it is currently designed does not work well for many non-traditional students. The purpose of this study is to investigate the college completion outcomes of non-first-time undergraduate students.

This study relies on Swail's Geometric Model of Student Persistence and Achievement as the theoretical framework for selecting variables of interest (Swail, 2003). To better understand the outcomes of non-first-time students, this study examines factors associated with student persistence and completion to determine whether those factors are also associated with completion for non-first-time students.

Logistic regression is used to understand the impact of each variable of interest on the award or degree completion outcomes of non-first-time students, and the resulting likelihood of completion is compared. By comparing logistic regression models through backward elimination, the analysis determined that first-term grade point average, developmental education, enrollment intensity, age, and Pell-eligibility are most predictive of completion out of the variables included in the Adapted Geometric Model of Student Persistence and Achievement.

As technology and industries change, the United States needs the ability to retrain and upskill adults whose previous job has been eliminated or whose industry is declining. To be responsive to the needs of our communities, colleges and universities must be able

to support non-first-time students through their education. These results offer insights for improving the college completion outcomes of non-first-time students.

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Chapter I: Introduction

At the beginning of his time in office and in the midst of a global economic recession, President Obama delivered his 2009 State of the Union address in which he insisted that the United States needs a better educated citizenry to be competitive in the global economy. In the knowledge-based economy of the 21st century, a college education has become a prerequisite to economic opportunity; and toward that end, President Obama stated his goal that the United States lead the world in the proportion of college graduates by 2020 (Obama, 2009). Similar to the President's plan, both the Lumina Foundation and College Board have set goals to increase the proportion of college graduates in the United States to 60 and 55 percent respectively by 2025. Though the specific targets vary, these initiatives share common principles: that educating more of our citizens through college is crucial to the success of individuals in a knowledge-based economy, and that the future economic success and global competitiveness of the United States relies on a highly educated workforce. There is also agreement that degree completion achievement gaps will become increasingly detrimental as the nation's demographics continue to change (College Board, 2010; Lumina Foundation, 2009).

In August 2013, President Obama announced a new college ranking system called the College Scorecard intended to measure performance of higher education institutions and score them based on access, affordability and outcomes, including student persistence and graduation rates (The White House, Office of the Press Secretary, 2013). President Obama pushed Congress to tie federal funding for institutions to the College Scorecard by 2018 in the reauthorization of the Higher Education Act. Though it

failed to gain political momentum, the College Scorecard was intended to be an alternative to the more widely used college rankings, such as *US News and World Report,* that have little to do with student experiences or outcomes. Though no longer a ranking system, the College Scorecard is a consumer-facing tool intended to help students and families determine which institutions are the best value for their investment and where they are most likely to be successful (Fain, 2015). In 2018, the U.S. Department of Education under Secretary Betsy Devos's leadership proposed rule changes related to the College Scorecard, eliminating the gainful employment rule, but instead requiring institutions to report the wages of graduates in the College Scorecard in addition to the existing completion rate and student debt metrics (Kelderman, 2018). Though the Devos administration of the Department of Education was not as supportive of college completion as their predecessors, they did not eliminate the Department's focus on college completion initiatives. In 2018, congressional leaders continued to support completion initiatives allocating $4 billion in the Bipartisan Budget Act of 2018 for "student-centered programs that aid college completion and affordability" though there were few details about the nature of the intended use (Harris, 2018).

In the present context, the Biden administration signaled their support for college completion efforts. The proposed American Families Plan includes two years of tuition-free community college, increasing the Pell grant amount, investments in historically black colleges and universities (HBCUs) and minority serving institutions (MSIs), and grants for colleges to adopt innovative solutions to improve student completion outcomes (Kelderman, 2021).

College completion has become part of the national policy agenda, and federal and state lawmakers have been charged with moving toward this college completion goal through improving college readiness, increasing access and affordability, ensuring quality of instruction, and accelerating degree completion. College student persistence is important in higher education as it is seen as a key indicator of its performance. Persistence is defined as a student continuing to enroll in postsecondary education from one year to the next or continuation of educational attainment inclusive of transfers, whereas retention is defined as an institutional measure of students persisting at their original institution (Hagedorn, 2012; St. John, Duan-Barnett, & Moronski-Chapman, 2013). It is a poor use of resources for colleges and universities as well as federal and state governments to invest in scholarships, subsidized student loans, recruitment expenditures and services provided in the first year of college only to have a large number of students not return for their second year or persist through to graduation. From 2003 to 2008, the amount spent on federal and state grants for first-time full-time students in the United States who did not continue to their second year of college was $2.9 billion (Schneider, 2010). During that same time, states appropriated nearly $6.2 billion to colleges and universities to help pay for the education of those students who did not return for a second year or complete their credential (Schneider, 2010). Similarly for the students themselves, investing in a semester or a year of college education without completing a degree is financially detrimental, as students incur costs, but not the full benefits of postsecondary education and a completed degree (U.S. Department of Education, 2015). Additionally, non-completers are significantly more likely to default

on student loans than students who completed degrees, even though their average debt is less than half of their peers (Hillman, 2014).

State support for higher education decreased dramatically during the Great Recession of 2008, and despite a strong economic recovery in most states, higher education funding has returned to pre-recession levels in only three states (Mitchell & Leachman, 2015). As a result of competing demands for state resources and state disinvestment, tuition at public institutions continues to rise, placing a growing proportion of higher education costs on students and families. During this time, both the percentage of students in higher education taking on student loan debt and the average amount of student loan debt have increased (Mitchell & Leachman, 2015). In this environment of increasing long-term costs to students, attrition is becoming an increasingly expensive negative outcome. Further, student loan defaulters are more likely to be non-completers than college graduates (Nguyen, 2012) which highlights the problem of incurring costs of higher education without securing the benefits of increased employability and earnings from holding a degree or postsecondary credential.

Because student persistence affects not only students, but also educational institutions and the nation as a whole, research on college student retention has expanded greatly (Tinto, 2006). While retention and persistence of college students has been studied by higher education researchers for decades, in recent years the conversation about retention and persistence has gained greater significance as a measurable outcome on which to base higher education funding (Alexander, 2000; Sanford & Hunter, 2011). However, retention and completion rates remain well below target levels despite decades

of research and programs to address the problem. About one in five students who enroll at a four-year institution do not return for the second year. According to the U.S. Department of Education National Center for Education Statistics (2015b), first-to-second year retention of first-time full-time students who enrolled to four-year institutions in 2012 is about 80 percent and 60 percent at two-year institutions.

Completion Rates by Student Type

College completion rates are best understood by distinguishing between first-time and non-first-time students. A first-time student is defined as a student who has no prior postsecondary experience attending any institution for the first time at the undergraduate level. This category includes students who enter college with advanced standing due to college credits earned before high school graduation (U.S. Department of Education, National Center for Education Statistics, n.d. a). The National Center for Education Statistics released a report on the degree attainment and employment of the high school sophomore class of 2002 (ELS:2002). Of those who enrolled in postsecondary education within 3 months of high school completion, only 53 percent had earned a bachelor's degree or higher within 8 years (U.S. Department of Education, National Center for Education Statistics, 2014). Relatedly, only 60.0 percent of first-time full-time bachelor's degree-seeking students who started in fall 2008 completed a bachelor's degree within 6 years (U.S. Department of Education, National Center for Education Statistics, 2016).

While the picture is not good for first-time full-time students, less is known about the persistence and completion outcomes of part-time, transfer, and other non-first-time students. Non-first-time students are defined as students transferring from another college

or university, students returning after a break in enrollment, or graduates returning to postsecondary education for another credential. These students make up a large portion of higher education nationally, and particularly of the two-year institution sector, and yet their completion outcomes are largely unknown. According to the National Student Clearinghouse Research Center, 38 percent of college students who started in the Fall 2011 cohort nationally transferred at least once within six years, representing over 1,069,243 students (Shapiro et al., 2018). Yet institutions have only been accountable for the persistence and completion outcomes of first-time full-time students because that is the primary cohort for which data on student completion outcomes are tracked and reported by the U.S. Department of Education. However, overall institutional performance relates to the ability of an institution to support students of a variety of enrollment patterns.

In fall 2013, total undergraduate enrollment in degree-granting postsecondary institutions was 17.5 million students (U.S. Department of Education, National Center for Education Statistics, 2015a). Of those students, 10.5 million or 60 percent were enrolled in four-year institutions, as compared to 7 million at two-year institutions. While 77 percent of students enrolled at four-year institutions were enrolled full-time, the majority of students at two-year institutions were enrolled part-time (59 percent). Students at two-year institutions were also older on average than at four-year institutions. A greater percentage of students at two-year institutions were students of color as compared to four-year institutions. Given this great variation of student profiles and enrollment patterns within higher education, limiting studies of completion to only first-time full-

time students fails to capture the enormous diversity and success of students within the higher education pipeline. U.S. Department of Education's Committee on Measures of Student Success said in their report to the Secretary of Education that the "federal graduation rate measure [of first-time full-time students] is incomplete and does not adequately convey the wide range of student outcomes" (U.S. Department of Education, National Center for Education Statistics, 2015a).

Data on the completion outcomes of the non-first-time population is largely missing from the conversation. A few attempts have been made to capture the outcomes of non-first-time students (American Council on Education et al., 2015; Erisman & Steele, 2015; Horn & Carroll, 1996, Taniguchi & Kaufman, 2005) and recent changes in federal policy and research agendas will allow for better data and understanding of this student population. In one of these studies, National Student Clearinghouse data was used to create state and national benchmarks of persistence and completion for non-first-time students and found that nationally only 33.7 percent of non-first-time students completed a degree, as compared to 54.1 percent of first-time students (American Council on Education et al., 2015). Whereas first-time students were more likely than their non-first-time peers to complete a degree when enrolled either full-time or part-time, non-first-time students were more likely to graduate than their first-time peers when having a mixed enrollment pattern.

In support of the Obama administration's college completion agenda and in response to recommendations by the Integrated Postsecondary Education Data System (IPEDS) technical review committees, IPEDS added the Outcomes Measures data

collection which is a retrospective data collection on first-time full-time, first-time part-time, non-first-time full-time, and non-first-time part-time degree/certificate-seeking students. The first release of preliminary data, intended for Fall 2016, was delayed due to data quality issues, highlighting the challenges of this alternative approach to measuring student completion (Ipeds_nces, 2016). However in October 2017, IPEDS released the first Outcome Measures preliminary data and included it in College Navigator thereby creating the first publicly-available national data set on the persistence and completion patterns of part-time and non-first-time students. Because Outcome Measures is an institutional data collection rather than student-level data collection, robust demographic data on non-first-time students nationally is not available. Improvements to the Outcome Measures survey are underway and future surveys will include disaggregation of Pell Grant recipients so that results can be used to examine outcomes of low-income students receiving grant aid to their peers; however, this is still not a full demographic profile (race/ethnicity, gender, age, and income) of non-first-time students and their completion outcomes.

The first Outcome Measures preliminary data shows that at public 2-year institutions non-first-time full-time students were slightly more likely to complete their degree at that institution within 8 years than first-time full-time students, at 35.6 and 32.8 percent respectively (U.S. Department of Education, National Center for Education Statistics, 2017). Similarly non-first-time part-time students were slightly more likely to complete than first-time part-time students, at 20.3 and 17.0 percent respectively. Across institution types, the average completion rate for all students at 2-year institutions was

26.6 percent for public, 62.3 for private nonprofit, and 65.0 at private for-profit. At 4-year institutions, the average completion rate for all students was 56.5 percent for public, 62.8 for private nonprofit, and 32.4 at private for-profit. The preliminary Outcome Measures released by NCES shows great variation in completion across enrollment intensity and institution types, further supporting the need for additional exploration of the completion outcomes of non-first-time students across enrollment patterns.

Purpose of the Study and Research Question

The purpose of this study is to investigate the college completion outcomes of non-first-time undergraduate students. To better understand the outcomes of these students, this study will examine factors associated with student persistence and completion to determine whether those factors are also associated with completion for non-first-time students. The research question driving this study is: What factors are most predictive of completion for non-first-time undergraduate students?

Definitions

In this study, completion is defined as attainment of any postsecondary credential or degree. Although the terms persistence and retention are often used interchangeably, the term persistence refers to a student continuing to enroll in postsecondary education from one year to the next, while retention is an institutional measure of the rate at which students persist in their educational program (Hagedorn, 2012; U.S. Department of Education, National Center for Education Statistics, n.d. a). Though the terms retention and persistence are often used interchangeably, St. John, Duan-Barnett, and Moronski-Chapman (2013) differentiated retention as the continuation of educational attainment at

a student's original campus while persistence referred to educational attainment inclusive of transfers. Because the focus of federal and state policy is degree completion inclusive of transfers, this is a helpful distinction. Attrition can be understood as the opposite of retention, an institutional measure of the rate of student departure. Relying on these terms, this study is focused on completion of any postsecondary certificate, diploma, or degree.

Study Significance and Rationale

Much of the research on undergraduate student persistence and completion focuses on first-time full-time students. However, this research ignores large groups of students that are on alternative pathways to a college degree or credential and whose journey to success should be better understood (Adelman, 2011; Adelman, 2007; Jones-White, Radcliffe, Huesman, & Kellogg, 2010). This study will contribute to the literature in three unique ways. First, this study examines the extent to which those variables predictive of success for first-time full-time students also predict success for non-first-time students. This differs from previous literature on persistence and completion in that the majority of past studies have focused solely on first-time full-time students. This study will inform the emerging discussion around the differing needs of non-first-time students in their efforts to complete a degree or credential.

Second, this study examines the extent to which these variations in student persistence and completion rates are associated with differences in income, family postsecondary experience, age, marital status, parenting status, gender, race/ethnicity, enrollment intensity, developmental education placement, and grade point average.

Drawing on institutional data, this study will provide a more nuanced understanding of the persistence and completion of non-first-time students than prior studies using only national data sets that contain fewer variables predictive of persistence and completion.

Third, this study will be among the first test the assumption that the same persistence and completion support strategies used for first-time students are effective for non-first-time students. If this analysis shows differing outcomes across student populations, this can inform institutional, state and federal policies around supporting non-first-time students to degree completion. In attempting to understand the success patterns of a broader cross-section of the college student population, this study will contribute to the national conversation about the importance of not just access to college, but completion of a credential. Additionally, increasing the degree completion of all students, including non-first-time students, is essential to meeting national attainment goals and attainment goals set in state legislatures.

Chapter II: Review of Literature

This study examines factors associated with college persistence and degree completion of non-first-time students. As the majority of research on student persistence and completion overlooks non-first-time students, this research will identify factors that are most influential in the degree or credential completion of this population. More specifically, this study will rely on factors known from prior research to be related to the persistence and completion of undergraduate students, and examine the degree to which those are or are not predictive for non-first-time students. The following section describes the theoretical framework used to organize the research and literature review for this study.

Swail's Geometric Model of Student Persistence and Achievement

This study relies on Swail's Geometric Model of Student Persistence and Achievement as the theoretical framework for selecting appropriate variables of interest because of the focus on the student as the central actor (Swail, 2003). Many theoretical frameworks that attempt to understand student persistence and completion prioritize the institution or institutional factors (e.g. Tinto's Student Integration Model, 1975; Bean and Eaton's Psychological Model of College Student Retention, 2000). However, given the focus on non-first-time students and the potential complexity of their lives outside of the college environment, this study needs to take into account the external influences on student completion, so institutionally-focused theoretical frameworks are not well aligned to the purpose of this study. Further, because the Swail model prioritizes the student and not the institution, this model can be used to understand the experience of students across

institution types – 2-year, 4-year, public or private. Other models of persistence or completion focus entirely on students' internal, cognitive, or social-emotional factors impacting persistence, such as satisfaction and commitment (e.g. Rusbult, Martz, & Agnew's Investment Model, 1998). However, these models fail to take into account the structural barriers encountered by underrepresented or nontraditional students as they enter and persist through their postsecondary experience.

