Fall 10-24-2016

Student-College Match and Bachelor's Degree Completion

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STUDENT-COLLEGE MATCH AND BACHELOR'S DEGREE COMPLETION

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

Seton Hall University
2016

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APPROVAL FOR SUCCESSFUL DEFENSE

Ryan P. Hudes, has successfully defended and made the required modifications to the text of the doctoral dissertation for the **Ph.D.** during this **Fall Semester 2016.**

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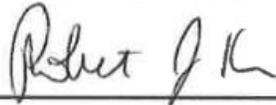Dr. Rong Chen   10/17/2016

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ABSTRACT

This dissertation investigates the prevalence of postsecondary student-college match and explores its relationship with bachelor's degree completion. This study differentiates itself from existing undermatch studies by examining alternative student-college match scenarios – including undermatch, match, and overmatch and examining the phenomena's relationship with a student outcome. Using nationally-representative data, this study found that 40.6% of students undermatched (or attended an institution with a selectivity rating below their academic potential), 35% overmatched (or attended an institution with a selectivity rating above their academic potential), and 24.4% matched (or attended an institution with a selectivity congruent with their academic potential). This study results indicate students of all backgrounds and with varying academic profiles mismatch in their postsecondary choice.

Related to bachelor's degree completion, this study found student-college match to be a statistically significant predictor of future degree completion. Specifically, compared to matched students, the odds of four-year degree completion for undermatched students are 26% lower. Comparatively, the odds of four-year degree completion for overmatched students – compared to matched students – are 19% higher. Subgroup analysis indicates variance by socioeconomic status and race/ethnicity, but likelihood ratio tests provide evidence that such differences are not statistically significant, demonstrating that the relationship between student-college match and degree completion is the same across socioeconomic and race/ethnicity groups.

Keywords: Undermatch, College Match, College Access, College Choice, Degree Completion, College Going, Postsecondary education

ACKNOWLEDGEMENTS

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CHAPTER I
INTRODUCTION

Fueled primarily by the need to expand the nation's economy, meet workforce demands, improve individual financial and social mobility, reduce inequality, and develop a better-educated citizenry, the American higher education enterprise has expanded dramatically in recent decades – evident by an increased number of institutions and several years of growing enrollments (Carnevale & Rose, 2012; Gilbert & Heller, 2010; Hutcheson, 2007, as cited in Perna & Jones, 2013). As it relates to enrollment, in fall 2013, approximately 10.5 million undergraduate students attended a four-year institution in the United States – 77 percent of those students attended on a full-time basis (NCES, 2015). Of concern, however, is that despite increasing enrollments, a proportionate increase of eventual bachelor's degree completion has not emerged. In 2014, across all American four-year postsecondary institutions, 59 percent of first-time, full-time bachelor's degree-seeking students completed a degree program within six years of initial enrollment at the same institution (NCES, 2015). Further, this completion rate is comparable when accounting for institutional control – 58 percent and 65 percent of first-time, full-time bachelor's degree-seeking students completed their program at public and private nonprofit institutions, respectively (NCES, 2015). While completion rates have modestly risen in recent years, the fact that approximately 40 percent do not complete degree programs within six years is generally not regarded as successful, but rather "a failure of either the student, the institution, or the entire educational system" (DesJardins, Ahlburg, & McCall, 2002, p. 556).

In recent years, researchers, policymakers, and practitioners have been charged with better understanding the factors that predict timely completion, particularly among students at four-year institutions pursuing bachelor's degrees. An emerging factor associated with degree

completion is institutional selectivity's relationship with degree completion. Specifically, the National Center for Education Statistics (NCES) reports that at institutions where less than 25 percent of applicants are accepted, 89 percent of first-time, full-time students completed a degree program from the first institution attended within six years of enrollment (2015). Similarly, at institutions where 25-49.9 percent of applicants are accepted, 69 percent of first-time, full-time students completed a degree programs within six years from the first institution attended (NCES, 2015). Related to institutional selectivity, Light and Strayer (2000) found that students of all academic ability levels have a higher probability of degree completion if the selectivity of the college they attend corresponds to their measured academic skill level. This raises the question, to what extent is a student's academic potential, institutional selectivity, and bachelor's degree completion related?

Given that the selectivity of an institution is correlated with bachelor's degree completion (Light & Strayer, 2000), further investigation of this as a factor related to bachelor's degree completion – specifically understanding the extent to which students attend institutions with a selectivity that matches their academic potential is warranted – something I argue can be framed in terms of a student-college match (Bowen, Chingos, & McPherson, 2009; Light & Strayer, 2000). The following sections detail this study's intent to examine student-college match and eventual bachelor's degree completion. First, the concept of student-college match will be defined and its extent among students is presented. Second, the current status of bachelor's degree completion in American higher education is examined. Finally, the current status of the relationship between student-college match and degree completion is presented, emphasizing the need to better examine the potential association between the two. To that end, this study sought

to expand existing research by reexamining the extent of student-college match and by investigating a student outcome such as degree completion.

Problem Statement

Student-College Match

The study of student-college match is primarily situated at the "nexus of both college access and college completion agendas" and is liked to several policy issues (Belasco & Trivette, 2015; Rodriguez, 2013, p. 3). Initially, the study of student-college match emerged following the implementation and evaluation of affirmative action policies – an effort to determine if minority students were underqualified, based on grade point average and standardized test performance, for admission to postsecondary institutions. Similarly, other research examines the substantial number of economically disadvantaged students with high academic qualifications that attend less selective institutions (Bowen et al., 2009; Rodriguez, 2015). The latter is referred to as undermatch and is often considered an estimate based on a given set of observable student-level characteristics, typically including grade point average, standardized test scores, and participation in AP/IB courses, compared to the selectivity of the institution attended. Given its roots in several federal policies, researchers have a renewed interest and have investigated the extent of student-college match, but have primarily focused on undermatch (Belasco & Trivette, 2015; Bowen et al., 2009; Roderick, Nagaoka, Coca, & Moeller, 2008; Smith, Pender, & Howell, 2012).

Existing statistics indicate that student-college