Swail's Geometric Model of Student Persistence and Achievement, by contrast, places the student at the center of the model and takes into account the influence of social, cognitive, and institutional factors in persistence and degree completion. Swail's Geometric Model presents social factors, cognitive factors, and institutional factors as the three sides of a triangle that interact to influence the student experience in postsecondary education which is represented in the center of the triangle. Examples of social factors in Swail's Model include financial issues, educational legacy, attitudes toward learning, maturity, social coping skills, cultural values, goal commitment, family influence, peer influence, and social lifestyle. Cognitive factors in Swail's Model include academic rigor, quality of learning, aptitude, content knowledge, technology ability, study skills, and time management. Institutional factors in Swail's model include financial aid, academic services, student services, and curriculum and instruction. These forces across the three factors can impact the overall student experience positively, negatively, or neutrally. According to Swail's Geometric Model theory, the forces also interact within or across axes which contributes to stability or instability for the student and their likelihood of persisting to completion (Swail, 2003).

When one of the three categories of factors is lacking, the result is that the student's experience would be out of a state of equilibrium and a student would be less likely to persist to completion. For example, if a student has strong cognitive factors in their critical thinking and time management skills and has strong institutional support through robust curriculum and instruction and student services, but then lacks robust social supports such as social coping skills and family encouragement, the three sides would be out of balance making it more difficult for that student to persist. By contrast, a student whose social, cognitive, and institutional factors are all robust would be more likely to persist through college and complete a degree.

Additionally, Swail's Geometric Model allows for inclusion of explanatory variables across the life span of individuals and takes into account variables that are typically outside of the purview of persistence and completion research, such as marital status, children, or prior enrollment at other institutions. Because Swail's Geometric Model takes into account the complexities of individuals' lives outside of the institution which lead to student success or attrition, this model aligns with an analysis of non-first-time student completion and is appropriate for this study.

The majority of the literature on college completion is based in the four-year college context or is conducted on national data sets that include students across institution types. However, where it is available, research on the completion outcomes of students in two-year colleges has also been included and highlighted throughout. The following literature review integrates studies across institution types around Swail's Geometric Model. The categories of Swail's Geometric Model, cognitive factors and

social factors, will be used to organize the literature review for this study. The literature review informs my approach to addressing the study's research question and variables used to answer this question.

Social Factors

The earliest research on persistence and completion focused on student-level indicators of departure. This work attempted to identify the students at risk for attrition by understanding the characteristics and predictors of student departure (Astin, 1972; Bean, 1983; Pascarella & Terenzini, 1980; Spady, 1970; Tinto, 1975). While a base understanding of student attrition was gained from this early research, many of these student-level indicators of departure were determined pre-college, outside institutional control, or otherwise not able to be changed so did not provide actionable information for higher education institutions. For example, student variables such as high school grade point average, academic and social attainment, family socioeconomic status, sex, and race/ethnicity are predictive of persistence and completion, but these are often fixed variables prior to enrolling in postsecondary and so are more often used as controls in modern studies. Many of these variables are taken into account as social factors in Swail's Model. Social factors in Swail's Model include financial issues, educational legacy, attitudes toward learning, maturity, social coping skills, cultural values, goal commitment, family influence, peer influence, and social lifestyle. Much of the research on social factors influencing persistence and completion come from the pathways literature which takes into account students' pre-college educational experiences as well as social, familial, and cultural systems that influence their educational experiences from

early in life through college. This allows researchers to study the factors that influence the success and degree completion of non-first-time students in addition to traditional first-time students, which is largely overlooked by other degree completion research (Bragg, 2013). By combining multiple external factors and their interactions, student pathways research illustrates the relationship between student persistence to degree completion and social factors including financial challenges, family postsecondary experience, gender, race/ethnicity, age, marital status, parenting status, and enrollment intensity.

Financial Issues – Pell-Eligible

Affordability of higher education is commonly understood to be a factor in both access to postsecondary and students' ability to complete their intended certificate or degree. The Federal Pell Grant Program is a need-based financial aid program that is awarded to undergraduate students based on student and family information provided on the Free Application for Federal Student Aid (FAFSA) and assists low-income students with their postsecondary educational costs. Pell-eligibility is commonly used as a proxy measure for socioeconomic status (SES) in higher education, similar to eligibility for free and reduced priced lunch being used as an SES proxy in K-12 education.

It is common in education research to control for the effect of socioeconomic status (SES) on outcomes in order to understand the impact of other variables. However, little research is done on what factors help low SES students to be successful despite the odds against them. Cabrera, Burkum, La Nasa, and Bibo (2005) attempted to understand the differences between socioeconomically disadvantaged students and their more

privileged peers by studying the effects of financial aid in addition to other determinants of student persistence and how it varies across SES. They analyzed the National Education Longitudinal Studies High School and Beyond data of nearly 15,000 students in the United States from the high school sophomore class of 1980 over 11 years. Using logistic regression, they found that factors other than SES were more significant in students completing a college degree. Of the pre-college factors studied, a student's degree aspirations and high school academic resources (a composite measure of high school academic performance and intensity of high school curriculum) increased a student's probability of earning a degree by 31 percent across SES groups. Once in college, continuous enrollment, academic performance, and a curricular emphasis on math and science were the strongest predictors of degree completion. Notably, attending a four-year institution increased the probability of degree completion for all groups, but for low-SES students the increase was 69 percent, a much greater effect than for other SES groups. While many of these findings are consistent with previous research, this study highlights that the effect of some predictors of student success and degree completion are more influential for socioeconomically disadvantaged students. This analysis also includes the success of students across institutions and inclusive of various enrollment intensities and enrollment patterns.

Jones-White, Radcliffe, Huesman, and Kellogg (2010) studied completion from any institution, not just the institution of origin. They found that 38.5 percent of the 15,496 students who enrolled at the institution of study as first-time full-time students departed, and of those, nearly 25 percent completed a degree from another institution

within 6 years of first enrolling. They found that a student's Pell-eligibility was negatively correlated with degree completion both at the institution and at transfer students' second institution.

More recent studies build on this understanding of completion outcomes of low-income students. Analyzing academic concentrations and stackable credentials at community and technical colleges, Jenkins and Weiss (2011) found that even within concentration areas low-SES students were less likely to earn a credential or transfer than their high-SES peers. Using data from the 1979 and 1997 National Longitudinal Surveys of Youth and the U.S. Census, Bailey and Dynarski (2011) found substantial increases in college completion across all income groups and genders over time, however the gap in college completion between students of low-SES and high-SES backgrounds also expanded during that timeframe. These studies reinforce the notion that students of lower socioeconomic backgrounds continue to face greater challenges to college completion than their peers. Overall, lower SES students identified by Pell-eligibility are less likely to complete a degree or credential in postsecondary.

Using Pell-eligibility as a measure to identify low-income students is common in higher education in the U.S.; however, the formula for awarding Pell Grants makes this an inexact measure that undercounts low-income students enrolled in institutions of higher education while counting some middle-income students as low-income (Delisle, 2017). Using nationally representative NPSAS data, Delisle (2017) found that only 68.7 percent of low-income students, identified by total income on the students' or parents' tax returns, received a Pell Grant. Of those low-income students who did not receive a Pell

grant, about half did not file a FAFSA and thus were not able to receive a Pell Grant, decreasing the percentage of Pell-eligible students actually utilizing the program. The others were more likely to be independent students, attend part-time, or attend lower-cost institutions, all of which factor into the awarding formula so they did not qualify for a Pell Grant. As such, using Pell-eligibility as a measure for low-income especially for longitudinal studies can be unreliable given how take-up rates and eligibility rules have changed over time. Studies using Pell-eligibility as a proxy for low-income students should analyze the timeframe being studied and whether the Pell awarding formula changed significantly during the timeframe.

Educational Legacy – First-Generation

Another common variable in higher education research is parental education level, and more specifically whether or not students are the first generation in their family to attend or complete college. First-generation can be used to describe students whose parents did not complete a college degree or parents who did not attend college. Research has shown that students whose parents did not attend college are less likely to enroll in college (Choy, 2001; Ward, Siegel, & Davenport, 2012) and when they do enroll, they are less likely to complete their credential or degree as compared to their continuing-generation college student counterparts (Choy, 2001; Engle & Tinto, 2008; Gibbons & Woodside, 2014). Using the Beginning Postsecondary Students Longitudinal Study (BPS:04/09), Cataldi, Bennet, and Chen (2018) found that more first-generation students left postsecondary education three years after first enrolling without earning a postsecondary credential (33 percent) as compared to their peers whose parents earned a

bachelor's degree (14 percent). Additionally, using precollege and institutional variables from the NELS:88 dataset and event history modeling technique, Ishitani (2006) demonstrated that being a first-generation college student reduced a student's odds of graduating in 4 and 5 years by 51% and 32% as compared to their peers.

A common challenge associated with researching first-generation college students are the multiple ways the variable can be defined. The federal definition for first-generation college student is that neither of the student's parent has earned a bachelor's degree (Higher Education Act Amendments of 1998, 2020). Other researchers or states have varying definitions including that neither parent has attended any postsecondary education (Auclair et al., 2008; Spiegler & Bednarek, 2013). These differences in definitions can make researching first-generation college students more difficult. For example, Redford and Hoyer (2017) studied two groups that are often included within the first-generation college student definition. They defined continuing-generation as students whose parents had participated in higher education but not completed a credential, and first-generation college students were defined as those whose parents had not participated in higher education. When comparing these two groups using Education Longitudinal Study of 2002 (ELS:2002) data, first-generation students by their definition were less likely to attend selective 4-year institutions and more likely to attend 2-year institutions than their continuing-generation peers, demonstrating variation of outcomes within the group generally analyzed together under the federal definition as first-generation students (Redford & Hoyer, 2017).

Another challenge of using first-generation status as a variable in research is that it can place the responsibility for differing outcomes on the student rather than the complexity of the systems making them difficult to navigate. By framing the variable as a student characteristic rather than a structural issue in higher education, this can obfuscate possible structural improvements such as increasing transparency of processes for navigating higher education or creating additional support programming targeted toward the needs of first-generation college students (Spiegler & Bednarek, 2013).

Educational Legacy – Gender

Because demographic variables such as gender and race/ethnicity were historically used to exclude populations from access to higher education, these variables are included under the broader construct called educational legacy. These variables are commonly considered to be important historical, societal factors in U.S. higher education, so they are included in social factors for these purposes. Most quantitative studies of persistence and completion use sex or gender and race/ethnicity as variables of interest or as control variables. Some research on completion focuses explicitly on how gender and race/ethnicity impact student outcomes. Research on variations between student outcomes by gender and race/ethnicity are often framed to study equity gaps or opportunity gaps for students from traditionally underrepresented backgrounds. While that is still the case for race/ethnicity in terms of higher education participation rates and completion rates, female students now participate in higher education at comparable or higher rates than male students nationally, with female students making up 56.7 percent of enrolled undergraduate students nationally in 2017 (U.S. Department of Education,

National Center for Education Statistics, 2018). Female students are also slightly overrepresented in degree completion with female students earning 60.8 of associate degrees and 57.3 of bachelor's degrees nationally in the 2016-17 academic year (U.S. Department of Education, National Center for Education Statistics, 2018).

Outcome gaps by gender still exist in student enrollment by major or program areas which show significant variation by gender. Female students are underrepresented in some academic program areas such as information technology and science while being overrepresented in others such as education and nursing. In 2016-17, only 32 percent of STEM certificates and degrees nationally were awarded to female students (U.S. Department of Education, National Center for Education Statistics, 2018). Dickson (2010) found that differences in major choice by gender, race, and ethnicity persist even after controlling for SAT score and high school class rank. Dickson (2010) also found that gender differences in major choice were larger than racial/ethnic disparities. When evaluating student outcomes by major or program area, there still remain opportunity gaps by gender.

When considering student completion specifically, Bailey and Dynarski (2011) found variation in completion outcomes across gender as well as socioeconomic status. Taniguchi and Kaufman (2005) considered the impact of students having children on college completion and how those outcomes varied by gender. As discussed previously, Markle (2015) found that female students were more likely to withdraw from college or consider withdrawing due to conflict between their student and family responsibilities, which was not a predictor of attrition for male students. On average, female adult

students' college persistence and completion was impacted more greatly by the caregiving responsibilities they bear in their family. Particularly when examining returning adult students, gender is an important role to include as adult women's decisions to enroll and persist in postsecondary education are influenced by family responsibilities and perceptions of support from both family of origin and current family (Plageman & Sabina, 2010).

Educational Legacy – Race/Ethnicity

Racial and ethnic identities are also important factors to study and control for in research on higher educational outcomes. Postsecondary enrollment in the U.S. varies greatly by race/ethnicity. Among recent high school completers, 82.7 of Asian, 69.1 of White, 61.0 of Hispanic, and 59.4 of Black students enrolled in postsecondary education in 2017 (U.S. Department of Education, National Center for Education Statistics, 2018). Enrollment of students of color varies across institution types, with students of color underrepresented at private non-profit institutions (36 percent) and overrepresented at public 2-year colleges (50.9 percent) and private for-profit institutions (57.2 percent) (U.S. Department of Education, National Center for Education Statistics, 2018). According to the American Communities Survey, people of color made up approximately 39 percent of the U.S. population in a similar time frame (U.S. Census Bureau, 2018) highlighting the over- and under-representation at various institution types.

Beyond variation in enrollment rates, college degree completion in the U.S. also varies by race/ethnicity. Attewell, Heil & Reisel (2011) found that variations in graduation rates were significantly associated with racial/ethnic groups, particularly at

community colleges, even after controlling for a range of variables. Including students in National Student Clearinghouse data who started in any type of college or university in Fall 2010, 54.8 percent completed a degree or certificate within six years at any institution, however Asian and White students had higher completion rates – 63.2 percent and 62.0 percent respectively – than Hispanic and Black students at 45.8 percent and 38.0 percent respectively (Shapiro et al., 2017c). These gaps in completion rates between racial/ethnic groups were smaller for adult learners though. Among adult learners in this study who started college at 25 or older, the gap was 12.3 percentage points between Black and White students and 9.1 percentage points between Hispanic and White students. While there are disparities in college completion outcomes by race/ethnicity, institutions within the community college sector have widely varying gaps in completion outcomes by race/ethnicity, which indicates that some institutions have identified ways to more effectively support students of all backgrounds in achieving their educational goals (Moore & Shulock, 2010).

In a study of a specific racial/ethnic group, Swail, Cabrera, Lee, and Williams (2005) used logistic regression on a subset of over 17,000 Latino/a students from the NELS:88 data and found that family support of their educational goals and maintaining continuous enrollment were significantly correlated with Latino/a student degree completion. While racial/ethnic variables are important to study individually, many of the factors included as variables are shown to interact with one another in various studies or be more important for some groups over others. For example, in Keels (2013) study, race/ethnicity, gender, and socioeconomic status interacted to produce outcomes that

cannot be predicted by combining the individual effects. Given the educational equity gaps and significant differences in completion outcomes by race/ethnicity, inclusion of race/ethnicity in education research is important as a stand-alone variable and to understand the interaction of various demographic and social variables.

Maturity – Age

Similar to first-generation college students, the definitions of traditionally- and nontraditionally-aged college students can vary within the research in this area. However, students age 18 to 24 are commonly considered traditionally-aged and 25 and older as nontraditionally-aged students. While historically that was the case, nontraditionally-aged learners make up a substantive portion of postsecondary students nationally. National Center for Education Statistics data indicate that 37.6 percent of the Fall 2007 enrollment in postsecondary education were twenty-five years of age or older, going as high as 39.3 percent in Fall 2011 and decreasing to 34.3 percent in Fall 2017 (U.S. Department of Education, National Center for Education Statistics, 2018). While the percentage of undergraduates who were nontraditionally-aged students has decreased as the United States recovered from the economic recession, according to the most recent national data, over one-third of students in higher education are nontraditionally-aged.

While this population of college students is large, they are often overlooked by the institutions who serve them. Additionally, their completion outcomes are not comparable to their peers. Nontraditionally-aged college students are less likely to complete a college credential than their traditionally-aged peers. When considering age in likelihood of college completion within six years of entering, Shapiro et al. (2017b) used

National Student Clearinghouse data to find that traditionally-aged students completed at higher rates than their adult learner peers (65.6 percent and 44.8 percent, respectively). Similarly, Taniguchi and Kaufman (2005) used the National Longitudinal Survey of Youth data set to study nontraditional students and found that age at entry had a significant relationship to college completion. This study also included a measure of cognitive ability and found a significant correlation between cognitive ability and age at college entry, noting that older students tended to score lower on average on standardized tests than traditionally-aged college students. Lower cognitive ability or test-taking skill could be a barrier to college completion for nontraditionally-aged learners.

Nontraditionally-aged students are also more likely to have a conflict of identities as adults and students. Markle (2015) found that nontraditionally-aged students wanted other students to see them as peers and not treat them differently because of their age, but wanted faculty to treat them like adults and not be patronized or dismissed by faculty. Nontraditionally-aged learners are also more likely to be employed, married, or have caregiving responsibilities. As such, they are often looking for more flexible times and locations for courses and student support services that enable them to manage their multiple responsibilities in and out of the classroom (Ross-Gordon, 2011).

Work commitment is an impactful factor that is relevant to many nontraditionally-aged students in higher education. Titus (2006) found that hours spent working negatively affects college completion even after controlling for other student and institutional characteristics. Miller's (2014) study of nontraditionally-aged students indicates that adult learners' completion rates are also affected by degree type,

completing certificates at higher rates than associate or bachelor's degrees. Given the complexity of nontraditionally-aged students' lives and competing priorities, it follows that academic programs that do not require as long of a sustained commitment would have higher completion rates for nontraditionally-aged students. Some higher education institutions have responded better than others to adapt to the needs of the adult learner population, offering credit for prior learning, distance learning, accelerated course formats, or competency-based education. These options allow students to earn credit for knowledge gained outside of the academic environment, learn in a self-paced fashion, or more quickly make progress toward completion of their credential or degree.

Family Influence – Marital Status

Family influence can have differing impacts for nontraditional students than those of traditional college students. Family influence is often considered in the first-generation college student status, referencing the non-academic information that is shared and other benefits of having parents who also attended or completed college. For example, McCarron and Inkelas (2006) found that family support influenced college attendance, aspirations, and success, particularly for first-generation college students. With non-first-time college students, other family influence that is important to consider includes additional family obligations such as marital status, student-parents, and students with other caregiving responsibilities.

Hernandez (2015) emphasized the challenge of balancing students' needs for independence and family connection with regard to choosing a college and relative distance from home. Participants noted that college costs and the burden of paying for

college were difficult to navigate with family members. Family also plays a role in educational aspirations, with students finding themselves needing to balance their goals and their families' aspirations with the financial realities of various college choices. Swail, Cabrera, Lee, and Williams (2005) highlight the importance of community and family support and early planning and preparation for college in achieving educational success and degree completion for Latino/a students. Family influence on student success can vary based on other student characteristics or identifiers. For example, adult women's decisions to attend college and persist toward degree attainment are influenced by family members from both family of origin and current family for married students, with emotional and behavioral support from the students' current family positively correlated to overall support to attend and persist (Plageman & Sabina, 2010).

In their study of nontraditional college students, Taniguchi and Kaufman (2005) found that marital status and having children had a significant relationship to college completion for nontraditional students. There was little difference in degree completion outcomes between married and never-married students, however, married students were more likely to complete than their divorced peers. Overall though, marriage offers limited support for achieving educational goals for adult learners.

When measuring the extent to which adult students felt conflict between their roles, including family-school conflict, Markle (2015) found that experiencing family-school conflict led female students to consider withdrawing from their education, but it was not a significant predictor of withdrawal for male students. Female students experienced conflict between their family responsibilities and academic goals to a greater

degree than male students. However, many female students also experienced a high level of will to persist and drive to complete their educational goals, attributed to the importance of making this investment in themselves, commitment to their family, as well as honoring the sacrifices made by others in their family. These studies highlight the potentially complex role that family and marital status can play in an adult learners' educational journey, providing support and motivation but also potentially creating conflict and barriers to completion.

Family Influence – Student-Parent

Student-parents face additional barriers to success including balancing work, home, childcare, and academic responsibilities. Peterson (2016) highlighted the additional challenges student-parents face in prioritizing responsibilities, managing time effectively, securing needed support services, addressing stress, developing study strategies while parenting, and maintaining a positive mindset.

Taniguchi and Kaufman (2005) considered the number and age groups of children in their study. They found that having infants and toddlers (0–2 years old) or preschoolers (3–5 years old) had a negative effect on completion for both male and female students, whereas older children (greater than or equal to 6 years old) did not have as strong an effect. More specifically, one additional infant or toddler reduced the chance of completing a degree by about 50 percent for both male and female students.

While the rate of college attendance has increased among unmarried parents, their college completion rates are low due to social interactions, challenges with time pressure, economic resources, and health (Goldrick-Rab & Sorensen, 2010). Examining unmarried

parents enrolling in postsecondary education, the authors found that nearly fifty percent enroll at a community or technical college. They were more likely to be enrolled in a short-term vocational program than a degree program, and they were more likely than their peers to depart college early (46 percent compared with 35 percent). Unmarried parents were more likely to complete a postsecondary certificate (30 percent vs. 12 percent) and much less likely to complete a bachelor's degree than their peers (5 percent vs. 29 percent) (Goldrick-Rab & Sorensen, 2010). Parenting and pregnant students tend to experience more pressures that undermine their success than their peers, including challenges with course sequencing or scheduling, childcare support, financial aid, and structural issues such as affordable housing and accessible parking (Brown & Nichols, 2013). Parenting students also have higher unmet financial need, greater student loan borrowing, and work more hours than non-parenting students in addition to their caregiving responsibilities (Nelson, Froehner, & Gault, 2013).

Another challenge identified in the research on completion of student-parents is that the data collection practices of the U.S. Department of Education undercount parenting students. When parents are separated, the parent definition only includes one of the two parents, which is the parent providing the majority of financial support for the child or children. In other words, parenting students who are not the primarily financially responsible parent, though they may contribute financially and have extensive caregiving responsibilities, are not identified in national data sets as parenting students. This can add to the challenge of appropriately studying the impact of parenting on college completion.

Social Lifestyle – Enrollment Intensity

Overall students enrolled full-time are more likely to complete their degree or credential than students who enroll part-time. The reasons for this are many. In part, this connects to the literature on momentum in higher education, in that students who move more quickly through their course of study, successfully complete the credits they register for, and sustain academic momentum are less likely to leave higher education without a degree (Adelman, 2006; Attewell, Heil, & Reisel, 2012; Clovis & Chang, 2019; Complete College America, 2011). In addition to the idea of momentum, for part-time students, there are added challenges that contribute to their decision to enroll part-time, such as work obligations or caregiving responsibilities, which can also make it more challenging for students to complete their credential or degree. Most literature on enrollment intensity focuses only on full-time or part-time enrollment, often defined by their course load in their first academic term of enrollment. As an example, Miller's (2014) analysis of nontraditional students found that those who enroll full-time graduate at higher rates than part-time students. Preliminary data from the first release of IPEDS Outcome Measures data shows at public 2-year institutions non-first-time full-time students were slightly more likely to complete their degree at that institution within 8 years than first-time full-time students, at 35.6 and 32.8 percent respectively. Similarly, non-first-time part-time students were slightly more likely to complete than first-time part-time students, at 20.3 and 17.0 percent respectively. (U.S. Department of Education, National Center for Education Statistics, 2017).

However, some literature also considers the students who alternate between full- and part-time enrollment as a separate category – mixed enrollment pattern or mixed-enrolled – to understand their persistence or completion outcomes in addition to those exclusively full or part-time (American Council on Education et al., 2015; McCormick, Geis, & Vergun, 1995; Shapiro et al., 2017a). Crosta (2013) attempted to further understand the breadth of enrollment patterns in postsecondary education by aggregating thousands of enrollment patterns into six distinct types using a cluster analysis correlated with the probabilities that students complete a credential and transfer to a bachelor's degree-granting institution. A pathway analysis utilizing data from the Beginning Postsecondary Students Longitudinal Study (BPS:04/09) and the Postsecondary Education Transcript Study (PETS:09) examined the relationship between co-enrollment at multiple institutions and baccalaureate completion. In this analysis, Wang and Wickersham (2014) found that attending a 4- and 2-year institution simultaneously had a positive impact on completion while co-enrolling at institutions of the same level was not significantly associated with degree completion. These studies add to the understanding of swirling students and nontraditional enrollment patterns.

Adelman's (2006) national longitudinal study followed over a million students from high school through their mid-20s using logistic regression to analyze the National Educational Longitudinal Study of 1988 (NELS:88) data. Completion of summer term courses and continuous enrollment without stop-outs were found to be strong predictors of degree completion. This study also highlights the difference in persistence and degree completion outcomes between departing students who transfer to another institution and

those who “swirl” nomadically from institution to institution, the latter of which is significantly negatively correlated with degree completion. Adelman (2006) offers insight into differences within the group of non-first-time students and transfer behaviors that lead to success and lack of success. Specifically, attendance patterns such as continuous enrollment, credits earned in summer term, and traditional community-college-to-four-year-college transfers were positively associated with completion, while multi-institutional enrollment often referred to as swirling was shown to be negatively correlated with completion.

In 2015, National Student Clearinghouse data was used to create state and national benchmarks of persistence and completion for non-first-time students comparing outcomes of exclusively full-time, exclusively part-time, and mixed enrollment patterns and found that nationally only 33.7 percent of non-first-time students completed a certificate or degree, as compared to 54.1 percent of first-time students (American Council on Education et al., 2015). At 2-year public institutions in this study, the completion rate of non-first-time students was only 26.9 percent with another 12.1 percent still enrolled, leaving 61 percent of non-first-time students who returned to 2-year public institutions without a credential and no longer enrolled after 6 to 8 years. Whereas first-time students were more likely than their non-first-time peers to complete a degree when enrolled either full-time or part-time, non-first-time students were more likely to graduate than their first-time peers when having a mixed enrollment pattern. The authors speculate that the reason those that non-first-time students were most successful in

completing is that they were willing to change their enrollment intensity according to the needs of their life during any given academic term.

In another report from the National Student Clearinghouse, Shapiro et al. (2017a) defined mixed-enrolled as students with both full- and part-time enrollment during regular (non-summer) academic terms during the six years examined. By that definition, mixed-enrolled students made up 47.9 percent of the national cohort of interest starting in Fall 2011. This study included students who stopped out and returned and also included students' enrollment across institutions of higher education. Of those mixed-enrolled students, 39.5 percent completed a credential either at their starting institution or elsewhere, which was considerably higher than their peers who enrolled exclusively part-time. Mixed-enrolled students were also more likely to still be enrolled and persisting (21.3 percent) than either their full- or part-time peers (2.1 and 8.9 percent respectively). When investigating only students who started at a 2-year college, mixed-enrolled students were more likely to complete their award than part-time students and less likely to no longer be enrolled without completing a credential. It is notable that categorizing students as mixed-enrolled is a departure from enrollment definitions by NCES, as IPEDS defines students' enrollment intensity based only on their first semester of enrollment. However, more recent research shows a significant relationship between completion and enrollment intensity over time, and not just the first term of enrollment, particularly for non-first-time students.

Cognitive Factors

The second axis of Swail's Geometric Model of Student Persistence and Achievement is cognitive factors. Cognitive factors in Swail's Model include academic rigor, quality of learning, aptitude, content knowledge, technology ability, study skills, and time management.

Aptitude – Developmental Education Placement

Colleges and universities go to great lengths to attempt to measure and compare the cognitive aptitude of students applying to their institutions. Cumulative high school grade point average (GPA) is a commonly understood measure of aptitude, however there is considerable variation in the GPA scales and weighting used by high schools making students' high school GPAs difficult to compare to one another (Belfield & Crosta, 2012). Standardized tests are used as a measure of aptitude that are comparable by their design, but less robust as they only represent student performance on a single test at a single point in time, rather than reflecting student academic performance over time, like cumulative high school GPA. Standardized college admission tests, such as the SAT and ACT, are common measures of student aptitude used by colleges and universities in the application process (Atkinson & Geiser, 2009). High scores on credit for prior learning exams such as Advanced Placement and International Baccalaureate exams are also used by college admissions officers to identify high-aptitude prospective students.

Colleges also use commercial placement exams, such as Accuplacer by College Board, to evaluate prospective students' cognitive aptitude and knowledge of a subject to determine the appropriate level to begin coursework on that subject. Whereas

standardized college admission tests are widely used at competitive or selective institutions, standardized course placement exams are prevalent at open access institutions, such as community and technical colleges, to determine students' readiness for college-level course work or the need for developmental education (Scott-Clayton, 2012). While these exams can be useful for course placement, placement exams are criticized for being "high-stakes" given the costs of misplacement error and the time and financial burdens that can be added to a students' college experience from the results of a single test (Scott-Clayton, 2012).

In attempting to understand the validity of course placement exams, there is considerably less research on course placement exams than on college admission tests (Scott-Clayton, 2012) so the literature is less conclusive about their utility. Accuplacer offers reading, writing and mathematical tests which are used for respective course placement. Institutions set score ranges or cutoffs for each of the Accuplacer tests that map to their curriculum for various combinations of course placement. Course placement test scores are not good predictors of grades in developmental education classes or in gatekeeper English and Math courses. Course placement exams are also not reliable predictors of college success generally including college GPA or credit accumulation (Belfield & Crosta, 2012).

Past literature has also identified limits in using the Accupalcer test for research purposes. For example, because Accuplacer is a computer-adapted test, students do not receive the same questions and therefore should not be used comparatively as a numeric variable in regression analysis (Yin & Volkwein, 2010). There is additional variation

within standardized test results across student populations. A study by Taniguchi and Kaufman (2005) included a measure of cognitive ability using a standardized test and found a significant correlation between cognitive ability and age at college entry, noting that older students tended to score lower on average on standardized tests than traditionally-aged college students. As such, standardized tests of cognitive ability may not fully represent the academic potential of older students. Rather standardized course placement exams can be used to assess level of understanding of a subject and potential developmental education needs.

Taniguchi and Kaufman (2005) make the case that institutions with open admission policies and those serving nontraditional students should recognize that limited cognitive mastery is a more prevalent challenge for their student population and offer additional academic support to maximize degree completion opportunity. Placement into robust developmental education course offerings and a variety of delivery methods and formats are particularly important. Developmental education offers underprepared students the opportunity to increase their skills and access a postsecondary education. However, developmental coursework can be time consuming and costly for students often extending the time to complete their educational goals. Another common criticism of developmental education is that at most institutions, students must pay tuition for developmental courses, but the credits they earn do not count toward graduation requirements (Bailey, 2009).

Bailey, Jeong, & Cho (2010) studied 57 community colleges and found that 59 percent of students were referred to developmental math and 33 percent were referred for

developmental English. Fewer than half of the students referred to remediation completed the entire sequence to which they are referred. Long developmental sequences can be a barrier to college completion. In a study examining the impacts of different levels of developmental reading and writing on students' academic outcomes, Xu (2016) found placement into lower-level, and therefore longer, developmental sequences have negative impacts on academic outcomes including persistence, progression to college level courses, credit accumulation, degree completion and transfer. Conversely, higher cognitive preparation measured by placement into higher-level coursework were not negatively correlated with success outcomes. Similarly, Boatman and Long (2018) estimate the impact of developmental education programs on students with differing levels of incoming academic ability, showing differences in persistence to the second year and lower accumulation of college-level credits. This research is particularly important by differentiating between students needing only one level of developmental education and those recommended for longer sequences.

While developmental education placement is in one part a cognitive variable of aptitude, it is also to some extent an institutional policy variable as institutions set the scores required for placement into various academic pathways. In alignment with the literature, categories can be used grouping placement into longer sequences of developmental education, shorter sequences and no developmental education required as various measures of cognitive preparation for college-level work. Xu (2016) used a similar approach of combining the standardized course placement score and institutional

policy on placement by using a calculated measure of placement score relative to the institutional cutoff scores for each level of developmental education.

Quality of Learning – First-Term Grade Point Average

Educators and educational institutions are often looking for early behavioral indicators of students' likelihood of successful completion or attrition. Thus, many attempt to identify predictors early in students' postsecondary education that can prompt intervention and student support. Quality of learning from Swail's Geometric Model can be measured early in a students' education through grades. Course grades in the first term of enrollment are an early indicator of a students' likelihood of academic success in college. Grade point average (GPA) is a common measure of students' academic performance calculated from the grade each student earned and the number of credits in the course. GPAs are often calculated over the course of a student's entire enrollment, referred to as cumulative GPA, as well as by academic term. Cumulative and term GPAs are used to monitor whether students are meeting federal satisfactory academic progress requirements as well as institutional academic requirements for some majors of study and for awarding credentials.

First-term GPA is used as an early academic indicator of the students' ability to demonstrate their learning in the classroom. First-term or first-year GPA are common measures of college academic performance (Koker and Hendel, 2003; Kobrin, Patterson, Shaw, Mattern, & Barbuti, 2008; Roszkowski & Ricci, 2009; Townsend, Wilson, & Dougherty, 2006). For a community or technical college, the shorter-term measure, first-

term GPA, is more appropriate given the shorter time frame of certificates, diplomas and associate degree programs and therefore shorter timeframe for intervention and support.

Cumulative GPA is another common academic performance measure, but that also includes credits from prior enrollment periods. Particularly for non-first-time students, cumulative postsecondary GPA may not be reflective of students' current ability to apply themselves and learn the academic content required to be successful. Prior college enrollment may have been when they were less mature, less motivated, or had additional complicating factors in their life that impeded their academic goals and learning. Using cumulative GPA would factor in the grades from college courses prior to their current enrollment and may not be representative of their current quality of learning and ability to persist toward their current educational goal. Zhai and Newcomb (2000) found that GPA after transferring is a stronger predictor of academic performance and retention than pre-transfer GPA. Similarly, Luo, Williams, and Vieweg (2007) found that first-term academic performance, including GPA, was a significant predictor of retention and success for transfer students.

High school GPA is also used in some research on persistence and completion, however this is more common with research on students in 4-year colleges (Ackerman, Kanfer, & Calderwood, 2013; Belfield & Crosta, 2012; Hall, Smith, & Chia, 2008; Zwick & Sklar, 2005). Additionally, high school GPA has been found to be less predictive of completion than early college GPA (Radunzel & Noble, 2012). Students in community colleges nationally are more likely than their peers at 4-year institutions to have a break in their academic journey – whether that is taking time between high school and college

or having enrolled in postsecondary education previously and returning after a period of stop-out. Students who delay entry into postsecondary are over twice as likely to enroll in public 2-year institutions as public 4-year or private non-profit 4-year institutions (U.S. Department of Education, National Center for Education Statistics, 2015c). Because of that delay between academic experiences, past academic performance measured by high school GPA or past college GPA may not be an accurate predictor of academic performance in later enrollment. Rather, many colleges use academic performance in their first term of enrollment at their current institution as a predictor of their future academic success. Of the various GPA measures that could be used, first-term GPA is more representative of the students' current motivation, commitment and quality of learning which are important to student success and college completion (Roszkowski & Ricci, 2009).

Summary

As identified earlier, student persistence to degree completion is a critical issue within the study of higher education. Organized within Swail's Geometric Model of Student Persistence and Achievement, each of these variables and associated areas of scholarship contribute to the understanding of student persistence to degree completion. Swail's Geometric Model is particularly useful when studying the completion outcomes of non-first-time students as it takes into account the complexities of students' lives outside of the institution and how those factors may positively or negatively influence student success.

While there is little data nationally on non-first-time students and their degree completion outcomes, 38 percent of students who started in Fall 2011 transferred at least once in the following six years (Shapiro et al., 2018). Despite the size of the non-first-time student population, there remains little evidence about the pathways of nontraditional students and the effectiveness of programs or institutions at supporting their degree completion (Bragg, 2013). Bragg (2013) makes the case for better data on these students and more quantitative longitudinal research on the outcomes for this student population. Given that this population has been minimally studied and is a large population within higher education, this study aims to fill a gap in the literature on student degree completion among this specific population. Better understanding the outcomes of non-first-time students will help all institutions to better support this large portion of students in higher education. By utilizing factors known from prior research to be related to the persistence and completion for undergraduate students, this study will examine the degree to which those factors are predictive for non-first-time students. Chapter three will detail the conceptual framework and methodology to address the study's research question.

Chapter III: Methods

The purpose of this study is to better understand the variation in completion rates of non-first-time students by identifying the factors that most influence their completion. This chapter further describes the research question and expected relationships related to completion of non-first-time students based on the literature review presented in chapter two. This study examines factors associated with degree completion among non-first-time students in higher education. The research question driving this study is: What factors are most predictive of completion for non-first-time undergraduate students? Completion is defined as receipt of a postsecondary certificate, diploma, or degree.

Institutional Context and Unit of Analysis

This study addresses the research question in a two-year college context. Specifically, this study draws on institutional data from an urban, majority-minority community and technical college in the Midwest, referred to as Midwest Technical and Community College (MTCC). The rationale for the selection of this single site is two-fold. First, it is the first attempt at utilizing the Adapted Geometric Model to understand the completion outcomes of non-first-time students. As such, it is worthwhile to investigate its utility and efficacy at a single institution with an appropriately large sample of non-first-time students. If proven to be useful in studying the completion outcomes of non-first-time students, the Adapted Geometric Model can then be applied to data across multiple institutions in future analyses. The institution selected for this study has a large population of non-first-time students allowing for variation in other characteristics of interest and a meaningful application of the model. Initial testing of this

model in a single site will be informative for refining the model for future larger scale studies. Second, a broad range of institutional data at the level of detail associated with Swail's model is currently difficult to capture due to their lack of availability. Thus, the study is confined to a single site for practical reasons related to data access secured by the researcher.

In this study, "student type" only includes non-first-time students. In alignment with the IPEDS definition, a first-time student has no prior postsecondary experience attending any institution for the first time at the undergraduate level, but includes students who enrolled for the first time the summer term immediately preceding their fall enrollment and who earned college credits before graduating from high school (U.S. Department of Education, National Center for Education Statistics, n.d. a). While there is no formal definition of non-first-time students in IPEDS, for this analysis it is defined as any student not included in the first-time student definition. So, in this study, non-first-time students include students who transferred from another institution; students previously enrolled at another institution and took time away from postsecondary before enrolling at the institution of study; students previously enrolled at the institution of study and not enrolled for at least one non-summer term prior to returning; and students otherwise coded as a new transfer student at entry.

Cohorts are identified at date of enrollment in MTCC with four starting fiscal years and followed for 6 years each. The typical IPEDS time-to-degree measures for an associate degree are 100, 150, or 200 percent of normal time to completion, or 2, 3, and 4 years respectively. However, the IPEDS timeframes have been criticized as inadequately

representing the goals and successful outcomes of community college students and part-time students (Ma & Baum, 2016; Bailey, Leinbach, & Jenkins, 2005). Thus, instead of aligning to one of the IPEDS timeframes, this study will observe MTCC students for a longer time frame, 6 years, in alignment with studies focused on understanding the success outcomes of nontraditional students, part-time students, and community college students (Jenkins & Fink, 2016; Shapiro et al., 2015). This strategy is also in alignment with Community College Research Center completion reporting (see Community College Research Center, n.d.). Data for each of the 6 years will include enrollment data for fall and spring academic terms and completion data for fall, spring or summer term. Non-first-time students starting at MTCC in summer term were much more likely to be visiting students and only enroll for that single term, rather than students intending to complete a credential at MTCC. Cohorts were identified through enrollment in fall and spring term.

Data Collection

Data Sources

All of the data included in this analysis are collected as part of the administrative processes of MTCC. The data collected only include non-first-time students enrolling at the institution in fiscal years 2011 through 2014. Students starting in each of those fiscal years are examined for 6 years after entry for their ongoing enrollment and completion outcomes. Each year around 1,500 non-first-time students start at the institution, so the data initially included for this analysis over 4 years of entering students included around 6,000 individual student records.

The variables used in this analysis are included in administrative records on all students enrolled at the institution and collected at various time points in the students' enrollment. The variables first-generation student, gender, race/ethnicity and age at entry are collected from students through the application for admission. All students are required to complete the application for admission prior to enrollment so these data are maintained in the administrative records on all students at the institution.

The variables Pell-eligible, marital status, and student-parent are collected through the Free Application for Federal Student Aid (FAFSA) and aid awarding process. The FAFSA is not required for admission or enrollment, but is required annually to access federal, state and some institutional financial aid programs including grants, scholarships and loans, so the majority of students enrolling at MTCC complete the FAFSA.

Developmental education placement is recorded in the students' administrative and academic records during the admission and course placement process before a student enrolls for their first term. Students' first-term grade point average is determined by term course grades and is maintained in the students' academic records. Enrollment intensity is recorded in each term of enrollment based off of the number of credits a student registers for. Enrollment intensity is recorded in the academic records for each student.

Data on award or degree conferred is recorded in students' academic records. When students apply for graduation, a credential audit is conducted to ensure the student meets the requirements for the credential. Students meeting the requirements are

conferred an award, and these award or degree data are maintained within the students' academic records as well as in the administrative records of the institution.

Sampling

While the data initially included 6,068 non-first-time student records, incomplete records that contained null or unknown values were excluded, reducing the student records to n=4,693. The majority of the records excluded (n=1,246) were from students that did not submit the FAFSA and therefore Pell-eligible, marital status and student-parent variables were incomplete. The variables age, first-generation and race/ethnicity also contained null or unknown values so additional student records (n=129) were excluded in the final dataset (n=4,693).

By including all new non-first-time students with complete data rather than sampling, there are enough records to make sound conclusions based on the population of interest. Harlow (2005) recommends n=50 participants per independent variable for appropriate power, so with ten independent variables that threshold is more than sufficiently met. However, because power calculations in logistic regression take into account not only the number of variables but also the relative proportions of individuals that fall into each group, "the complexities of logistic regression prohibit the effective formulation of simple, universal rules of thumb regarding sample size" (Osborne, 2015, p. 322). Nonetheless small samples are less likely to be replicable, so a large data set was utilized for this analysis.

Crosstabs were analyzed between completion and all Boolean or categorical variables that are used as predictors for completion to make sure each variable is

representing a sufficient number of students. All categories had sufficient count to represent adequate proportion of students. The smallest groups within the categorical variables were students who placed into one developmental education course (n=646) representing 13.8 percent of total records and married students (n=892) representing 19.0 percent of total records. No additional adjustments were needed based off the relative proportions within the data.

By including all new non-first-time students in each of the fiscal years of interest, this approach overcomes biases created by various sampling methodologies. However by only including data from a single institution, the results cannot be generalized to students at other postsecondary institutions, especially those significantly different from the institution of study.

Human Subjects Review and Confidentiality Measures

Because the data include student record level information, the researcher submitted a human research determination through the University of Minnesota Institutional Review Board (IRB) to ensure the protection of the students' whose data were utilized in this analysis. The IRB determined that the deidentified data do not constitute human research, so further IRB submission and review was not warranted (see Appendix). Upon this notice and approval of the research prospectus, the MTCC administrators vetted access to the data for research purposes. Since the outcome of the research will be used by MTCC to inform their supports for non-first-time students, access to the data falls under the FERPA school official exemption for data sharing. Research was conducted according to institutional policy and FERPA requirements. The

data file was maintained by MTCC on institutional technology throughout the analysis process and never transferred to the researcher's personal devices, so no data transfer or associated data destruction were required.

Adapted Geometric Model of Student Persistence and Achievement

As described in chapter two, this study draws on Swail's Geometric Model of Student Persistence and Achievement as the theoretical framework for selecting appropriate variables of interest because of the focus on the student as the central actor (Swail, 2003). Swail's Geometric Model of Student Persistence and Achievement places the student at the center of the model and takes into account the influence of social, cognitive, and institutional factors in student persistence. Swail presents social, cognitive, and institutional factors as the three sides of the student experience in postsecondary. Various forces within these categories impact the overall student experience and also interacts within or across axes which contributes to students' likelihood of persisting to completion (Swail, 2003).

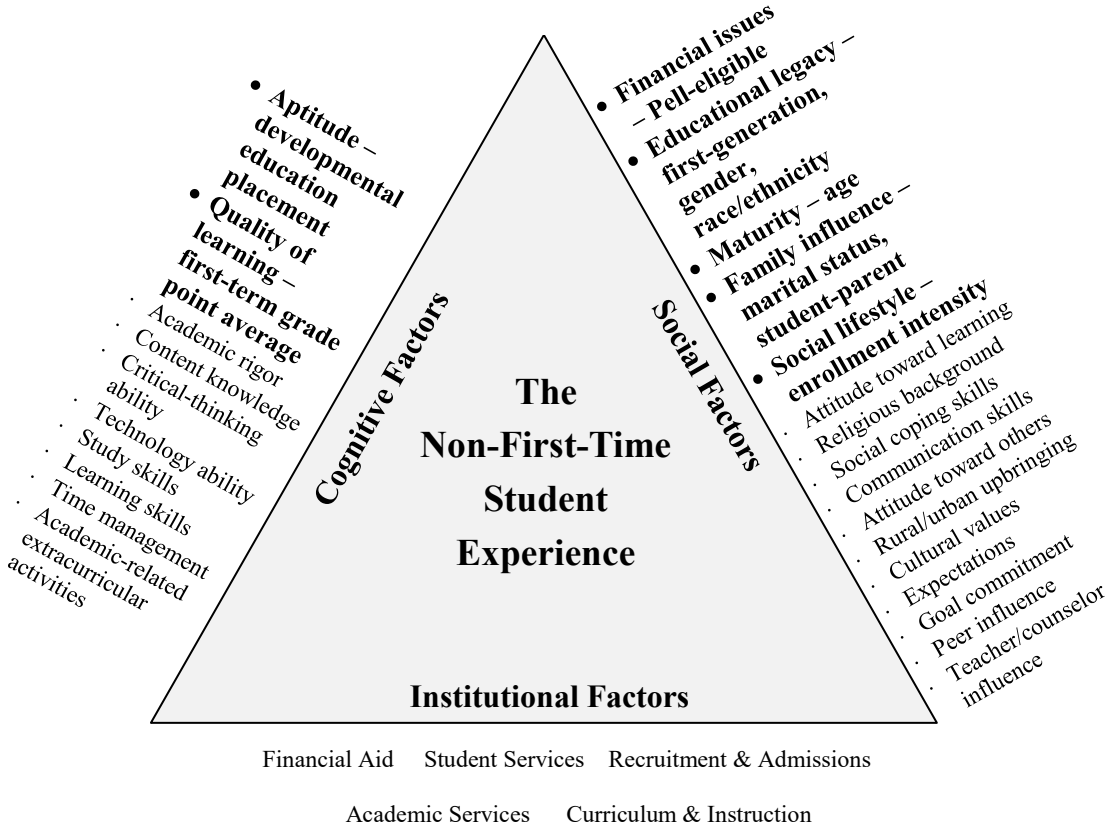
Swail's Geometric Model also provides for variation of each of these dimensions over time. Another iteration of Swail's Geometric Model, the Chronological Metric, explains this construct as a series of concentric triangles with the present represented by the innermost triangle and the past expanding out beyond. The Chronological Metric version of Swail's Model reflects that the distance in time from various experiences limits the impact of those experiences on the students' performance in college. An example would be that high school academic performance may be a stronger predictor of postsecondary success for younger postsecondary students, whereas high school

academic performance may be less relevant for older students such as non-first-time students and less predictive of their success in postsecondary. As such, the variables selected to represent each factor in Swail's Geometric Model should reflect recency.

While Swail's model is helpful in understanding the cognitive, social, and institutional factors that impact traditional students and how the impact of variables may change over time, some of the factors within those categories must be adapted to reflect the differing needs and lives of non-first-time students. To that end, Swail's model has been adapted for this study of non-first-time students in Figure 1 below, the Adapted Geometric Model of Student Persistence and Achievement, to include variables that reflect the challenges faced by older students. Additionally, because this analysis will be conducted on a single institution and institutional factors will remain constant, only cognitive and social factors from the model will be utilized. The Adapted Geometric Model also details the specific variables that will be used to represent each factor in this analysis. For example, placement into developmental education will be the variable used as a measure of the cognitive factor aptitude. All factors from the original Swail model are presented, but only those bolded and presented with the variables representing that factor are included in this analysis. In this manner, the Adapted Geometric Model was used to identify appropriate variables for analysis in predicting student completion for the cohort of interest, non-first-time students.

Figure 1

Adapted Geometric Model of Student Persistence and Achievement



Social factors in Swail's Geometric Model are the external factors influencing students' stability and therefore persistence and success. The social factors included in the Adapted Geometric Model are financial issues – Pell-eligible; educational legacy – first-generation status, gender and race/ethnicity; maturity – age; family influence – marital status and student-parent; and social lifestyle – enrollment intensity. Cognitive factors in Swail's Geometric Model relate to the intelligence, knowledge, and academic ability students have upon entering the college environment. Cognitive factors are important in persistence and completion analyses in that they represent students' ability

to be successful in the academic curriculum. The cognitive factors used in the Adapted Geometric Model are aptitude measured by developmental education placement and quality of learning measured by first-term grade point average. Because this study focuses on a single institution, the institutional factors remain consistent across the study. Though institutional factors are not variables of interest for the analysis, institutional factors are important for analyzing student outcomes across institutions or as changes are made within an institution's student services, academic supports, and student-facing processes.

Based on the literature reviewed in chapter two and the Adapted Geometric Model of Student Persistence and Achievement, the variables for this analysis are as follows.

Dependent Variable

The dependent variable for this study is award or degree completion of non-first-time students. The completion variable will include any certificate, diploma or degree conferred to the student. Students who have not completed any credential will be recorded as no award or degree conferred. This variable may include students still enrolled at MTCC, enrolled at another institution, or are not enrolled.

Independent Variables

The independent variables in this analysis align with the constructs and associated variables presented in chapter two and depicted in Figure 1. Specifically, the independent variables fall in the constructs of financial issues, educational legacy, maturity, family influence, social lifestyle, aptitude, and quality of learning. Based on the results of past

research, the expected relationships among these variables and the dependent variable are presented in the paragraphs below.

Financial Issues

The variable representing financial issues will be Pell-eligible. Though this measure can undercount low-income students due to the awarding formula for independent and part-time students (Delisle, 2017), Pell-eligible is a commonly-used measure for low-income or students facing financial challenges. Federal Pell Grant Eligibility will be a binary variable (Yes/No) with 'No' set as the reference value. Based on previous literature (Bailey & Dynarski, 2011; Jenkins & Weiss, 2011; Jones-White, Radcliffe, Huesman & Kellogg, 2010), I expect to see a negative relationship between the variable Pell-eligible and completion for non-first-time students.

Educational Legacy

The variables representing educational legacy will be first-generation student status, gender and race/ethnicity of non-first-time MTCC students. A common challenge associated with researching first-generation college students are the multiple ways the variable can be defined (see Auclair et al., 2008; Spiegler & Bednarek, 2013). However, for this analysis first-generation status will use the federal definition that neither parent completed postsecondary degree or credential.

To determine if a student is a first-generation college student, the question on the MTCC application for admission reads: "What is the highest level of education for your parent(s)/guardian(s)?" and the response options are: no high school diploma, high school diploma, some college, two-year college degree/diploma, Bachelor's degree or higher, or

unknown. The highest level of parental education from either parent or guardian is determined from these application questions. A binary variable for first-generation student (Yes/No) is then generated based on the federal definition that neither parent has a bachelor's degree, and 'No' is set as the reference value. Based on previous literature using the federal definition of first-generation student status (Cataldi, Bennet & Chen, 2018; Choy, 2001; Engle & Tinto, 2008; Gibbons & Woodside, 2014; Ishitani, 2006), I expect to see a negative relationship between the variable first-generation student status and completion for non-first-time students.

The second educational legacy variable is gender. For the entering terms for this study, the gender options presented for students on the application were male and female, with female set as the reference value. For the variable gender, female students are slightly overrepresented, as compared to the U.S. population, in both undergraduate enrollment and degrees completed (U.S. Department of Education, National Center for Education Statistics, 2018). However, in other studies (Bailey & Dynarski, 2011; Kaufman, 2005; Markle, 2015; Plageman & Sabina, 2010), gender interacts with other variables such as marital status and student-parent status impacting students' likelihood of completion. Based on this previous literature, I expect that gender on its own may not have a statistically significant relationship to completion for non-first-time students, but may be significant in combination with other variables.

The third variable representing educational legacy is race/ethnicity. The variable race/ethnicity is determined by student self-report on the application for admission and the federally required standards used for IPEDS reporting. According to the U.S.

Department of Education 2007 guidance, race/ethnicity is required to be presented to students in a two-question format, the first question being, "Are you Hispanic or Latino?" and the second being, "Race or Ethnic Background (Please select all that apply): American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian/Other Pacific Islander, White" (Final Guidance on Maintaining, Collecting, and Reporting Racial and Ethnic Data, 72 Fed. Reg. 202, 2007). These responses are then used according to the federal guidance to report race/ethnicity in the following categories: Hispanic of any race, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, White, Two or More races, and Race and Ethnicity unknown. The IPEDS categories of Hispanic, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, and Two or More races will be combined into the category students of color, and white students will be a category set as the reference value. Based on previous literature (Attewell, Heil & Reisel, 2011; Moore & Shulock, 2010; Shapiro et al., 2017c), I expect students of color to be less likely to complete than white students.

Maturity

The variable representing maturity will be age. Given the differing outcomes of nontraditionally-aged students, this analysis will use age at entry (Taniguchi & Kaufman, 2015) calculated from the students' date of birth. Within the MTCC application for admission, students are asked for their date of birth in the following format "Date of Birth (mm/dd/yyyy)." Date of birth is used in conjunction with entering term to determine age.

Age is calculated as of September 1 each year. The age record for each student's first term of enrollment will be used as a measure of age at entry.

Nontraditionally-aged learners make up approximately one-third of postsecondary students nationally, which can be higher during downturns in the labor market (U.S. Department of Education, National Center for Education Statistics, 2018). However, these students continue to see worse completion outcomes than their traditionally-aged peers. Based on previous literature (Miller, 2014; Shapiro et al., 2017b: Taniguchi & Kaufman, 2005), I expect to see a negative relationship between older students and completion of non-first-time students.

Family Influence

The variables representing family influence will include marital status and student-parent status. Marital status and student-parent status are included to represent family influence from Swail's Geometric Model as they are shown to be impactful on the likelihood of completion (Goldrick-Rab & Sorensen, 2010; Peterson, 2016). Marital status is determined from student self-report on the Free Application for Federal Student Aid (FAFSA) question number 16 and is used to create a binary variable for Married (Yes/No) with 'No' set as the reference value. Based on previous literature on student marital status (Goldrick-Rab & Sorensen, 2010; Taniguchi & Kaufman, 2005), I expect that the variable, "married" would be positively correlated with completion.

Student-parent status will be a binary variable aligned to the FAFSA variable of whether or not the student has children for whom they provide more than half of their financial support. FAFSA question number 50 is, "Do you now have—or will you

have—children who will receive more than half of their support from you" during the federal financial aid year? Students reporting "Yes" to this question will be considered student-parents for this analysis in a binary variable (Yes/No) with 'No' set as the reference value. Based on previous literature (Brown & Nichols, 2013; Goldrick-Rab & Sorensen, 2010; Nelson, Froehner, & Gault, 2013; Taniguchi & Kaufman, 2005), I expect to see a negative relationship between student-parent status and completion among non-first-time students.

Social Lifestyle

The variable representing social lifestyle will be enrollment intensity. Enrollment intensity is associated with differing completion outcomes particularly for non-first-time students. Full-time enrollment for this purpose is aligned to the federal full-time definition for undergraduates, which is a student enrolled for 12 or more semester credits (U.S. Department of Education, National Center for Education Statistics, n.d. a). Enrollment intensity is then classified as exclusively full-time (12 or more credits at census date during all terms of enrollment), exclusively part-time (fewer than 12 credits at census date during all terms of enrollment), or mixed-enrolled (any combination of full- and part-time enrollment). Enrollment intensity is an ordered factor with the reference value set to part-time, followed by mixed-enrolled and full-time.

Based on previous literature (Adelman, 2006; American Council on Education et al., 2015; Attewell, Heil, & Reisel, 2012; Clovis & Chang, 2019; Complete College America, 2011; Shapiro et al., 2017a; U.S. Department of Education, National Center for Education Statistics, 2017), I expect the enrollment intensities full-time and mixed-

enrolled would be positively correlated with completion as compared to the reference category part-time.

Aptitude

The variable representing aptitude will be placement in developmental education. Placement into developmental education will be used as a measure for cognitive aptitude at entry, similar to Andrews, Li, and Lovenheim's (2014) use of pre-college academic preparation. The variables for aptitude will be: placed into one developmental course, placed into two or more developmental courses, and placed out of all developmental education by Accuplacer or another measure such as ACT or SAT. Development education is an ordered factor with "None" as the reference value, followed by "One" and "Two or more." By categorizing placement by number of developmental education courses required, this variable will also take into account the length of developmental education sequence as longer developmental sequences have negative impacts on degree completion (Boatman & Long, 2018; Xu, 2016). Based on previous literature (Boatman & Long, 2018; Xu, 2016), I expect that placement into developmental education will be negatively correlated with completion, while placement into two or more developmental courses will have a stronger effect than placement into one developmental course.

Quality of Learning

The variable representing quality of learning will be first-term grade point average. First-term GPA is an early behavioral indicator of a student's likelihood of student success and completion. First-term GPA will be treated as a numeric variable with a 4.0 GPA scale. Based on previous literature (Luo, Williams, & Vieweg, 2007;

Roszkowski & Ricci, 2009; Zhai & Newcomb, 2000), I expect higher first-term GPA to be positively associated with completion among non-first-time students.

Table 1 details the relationship between the categories and factors from the Adapted Geometric Model of Student Persistence and Achievement to the variables, data sources, and measure details included in the analysis. This table also includes detailed descriptions of the variable measures.

Table 1

Category, Factor, Variable, Measure Details and Data Source for Analysis

Category	Factor	Variable	Variable Measure Details	Reference Value	Data Source
Social Factors	Financial Issues	Pell-Eligible	Federal Pell Grant eligibility – Yes/No	No	FAFSA
	Educational Legacy	First-Generation	Federal definition – neither parent completed postsecondary degree/credential	No	College Application
	Educational Legacy	Gender	Male, Female	Female	College Application
	Educational Legacy	Race/Ethnicity	White, Student of Color	White	College Application
	Maturity	Age	Age at first term of enrollment	–	College Application
	Family Influence	Marital Status	Yes/No – Q16 marital status	No	FAFSA
	Family Influence	Student-Parent	Yes/No – Q50 Do you now have—or will you have—children who will receive more than half of their support from you between July 1, 2020, and June 30, 2021?	No	FAFSA
	Social Lifestyle	Enrollment Intensity	Full-time – exclusively 12+ credits, Part-time - exclusively <12 credits, Mixed-enrolled	Part-time	Academic Records
Cognitive Factors	Aptitude	Developmental Education Placement	Placed into one developmental course, Placed into two or more developmental courses, None – Placed out of all developmental education	None	Academic Records
	Quality of Learning	First-Term Grade Point Average	Numeric variable, 4.0 GPA scale	–	Academic Records
Dependent Variable	Completion	Award or Degree Conferred	1 - Diploma, certificate or associate degree conferred; 0 - no award or degree conferred (still enrolled, enrolled other institution, or no enrollment in 6th year)	–	Academic Records

Method of Analysis

Because the dependent variable of interest in this study, award or degree completion, is categorical and nonlinear, this analysis utilized logistic regression rather than a linear regression model. Logistic regression is a model that estimates the probability of a binary outcome response based on the independent or predictive variables (Osborne, 2015). Award or degree completion is treated as a binary variable for this study (diploma, certificate or associate degree conferred being 1, no award or degree conferred being 0). The logistic regression model will be used to understand the impact of each variable of interest on the completion outcomes of non-first-time students. The resulting likelihood of completion will be compared.

Though other studies of degree completion have used logistic event history modeling (Taniguchi & Kaufman, 2005; Ishitani, 2006), those studies were seeking to understand how student departure or persistence decisions changed over time resulting in completion or non-completion. Conversely, the primary focus of this study is completion at any point and not how factors change over time. Compared to Taniguchi and Kaufman (2005) and Ishitani (2006), this study observes students for a longer timeframe, 6 years, to investigate whether a degree or credential is completed at any point during that timeframe, rather than being focused on time to degree. Additionally, students who make changes over time in enrollment intensity, part-time to full-time or vice versa, are treated as a third value (mixed-enrolled) within the enrollment intensity variable, rather than change of enrollment intensity being treated as a longitudinal variable. This study is not focused on the impact of a series of decisions, but on the impact of characteristics in the

Adapted Geometric Model. For these reasons, logistic regression is a better method of analysis than logistic event history modeling. In sum, the data and analytic techniques proposed in this chapter will allow me to answer the research question and better understand the completion outcomes of non-first-time students.

Data Modeling

Analyses were completed using R (v 4.0.3.; R Core Team, 2020). Descriptive and summary statistics were obtained, and collinearity analyses were conducted. Pearson's correlation test was used to test collinearity of the numeric variables (age and first-term GPA). Chi-square test of independence was used to compare the independent categorical variables. Variance inflation factor (VIF) test was also used to test potential correlation of variables in the model, and if high, variables were considered for dropping from the model. Because terms in the model have more than one degree of freedom (developmental education and enrollment intensity), generalized variance-inflation factors (GVIF) were calculated (Fox and Monette, 1992). Various thresholds for VIF can be used as a threshold for assessing problematic correlation including 3.3, 5 and 10, but Kock & Lynn (2012) recommend 3.3 which was used as the threshold for this analysis.

As to data modeling, a logistic regression model was developed including all variables from the theoretical framework. Variables were removed based on size of *p*-values and collinearity if present to identify a reduced final model. McFadden's psuedo-R^2, Bayesian information criterion (BIC) and likelihood ratio test were used to compare reduced models to the original and previous models. Bayesian information criterion

(BIC) was used over AIC given its performance with large sample sizes (Vrieze, 2012). Results of these analyses are presented in the following chapter.

Chapter IV: Results

This chapter presents the analytical findings related to the research question: What factors are most predictive of completion for non-first-time undergraduate students? The results of the full model are presented. Backward elimination and the statistical tests used to inform the modeling steps are reviewed. The final reduced model is presented and results discussed.

Full Model

The full model included all variables from the theoretical framework. The equation for the full logistic regression model, Model 1, for the probability of completion is:

Model 1

$$ln\left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0 + \beta_1(\text{GPA}_i) + \beta_2(\text{Dev}_i) + \beta_3(\text{Enr}_i) + \beta_4(\text{Age}_i) + \beta_5(\text{First Gen}_i) + \beta_6(\text{Pell}_i) + \beta_7(\text{Gender}_i) + \beta_8(\text{SOC}_i) + \beta_9(\text{Married}_i) + \beta_{10}(\text{Parent}_i) + \varepsilon_i$$

where $ln\left(\frac{\pi_i}{1-\pi_i}\right)$ is the logit for the *i*th student. (For categorical variables in the model, reference values were set and described in chapter three.)

The full model had a *p*-value of 0.000 which was less than .001, implying that the set of predictors used in the model had better model–data fit than the intercept-only model. The results in Table 3 indicate the estimates, uncertainty, and significance for each of the coefficients in the model. The variables found to be statistically significant in

predicting completion were first-term GPA, developmental education one course required, enrollment intensity both mixed and full-time, age, and Pell-eligible. First-term GPA, mixed enrollment intensity, and age were positively correlated with completion. Developmental education one course required, full-time enrollment intensity, and Pell-eligible were negatively correlated with completion. Variables not found to be statistically significant in predicting completion were developmental education two or more courses required, first-generation, gender, race/ethnicity, married, and parent.

Correlation Tests

Pearson's correlation test was used to test collinearity of the numeric variables, age and first-term GPA. There were no concerns of collinearity of numeric variables with a correlation coefficient of .042. Variance inflation factor scores are used to test potential correlation of variables in the model. These are presented in Table 3. For variables with more than one degree of freedom, generalized variance inflation factors (GVIF) are calculated. A threshold score of 3.3 (Kock & Lynn, 2012) was used for assessing problematic correlation. All of variables included in this model had VIF or GVIF scores of less than two, so none of the variables were excluded from the models due to correlation.

Table 2

Variance Inflation Factors for All Model Variables

Variables	VIF	GVIF	Degrees of Freedom
First-Term GPA	1.108588		1
DevEd		1.138451	2
EnrInt		1.167605	2
Age	1.172038		1
FirstGen	1.080778		1
Pell	1.272644		1
Gender	1.095273		1
SOC	1.223023		1
Married	1.304580		1
Parent	1.444907		1

Chi-square test of independence was used to compare the independent categorical variables. The results indicated potential correlation between a number of categorical variables. The Chi-square test results indicate there may be interaction between variables in the full model, which were taken into account in the stepwise elimination process.

Additional Models Tested

Additional logistic regression models for the probability of completion were tested using backward elimination. Variables that were not statistically significant were removed, and Bayesian information criterion (BIC) was used to compare each of the models. Results of all models are presented for comparison in Table 3. The following regression equations were tested and compared prior to arriving at the final model, Model 7.

Model 2

$$ln\left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0 + \beta_1(\text{GPA}_i) + \beta_2(\text{Dev}_i) + \beta_3(\text{Enr}_i) + \beta_4(\text{Age}_i) + \beta_5(\text{First Gen}_i) + \beta_6(\text{Pell}_i) + \beta_7(\text{Gender}_i) + \beta_8(\text{Married}_i) + \beta_9(\text{Parent}_i) + \varepsilon_i$$

Model 3

$$ln\left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0 + \beta_1(\text{GPA}_i) + \beta_2(\text{Dev}_i) + \beta_3(\text{Enr}_i) + \beta_4(\text{Age}_i) + \beta_5(\text{First Gen}_i) + \beta_6(\text{Pell}_i) + \beta_7(\text{Married}_i) + \beta_8(\text{Parent}_i) + \varepsilon_i$$

Model 4

$$ln\left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0 + \beta_1(\text{GPA}_i) + \beta_2(\text{Dev}_i) + \beta_3(\text{Enr}_i) + \beta_4(\text{Age}_i) + \beta_5(\text{First Gen}_i) + \beta_6(\text{Pell}_i) + \beta_7(\text{Parent}_i) + \varepsilon_i$$

Model 5

$$ln\left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0 + \beta_1(\text{GPA}_i) + \beta_2(\text{Dev}_i) + \beta_3(\text{Enr}_i) + \beta_4(\text{Age}_i) + \beta_5(\text{First Gen}_i) + \beta_6(\text{Pell}_i) + \varepsilon_i$$

Model 6

$$ln\left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0 + \beta_1(\text{GPA}_i) + \beta_2(\text{Dev}_i) + \beta_3(\text{Enr}_i) + \beta_4(\text{Age}_i) + \beta_5(\text{Pell}_i) + \beta_6(\text{Parent}_i) + \varepsilon_i$$

Model 7

$$ln\left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0 + \beta_1(\text{GPA}_i) + \beta_2(\text{Dev}_i) + \beta_3(\text{Enr}_i) + \beta_4(\text{Age}_i) + \beta_5(\text{Pell}_i) + \varepsilon_i$$

McFadden Pseudo-R^2

Pseudo-R^2 can be used to compare logistic regression models predicting the same outcome using the same data. According to McFadden (1978), values of McFadden pseudo-R^2 between .2 and .4 represent an "excellent fit." In this case, the first model had a McFadden pseudo-R^2 of 0.312. The final model has a McFadden pseudo-R^2 of 0.311. Both of these would be considered to be well-fit models. In this situation, the reduced final model is a simpler model and has a pseudo-R^2 of .001 less than the full model, so the reduced final model is preferable.

Bayesian Information Criterion

Bayesian information criterion (BIC) was also used to compare each of the models. BIC represents the probability of a model being true after the relevant evidence is taken into account in which a lower BIC score is more likely to be the true model. The final model had a BIC of 4,171.908, as compared to the full model's BIC of 4,208.233. The lower BIC of the final model indicates that this model is more likely to be the true model.

Likelihood Ratio Test

The likelihood ratio test was used to assess the effectiveness of the final model to the full model. The result of the likelihood ratio test was not statistically significant. The lack of statistical significance indicates that the model with more variables and complexity was not significantly different or better than the simpler model. When there is no difference, then the reduced model is preferred. In this case, the more complex model did not improve the explanation of variation over the reduced final model to warrant the

increased complexity. The results of the likelihood ratio test supports selection of the reduced model over those previously analyzed. Results from McFadden pseudo-R^2, BIC and likelihood ratio test support the selection of the final model.

Table 3

Coefficients, Standard Errors, and Model-Level Estimates for a Taxonomy of Models Fitted to Predict Completion

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**
Intercept	-4.182***	-4.185***	-4.227***	-4.217***	-4.248***	-4.143***	-4.173***
	(0.219)	(0.213)	(0.209)	(0.208)	(0.207)	(0.203)	(0.202)
First-Term GPA	1.030***	1.031***	1.033***	1.031***	1.032***	1.028***	1.028***
	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)
DevEd 'One'	-0.498***	-0.499***	-0.496***	-0.495***	-0.494***	-0.488***	-0.487***
	(0.071)	(0.070)	(0.070)	(0.070)	(0.070)	(0.070)	(0.070)
DevEd 'Two or more'	-0.063	-0.063	-0.064	-0.064	-0.067	-0.063	-0.065
	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)	(0.098)
EnrInt 'Mixed'	1.044***	1.044***	1.030***	1.030***	1.020***	1.026***	1.016***
	(0.077)	(0.077)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)
EnrInt 'Full'	-1.037***	-1.037***	-1.039***	-1.038***	-1.038***	-1.037***	-1.036***
	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)
Age	0.013**	0.013**	0.013**	0.012**	0.014***	0.013**	0.014***
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Pell 'Yes'	-0.240**	-0.241**	-0.246**	-0.240**	-0.206*	-0.217*	-0.182*
	(0.091)	(0.090)	(0.089)	(0.088)	(0.084)	(0.087)	(0.083)
FirstGen 'Yes'	0.134	0.133	0.137	0.137	0.139		
	(0.084)	(0.083)	(0.083)	(0.083)	(0.083)		

Table 3 Continued

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Parent 'Yes'	0.116	0.116	0.136	0.121		0.123	
	(0.098)	(0.098)	(0.096)	(0.089)		(0.089)	
Married 'Yes'	-0.034	-0.034	-0.046				
	(0.107)	(0.107)	(0.106)				
Gender 'Male'	-0.087	-0.087					
	(0.082)	(0.082)					
SOC 'Yes'	-0.005						
	(0.085)						
BIC	4208.233	4199.783	4192.467	4184.202	4177.575	4178.448	4171.908
McFadden's Pseudo-R^2	0.312	0.31	0.31	0.31	0.31	0.31	0.311

Significance levels: $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$

Final Model

The equation for the final logistic regression model for the probability of completion, Model 7, is: $ln\left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0 + \beta_1(\text{GPA}_i) + \beta_2(\text{Dev}_i) + \beta_3(\text{Enr}_i) + \beta_4(\text{Age}_i) + \beta_5(\text{Pell}_i) + \varepsilon_i$. The results of the final model are presented in Table 3 along with the other models for comparison. With logistic regression, the model represents the probability curve of being in the category completed and each coefficient is predicting the log likelihood of degree completion. As previously mentioned, this reduced model provides the best representation to address the research question because it maintained explanatory power compared to prior models tested while being a simpler model.

Odds ratios were calculated for each predictor in the final model. Odds ratios and their confidence intervals are presented in Table 4. The odds ratio is the amount the log-odds of completion changes with a one unit change in the predictor. For example, for a one-unit increase in First-Term GPA, the odds of completion (versus not completing) increase by a factor of 2.796. The confidence intervals are provided representing a ninety-five percent probability that the odds ratio will fall between the upper and lower limits.

Table 4

Odds Ratio and Confidence Intervals for Variables in the Final Model

	Odds Ratio *exp*(*b*)	95% CI	
		LL	UL
Intercept	0.015	0.010	0.023
First-Term GPA	2.796	2.572	3.051
DevEd 'One'	0.615	0.536	0.704
DevEd 'Two or more'	–	–	–
EnrInt 'Mixed'	2.762	2.387	3.201
EnrInt 'Full'	0.355	0.312	0.403
Age	1.015	1.006	1.023
Pell 'Yes'	0.833	0.708	0.981

First-term grade point average is statistically significant in the final model and increases the likelihood of degree completion. A first-term GPA of 1 is 2.796 times as likely to graduate as compared to a first-term GPA of 0. This finding points to the importance of early academic success as a key predictor of completion for non-first-time students.

Being required to take one developmental education course (DevEd 'One') is statistically significant and decreases the likelihood of degree completion. A student required to take one level of developmental education is 0.615 times as likely to complete as a student requiring no developmental education. Being required to take two or more developmental education courses (DevEd 'Two or more') was not statistically significant as compared to the reference value no developmental education required. These findings related to developmental education may be interpreted to mean that students with some developmental needs are less likely to complete than those requiring no developmental

education. However, the results were not significant for those students requiring a greater amount of developmental education.

Enrollment intensity is statistically significant in the model. Mixed enrollment pattern increased the likelihood of completion 2.762 times over the reference value exclusively part-time students. Exclusively full-time enrollment was also statistically significant but decreased likelihood of completion for non-first-time students as compared to part-time students. Exclusively full-time non-first-time students were .355 times as likely to complete as compared to their part-time peers. What these findings suggest is that non-first-time students who adjust their enrollment intensity as needed between full-time and part-time are more likely to complete than exclusively part-time students. These findings also suggest that non-first-time students pursuing exclusively full-time enrollment are not as likely to be successful as their part-time counterparts.

Age is statistically significant and increases the likelihood of completion. The impact is small as each year of age maturity increases a student's likelihood of completion by 1.015. Applying this to potential ages of adult learners, a 30-year-old non-first-time student is .199 times more likely to complete than a 20-year-old non-first-time student. Though the effect is small, this finding suggests that there is a slightly greater likelihood of completion for older non-first-time students.

The variable Pell-eligible is statistically significant and decreases the likelihood of degree completion. A student who is Pell-eligible is .833 times as likely to complete as a student who is not Pell-eligible. This finding points to the importance of socioeconomic status as a predictor of completion. Despite the benefits provided by the Pell grant

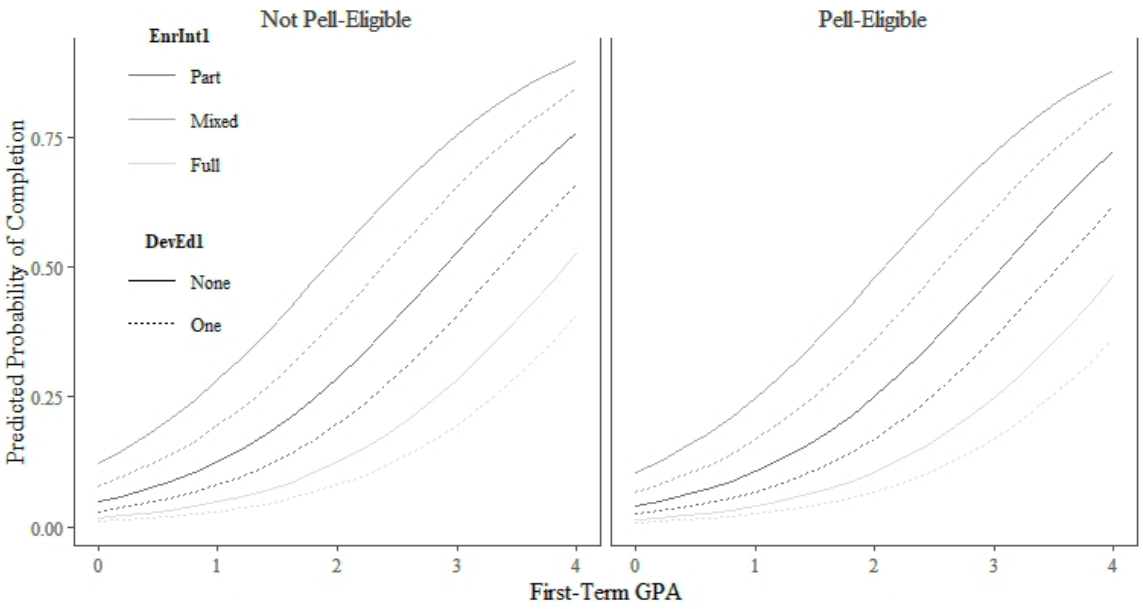
program to support low-income students, Pell-eligible students are still less likely to complete than their more affluent peers.

The potential correlation in categorical variables as indicated by the Chi-square test of independence were taken into consideration in the stepwise reduction but could have impacted the results of the final model. The test results indicate that there may be some interaction effect between variables in the models and the dependent variable completion. These potential interactions could be analyzed and understood further by including interaction effects in future models.

Results of the final model are plotted in Figure 2 and Figure 3 below with the predicted probability of completion on the y-axis. In Figure 2, age is held constant at 30 years old, the mean age of students in the population. The x-axis is first-term GPA, and the plot shows probability of completion increasing with first-term GPA. Predicted probability of completion is highest for mixed-enrolled, non-Pell-eligible students whose placement requires no developmental education. Predicted probability of completion is lowest for exclusively full-time, Pell-eligible students who place into one developmental education course.

Figure 2

Predicted Probability of Completion by First-Term GPA, Pell-Eligibility, Enrollment Intensity and Developmental Education



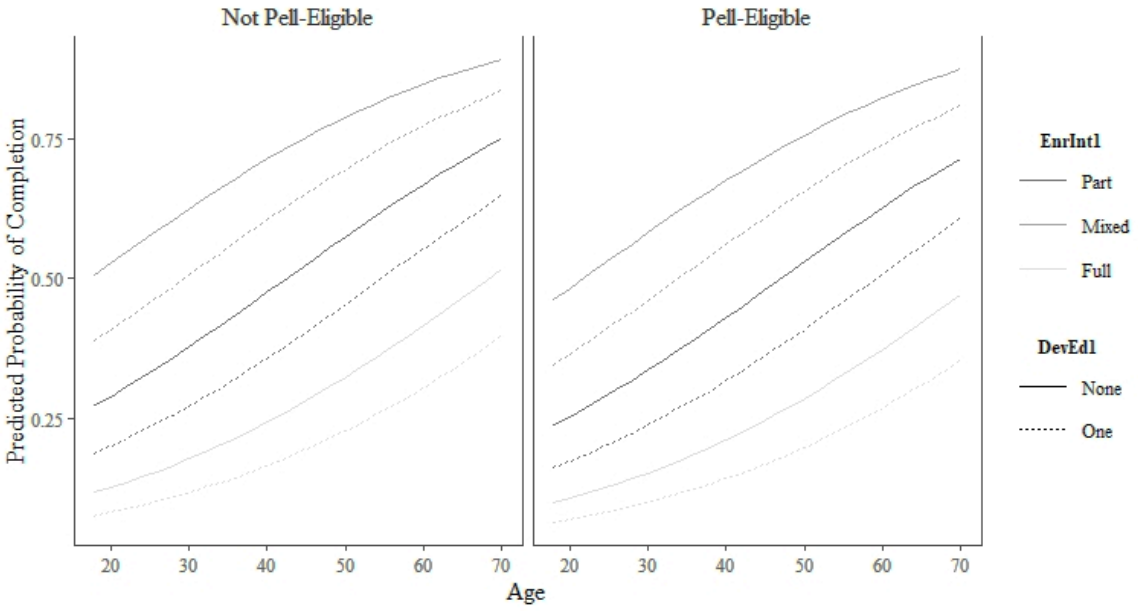
Notes: The plots show predicted probability of completion by first-term GPA as it differs by Pell-eligibility. Line color represents enrollment intensity. Line style represents developmental education. Developmental education "Two or more" is not plotted because it was not statistically significant. Age is held constant at the average age of students in the population, 30 years old.

In Figure 3, first-term GPA is held constant at 2.4, the mean GPA in the population. The x-axis is age, and the probability of completion increases with age. Similar to Figure 2, predicted probability of completion is highest for mixed-enrolled, not Pell-eligible students placed into no developmental education. Predicted probability of completion is lowest for exclusively full-time, Pell-eligible students placed into one developmental education course. Figure 3 also highlights the variation in predicted probability of completion by enrollment intensity with mixed-enrolled students having

the highest probability, followed by exclusively part-time, and the lowest being exclusively full-time students. Together, these findings indicate that the largest differences in probability of completion are between enrollment intensity levels, with mixed-enrolled highest, followed by part-time and then full-time being the lowest. Probability of completion also increased along with increases in first-term GPA (Figure 2) and with age (Figure 3). These figures, as well as the odds ratios, demonstrate that while the difference between Pell-eligible and not Pell-eligible is statistically significant, the impact on probability of completion is smaller than some of the other metrics in the final model. Figure 2 also demonstrates that Pell-eligible students who are academically successful in their first term by GPA have quite a high probability of completion.

Figure 3

Predicted Probability of Completion by Age, Pell-Eligibility, Enrollment Intensity and Developmental Education



Notes: The plots show predicted probability of completion by age at entry as it differs by Pell-eligibility. Line color represents enrollment intensity. Line style represents developmental education. Developmental education "Two or more" is not plotted because it was not statistically significant. First-term GPA is held constant at 2.4, the average GPA of students in the population.

Based on review of the current literature, this study examined the relationship between variables in the Adapted Geometric Model of Student Persistence and Achievement and the outcome degree or credential completion. Specifically, this chapter presented the analytical findings related to the research question: What factors are most predictive of completion for non-first-time undergraduate students? The full model with all variables from the Adapted Geometric Model of Student Persistence and Achievement was statistically significant with a *p*-value less than .001. With a McFadden pseudo-R^2 of

0.312, this model is an excellent fit. However through backward elimination, a reduced model with similar explanatory strength was identified. The final model had a comparable McFadden pseudo-R^2 of 0.311, and both the BIC and likelihood ratio test indicate the final model is more likely to be the true model representing the data. The variables in the final model were first-term GPA, developmental education, enrollment intensity, age, and Pell-eligible. By comparing the models through backward elimination and the above statistical tests, the analysis determined that first-term GPA, developmental education, enrollment intensity, age, and Pell-eligible are most predictive of completion out of the variables included in the Adapted Geometric Model. The final chapter discusses the study's results as it contributes to previous literature and its connection to the Adapted Geometric Model of Persistence and Achievement. The chapter concludes with implications of the study for policy, practice, and future research.

Chapter V: Discussion

This chapter discusses the interpretation and impact of the results as it relates to the literature on college completion. This chapter will analyze the expected relationships discussed in chapter three and the results in relation to the conceptual framework. Additionally, limitations of the study, implications for theory, policy and practice, and suggestions for future research are discussed.

Contributions to Conceptual Framework

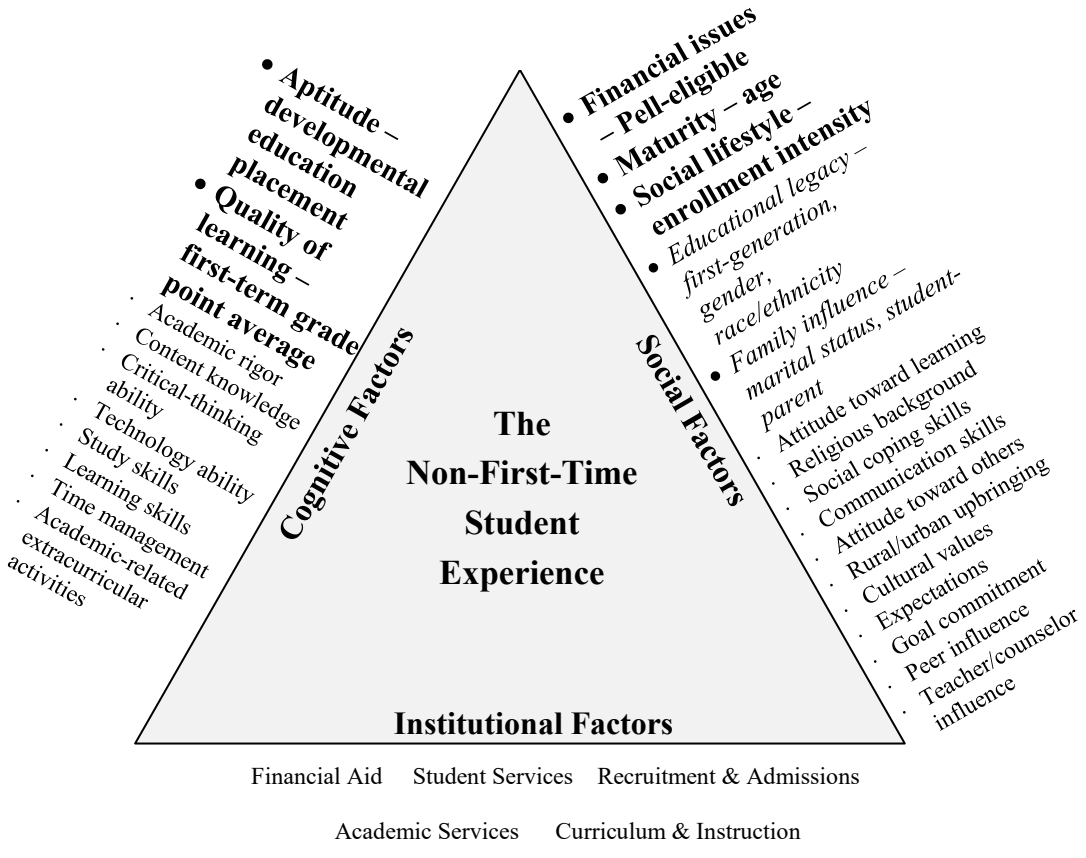
The purpose of this study is to better understand the variation in completion rates of non-first-time students by identifying the factors that most influence their completion. Specifically, the research question is: What factors are most predictive of completion for non-first-time undergraduate students? By testing a series of logistic regression models and comparing the models through backward elimination, the analysis identified factors and variables within the Adapted Geometric Model of Persistence and Achievement that are most predictive of completion for non-first time students at MTCC. The factors that were found to be statistically significant are: financial issues – Pell-eligible, maturity – age, social lifestyle – enrollment intensity, aptitude –developmental education placement, and quality of learning – first-term grade point average.

Figure 4 below presents the Final Adapted Geometric Model of Persistence and Achievement. The final model includes all factors in the original model, the factors that were tested in the statistical analyses and not found to be statistically significant in italics, and the factors that were found to be statistically significant when applied to the population of non-first-time students in bold. The distribution of the significant variables

and factors across both axes tested reinforce Swail's (2003) premise that all axes of the model are important to student persistence and achievement. Additionally, students need to have strengths or assets distributed across the axes of the model. This balance is indicative of a greater likelihood of successful completion. Further discussion of the factors tested and the results of the Final Adapted Geometric Model of Student Persistence and Achievement follows.

Figure 4

Final Adapted Geometric Model of Student Persistence and Achievement



Educational Legacy

This study identified a number of variables that were surprisingly non-significant given previous scholarship that points to their importance in understanding the college completion puzzle. This was evident within the family of variables related to educational legacy. The variables representing educational legacy are first-generation student status, gender, and race/ethnicity. Based on previous literature using the federal definition of first-generation student status (Cataldi, Bennet & Chen, 2018; Choy, 2001; Engle & Tinto, 2008; Gibbons & Woodside, 2014; Ishitani, 2006), I expected to see a negative relationship between the variable first-generation student status and completion for non-first-time students. First-generation was not found to be statistically significant in the models.

The second educational legacy variable is gender. Based on this previous literature, I expected gender on its own may not have a statistically significant relationship to completion for non-first-time students, but may be significant in combination with other variables. Gender was not found to be statistically significant in the models.

The third variable representing educational legacy is race/ethnicity. Based on previous literature (Attewell, Heil & Reisel, 2011; Moore & Shulock, 2010; Shapiro et al., 2017c), I expected students of color to be less likely to complete than white students. Race/ethnicity as a binary variable was not found to be statistically significant. The variables representing educational legacy in the Adapted Geometric Model of Persistence

and Achievement were not found to be significant for this analysis of non-first-time students so were not maintained in the final model.

Taken together, these findings indicate that educational legacy variables as defined for this analysis were less impactful than expected. These findings leave questions about how educational legacy might relate to completion for non-first-time students at MTCC. One plausible explanation for these non-findings is that a binary variable for race/ethnicity obfuscated variation across racial/ethnic groups resulting in an insignificant finding. I hypothesized that completion may not be associated with gender for non-first-time students, and that hypothesis held with these results which is a reasonable outcome. The non-finding with regard to educational legacy may be attributed to this factor being less important for non-first-time students since, unlike their first-time, first generation peers, they have some knowledge and understanding of college processes. For non-first-time students, their prior college experience may blunt the impact of first-generation status on their likelihood of completion.

Family Influence

Similar to educational legacy, it was surprising to see that none of the variables related to family influence appeared in the final model. The variables representing family influence are marital status and student-parent status. Based on previous literature on student marital status (Goldrick-Rab & Sorensen, 2010; Taniguchi & Kaufman, 2005), I expected married would be positively correlated with completion for non-first-time students. Married was not found to be statistically significant in the models.

Based on previous literature (Brown & Nichols, 2013; Goldrick-Rab & Sorensen, 2010; Nelson, Froehner, & Gault, 2013; Taniguchi & Kaufman, 2005), I expected to see a negative relationship between student-parent status and completion among non-first-time students. Student-parent was not found to be statistically significant in the models. The variables representing family influence in the Adapted Geometric Model of Persistence and Achievement were not found to be significant for this analysis of non-first-time students so were not maintained in the final model.

At least in this study, these findings indicate that the data sources and variables selected to represent family influence may be inadequate to capture the variation within these categories. The binary variable for married, collected through the Free Application for Federal Student Aid (FAFSA), may be obfuscating variation within the not married group – such as those who have never been married, those who are divorced, or other family arrangements. Variation within the group of not married students may change family influence and its impact on completion. Similarly, data on parenting-students are collected on the FAFSA, but separated parents are only considered to be parenting if they are providing more than 50 percent of the financial support for the child, though they may contribute financially and have caregiving responsibilities for children. From the literature, it is time constraints and caregiving responsibilities that may limit a student's probability of completion (Goldrick-Rab & Sorensen, 2010; Nelson, Froehner, & Gault, 2013; Peterson, 2016). So the non-finding with parenting-students may be related to the definition used for this data collection as being financial in nature for separated parents and its inadequacy in capturing family influence on completion. This is a notable

challenge for appropriately studying the impact of marital status, parenting and family influence on college completion, and requires researchers or institutions to identify new ways of collecting family data that is more robust and representative of student experiences.

Financial Issues

Contrasted to educational legacy and family influence, financial issues emerged as an important predictor of completion for non-first time students at MTCC. The variable representing financial issues is Pell-eligible. Based on previous literature (Bailey & Dynarski, 2011; Jenkins & Weiss, 2011; Jones-White, Radcliffe, Huesman & Kellogg, 2010), I expected to see a negative relationship between the variable Pell-eligible and completion for non-first-time students. Pell-eligible was statically significant, and as expected, decreases the likelihood of degree completion as compared to the reference category of not Pell-eligible students. Holding all other variables in the final model constant, a student who is Pell-eligible is .833 times as likely to complete than a student who is not Pell-eligible. So the variable representing financial issues in the Adapted Geometric Model of Persistence and Achievement was maintained in the final model.

The findings within this portion of the model are well supported by prior research illustrating that financial challenges pose a significant barrier for college completion. For example, Bailey and Dynarski (2011) found a consistent and growing gap in completion outcomes by socioeconomic status over time. This analysis reinforces that lower-income students facing financial challenges, as represented by Pell-eligibility, continue to face greater challenges to college completion than their peers. Despite the additional resources

provided to lower income students through the Pell grant, some of those students still struggle to complete at the same rate as their peers, so additional supports may be needed for that group to persist to completion.

When comparing the odds ratios of the variables in the final model, the outcome of this research is also consistent with Cabrera, Burkum, La Nasa, and Bibo's (2005) finding that while Pell-eligibility is significant, academic variables were stronger predictors of completion for low-income students. In this analysis, while Pell-eligible was significant, the odd ratio comparison shows a smaller effect on probability of completion than first-term GPA. Figure 2, presented in chapter four, highlights that academically proficient students, those with first-term GPAs above 3.0 and no developmental education required, have a 50 percent or higher predicted probability of completion. So financial challenges do not prevent college completion for non-first-time students. Given the combination of these findings regarding Pell-eligibility and academic preparedness, students facing financial challenges who show early signs of lower academic preparedness may be important to target for additional student success interventions. This study builds on the literature regarding financial issues and academic preparedness and demonstrates that these patterns hold for non-first-time student completion.

Maturity

Maturity (represented by age) also turned out to be an important factor to explain completion rates among non-first time students, but in unexpected ways. Based on previous literature (Miller, 2014; Shapiro et al., 2017b: Taniguchi & Kaufman, 2005), I expected to see a negative relationship between older students and completion of non-

first-time students. Age was statistically significant and remained in the final model; however, age unexpectedly increases the likelihood of completion for non-first-time students, contrary to the hypothesis. Though significant, the impact is small, as each year of age maturity increases a student's likelihood of completion by 1.015. Applying this to potential ages of adult learners, a 30-year-old non-first-time student is .199 times more likely to complete than a 20-year-old non-first-time student.

The finding that age is a positive predictor of completion for non-first-time students contradicts prior research, such as Shapiro et al. (2017b) that found traditionally-aged students completed at higher rates than their non-traditionally-aged peers. Perhaps one explanation of this contradiction is that age and maturity are an asset for non-first-time students. Those with more life experience as represented by age and previous experience in higher education may be more realistic about the sacrifices needed to complete college in their later attempt. The combination of past college experience and age could be important for non-first-time students as compared to first-time, traditionally-aged students. Further research is needed to understand why age is positively associated with completion in this analysis of non-first-time students when most studies find a negative correlation between age and completion.

Nontraditionally-aged learners make up approximately one-third of postsecondary students nationally (U.S. Department of Education, National Center for Education Statistics, 2018). Developing a deeper understanding of the completion challenges of non-traditionally-aged students is important to supporting this large student population. Needs of adult learners are not the same as their traditionally-aged peers. Older students

often want more flexibility of course times, location and support services (Ross-Gordon, 2011). Older students are also more likely to be managing multiple responsibilities beyond college, including work and family obligations that may impact their completion outcomes (Titus, 2006; Ross-Gordon, 2011). However as this study showed, when analyzing non-first-time students, age and maturity can be a positive predictor of completion and an asset rather than a deficit.

Social Lifestyle

Social lifestyle also emerged as an important predictor in this study. The variable representing social lifestyle is enrollment intensity. Based on previous literature (Adelman, 2006; American Council on Education et al., 2015; Attewell, Heil, & Reisel, 2012; Clovis & Chang, 2019; Complete College America, 2011; Shapiro et al., 2017a; U.S. Department of Education, National Center for Education Statistics, 2017), I expected full-time and mixed enrollment patterns would be positively correlated with completion as compared to the reference category part-time. Both full-time and mixed-enrolled were statistically significant in the models, however the directional relationship was unexpected. Mixed enrollment pattern increased the likelihood of completion 2.762 times over the reference value exclusively part-time students, while exclusively full-time non-first-time students were .355 times as likely to complete as compared to their part-time peers.

When comparing the odds ratios for enrollment intensity to other variables in the final model, exclusively full-time enrollment had the largest negative impact on probability of completion of the variables in the final model. It is unclear why exclusively

full-time enrollment would decrease probability of completion for non-first-time students. Generally, students enrolled full-time are more likely to complete than students who enroll part-time. Research on momentum in higher education indicates that students who move more quickly through their course of study, successfully complete the credits they register for, and sustain academic momentum are less likely leave higher education without completing a degree (Adelman, 2006; Attewell, Heil, & Reisel, 2012; Clovis & Chang, 2019; Complete College America, 2011). However, this pattern of completion for full-time students did not hold in this analysis of non-first-time students. The unexpected direction of full-time enrollment decreasing the projected probability of completion might be explained, in part, by student borrowing and drop out patterns at an open access institution. Given past challenges with student loan borrowing and high cohort loan default rate at MTCC – with students taking out their maximum loan amount in first term and then dropping out – it is possible that some of the full-time students in this analysis may not have been intending to complete their credential or degree, decreasing the completion rate for full-time students. Alternatively, this finding may indicate that for non-first-time students, exclusively full-time enrollment intensity is not sustainable given their work, family or other obligations. Further research is warranted on this unexpected finding regarding full-time enrollment intensity and completion of non-first-time students.

Mixed enrollment intensity increased the probability of completion as compared to part-time students. This finding is consistent with the American Council on Education et al. (2015) finding that non-first-time students were more likely to graduate than their

first-time peers when having a mixed enrollment pattern. The American Council on Education et al. (2015) speculate the reason non-first-time students are more likely to complete when mixed-enrolled is that they were willing to change their enrollment intensity according to the needs of their life and external obligations during any given academic term. This adaptability with enrollment intensity may also be connected to strong goal commitment, as mixed-enrolled students are willing to increase or decrease their credit load to stay enrolled and making progress toward completion. This study adds to the early literature analyzing mixed enrollment patterns by indicating a strong positive effect of mixed enrollment intensity on completion. This suggests that enrollment patterns should be tracked and examined more carefully, particularly as it relates to non-first time students. Enrollment intensity in a students' first-term of enrollment, as tracked for IPEDS and commonly utilized in completion research, may not be as meaningful for non-first-time students, but rather using measures of enrollment intensity over time may be more predictive of completion. More research on mixed enrollment patterns is needed to understand why this enrollment pattern is connected to increased likelihood of completion for non-first-time students and if this pattern holds across other institutions and institution-types.

Aptitude

Aptitude emerged as an important factor that explains completion for non-first time students. The variable representing cognitive aptitude is placement in developmental education. Based on previous literature (Boatman & Long, 2018; Xu, 2016), I expected that placement into developmental education would be negatively correlated with

completion, while placement into two or more developmental courses would have a stronger effect than placement into one developmental course. Placement into one developmental course was statistically significant and decreases the likelihood of degree completion as compared to the reference category placement into no developmental education courses. A non-first-time student required to take one level of developmental education is 0.615 times as likely to complete as a student requiring no developmental education. This finding – that one level of developmental education predicted that non-first-time students were less likely to complete – aligned with past literature and suggests that less academically prepared students are less likely to be successful in completing their credential or degree.

Contrary to the hypothesis however, placement into two or more developmental courses was not statistically significant as compared to placement into no developmental courses. This result was unexpected as past research (e.g. Boatman & Long, 2018; Xu, 2016) has shown that longer developmental sequences can be a barrier to college completion due to delayed progression to college-level courses and lower credit accumulation. What this unanticipated finding may be telling us is that there may be unexpected variation within the two or more developmental courses group, warranting further disaggregation in future research. Alternatively, with non-first-time students placing into longer developmental sequences, it is likely they had some experience in developmental education in their prior enrollment experience. Some of these students may be coming back to higher education with the understanding and expectation that a long developmental sequence would be required and therefore are not deterred in their

college completion goal by the placement. Further research is needed to understand how developmental education placement and cognitive aptitude impact completion outcomes for non-first-time students.

Quality of Learning

Quality of learning turned out to be perhaps the most important to understanding the completion among non-first-time students in the sample. The variable representing quality of learning is first-term grade point average. Based on previous literature (Luo, Williams, & Vieweg, 2007; Roszkowski & Ricci, 2009; Zhai & Newcomb, 2000), I expected higher first-term GPA to be positively associated with completion among non-first-time students. First-term GPA is statistically significant in the models and increases the likelihood of degree completion. Higher first-term GPA and early quality of learning were expected to be predictive of increased completion among non-first-time students (Roszkowski & Ricci, 2009; Luo, Williams & Vieweg, 2007). A first-term GPA of 1 is 2.796 times as likely to graduate as compared to a first-term GPA of 0. First-term GPA was one of the strongest positive predictors in the model, with an odds ratio comparable only to mixed-enrolled. What this tells us is that early academic performance and quality of learning is a good predictor of degree completion. Many variables used to study college completion are static or determined prior to enrolling in higher education, such as family educational legacy, demographics, or socio-economic status. By contrast, first-term GPA occurs after a student enrolls at an institution, so the student can be aided in their early academic experience through tutoring, supplemental instruction, study skills support, and other institutional support services. Institutions have agency in whether or

how to help students get off to a strong start academically. The salience of first-term GPA for non-first-time students is particularly important to institutions because it can be used to target early intervention strategies for students with lower early grades who may be less likely to complete college. Additionally, strong orientation programs that connect students to early support services could further aid students' quality of learning in their first term.

Limitations of the Study

The primary limitation of this single institution study is that the results cannot be broadly generalized to other institutions. Particularly, one would caution against generalizing results of this study to colleges of different size, mission, region, demographics, or other characteristics. Additional research applying the Adapted Geometric Model more broadly across multiple institutions would be necessary before further generalization of results.

Another limitation of this study is the exclusion of records for null values. Because three of the data elements – Pell-eligible, married and student-parent – were derived from the FAFSA, student records without a FAFSA were excluded. It is unknown whether students who did not file a FAFSA would behave similarly or different in the model to those with complete data. So records were excluded from the analysis so as not to introduce error. As the final model was refined, different approaches could be used in future research to include and analyze students who did not file a FAFSA.

Lastly, as this is an exploratory analysis to guide future research, some variables were calculated as binary variables which potentially limited the utility of those variables

or obfuscated variation within the binary categories. Future research could introduce more detailed categorical variables, such as detailed race/ethnicity, to understand how that variation impacts the models tested and completion outcomes of students.

Primary Contributions and Implications for Future Research

Despite the aforementioned limitations, this study breaks new ground in that it exclusively analyzed the completion outcomes of non-first-time students. This analysis demonstrates how this population of students behaves in some ways differently from first-time students, on whom most completion research is conducted. Not all findings from research on first-time students held when applied to non-first-time students in this analysis, such as the relationship of full-time enrollment intensity decreasing probability of completion as compared to part-time students. Further research on the completion outcomes of non-first-time students is warranted based on these findings.

The enduring contribution of this study to the literature on non-first-time students is that it provides further evidence of the salience of mixed enrollment patterns in understanding student completion outcomes. More nuanced enrollment intensity categories are relatively new in completion research, so the strong positive relationship between mixed-enrolled and completion reinforces the early research and warrants further study using the more nuanced enrollment intensity variables.

Additionally, this research demonstrates how Swail's Geometric Model of Student Persistence and Achievement (2003) can be adapted to further understand the completion outcomes of non-first-time students in addition to the traditional students it was initially conceived for. This research found that variables on both the cognitive and

social axes were significant and sustained in the final model. As such, these findings demonstrate the importance of variables across the axes of the Adapted Geometric Model to maintain balance and support student completion.

Building on the results of this present study, future research could include applying this framework and analysis approach to a multi-institution study of non-first-time students. The model could also be used to compare the completion outcomes of first-time and non-first-time students. The model could be more fully vetted through replicating the research and expanding the number or type of institutions studied. Additionally, applying the framework across institutions would allow for institutional factors that vary between institutions to be included in the analysis and further examine the application of the Adapted Geometric Model for Persistence and Achievement. Additional complexity could be added to future analyses by including interaction effects in the statistical modeling to better understand the relationship between categorical variables and their impact on completion.

In the current study, some student records were excluded for missing data due to those students not submitting the FAFSA. Future research utilizing the final model could include all records since the variables married and student-parent – which come from the FAFSA but are not directly related to financial need – were not maintained in the final model. The variable for low-income students could include Pell-eligible, not Pell-eligible and did not apply for aid. In future research, including records for students that did not apply for aid may add complexity and nuance and allow for a large number of additional student records to be included in the analysis.

Further research is needed to understand why age is positively correlated with completion in non-first-time students. In most studies of completion on first-time students, being a non-traditionally aged is negatively correlation with completion. More research would help to understand why this pattern reverses for non-first-time students and if that holds true across institutions, regions or institution types.

Future research could also reintroduce race/ethnicity with expand categorical variables. In this analysis, the binary variable of Student of Color or White was not statistically significant. Because the institution of analysis has extensive racial/ethnic diversity, simplifying race/ethnicity to a binary variable may not have effectively represented the population. By using the binary variable for race/ethnicity, this may have obfuscated variation across different race/ethnicity groups. Future research could apply the Adapted Geometric Model but reintroduce detailed race/ethnicity categories to see if more detailed race/ethnicity categories are stronger predictors of completion.

Given the salience of the cognitive variables in the model – developmental education placement and first-term GPA – identifying additional early measures of cognitive academic performance in alignment with the Adapted Geometric Model could be useful in future studies. Grade outcomes in early gateway courses could be used as a cognitive variable of content knowledge to predict student persistence to completion. Other examples from the Adapted Geometric Model include critical thinking, technological ability, study skills, and time management.

An additional area of inquiry could be further understanding non-first-time student's goals and motivations to return to postsecondary. While access to federal

financial aid is dependent upon students indicating that they are degree-seeking, it may not be every returning students' goal to complete a degree. A student could return to college to take a class for upskilling in their professional field, for personal interest, for promotional opportunities at work, or to get a better grade in a previously completed course before applying to another college, university, or professional school. Better understanding students' actual goals may inform different definitions of success beyond college completion. Future research could use student goal attainment, rather than just credential completion, as the dependent variable. Along that same line, the area of student motivation deserves further inquiry, particularly for non-first-time students returning to college. Better understanding what leads people to try again at postsecondary could inform public policy on reconnect programs incentivizing and supporting students with some college but no degree to return, as well as employer incentives such as tuition assistance or loan repayment. Future research of non-first-time student motivation to return and goals for their education could inform both policy and practice.

Lastly, further research is warranted on enrollment intensity over time and mixed enrollment patterns. Most academic research and institutional reporting on enrollment intensity is based on the students' first term of enrollment, in alignment with the federal IPEDS definitions for full-time and part-time enrollment. However, by looking at students' enrollment patterns over time, mixed-enrolled was a remarkably positive predictor of degree completion as compared to part-time and full-time students. Future research should consider including enrollment intensity over time and including mixed-

enrolled as an enrollment intensity variable. Additional research could be done to better understand the relationship between mixed enrollment patterns and completion.

Implications for Policy and Practice

Results of this analysis also hold practical implications for policy and practice. As these results demonstrate, institutions should more closely monitor placement into developmental education and first-term GPA of non-first-time students. Developmental education offers underprepared students the opportunity to increase their skills and access a postsecondary education. Additional interventions and supports should be provided for those students that show early indications of attrition. Taniguchi and Kaufman (2005) argue that institutions with open admission policies and those serving nontraditional students should offer additional academic support to maximize degree completion opportunity. Also differentiating enrollment intensity over time by student type would help institutions better identify students that are likely or unlikely to persist to completion. Institutions have agency over a wide array of curriculum and service offerings that could support more non-first-time students in persisting to completion. Colleges can identify the first semester course offerings or key support interventions and proactively connect students to those programs based on their background characteristics.

Returning to college as an older student can carry a negative stigma. However, this study shows that older non-first-time students were more likely to succeed than their younger peers. Reinforcing age as an asset rather than a deficit in higher education may offer support and sense of belonging to older students. Some higher education institutions have responded better than others in adapting to the needs of nontraditionally-aged

students, offering credit for prior learning, distance learning, accelerated course formats, or competency-based education. These options allow students to earn credit for knowledge gained outside of the academic environment, learn in a self-paced fashion, or more quickly make progress toward completion of their credential or degree. Given the complexity of nontraditionally-aged students' lives and competing priorities, offering academic programs that do not require as long of a sustained commitment and more flexible options for courses and support services would support the completion outcomes of older students.

Despite the additional financial aid provided through the federal Pell grant program, low income students still do not complete at the same rate as their more affluent peers. Given the design of the current funding formula, there has been little change to the Pell grant program over time. While the cost of college continues to increase, Pell grant amounts have remained relatively flat. Changing the funding formula so the Pell grant amount increases relative to the rising cost of college or indexed to inflation would ensure the continued buying power of the Pell grant for low-income students over time and would not require continued readjustment from Congress. Policymakers should also consider supports beyond tuition for low-income students to support not just access but also completion. The barriers to completion for low-income students include challenges with transportation, food and housing insecurity, work, and family obligations. Holistic support for low-income college students could help more students not just access college, but also complete their degree.

It is notable that categorizing students as mixed-enrolled was significant in this model and was consistent with the literature. The definition of mixed-enrolled is a departure from the traditional enrollment intensity definition by NCES, as IPEDS defines students' enrollment intensity based only on their first semester of enrollment. However, as additional research shows a relationship between completion and mixed enrollment intensity over time, policymakers may want to consider altering the way data on enrollment intensity are tracked and reported, particularly for non-first-time students.

As discussed in chapter one, the many national and state attainment goals set by various non-profits and governmental organizations will not be met by first-time, traditionally-aged students alone. Unfortunately, higher education as it is currently designed does not work well for many non-traditional students. Additionally, as technology, industries, and the economy change, the United States needs the ability to retrain and upskill adults whose previous job has been eliminated or whose industry is declining. To be responsive to the needs of our communities, colleges and universities must be able to support non-first-time students through their education and training to completion of a credential that provides career growth or economic opportunity. Though higher education in the United States was not originally designed for adult learners, the needs of our country today are such that many non-first-time students look to higher education for a mid-life career change or an opportunity to increase their financial security. Unfortunately, colleges are failing far too many of them. Higher education does a disservice to these students who return to college only to find their path to completion is anything but smooth. If colleges and universities are going to intentionally recruit non-

first-time and non-traditional students, then there is a moral obligation to consider the ways in which the systems and process of the institution should be adapted to better serve students of different backgrounds. Investment in retraining programs and free college policies should not just address the financial cost of tuition and fees for non-traditional learners. Those policies will be more successful in meeting their intended outcome of completion and attainment if considerations are included beyond the cost of tuition – course schedules, student services for adult learners, financial support for expenses beyond tuition, flexible academic support, and early interventions to support developmental learning and academic success. There are both moral and economic imperatives to better support non-first-time students who decide to try again at completing their college degree.

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Appendix: University of Minnesota Institutional Review Board Determination

UNIVERSITY OF MINNESOTA

Twin Cities Campus

Human Research Protection Program
Office of the Vice President for Research

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NOT HUMAN RESEARCH

September 3, 2020

David Weerts

612-625-2289
dweerts@umn.edu

Dear David Weerts:

On 9/3/2020, the IRB reviewed the following submission:

Type of Review:	Initial Study
Title of Study:	Completion of Non-First-Time Undergraduate Students
Investigator:	David Weerts
IRB ID:	STUDY00010792
Documents Reviewed with this Submission:	• HRP-503-Human-Research-Determination-Form NS 200831.docx, Category: IRB Protocol;

The IRB determined that the proposed activity is not research involving human subjects as defined by DHHS and FDA regulations. To arrive at this determination, the IRB used "WORKSHEET: Human Research (HRP-310)." If you have any questions about this determination, please review that Worksheet in the HRPP Toolkit Library and contact the IRB office if needed.

Ongoing IRB review and approval for this activity is not required; however, this determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether IRB review is required, please submit a Modification to the IRB for a determination.

Sincerely,

Jeffery Perkey, CIP, MLS
Senior IRB Analyst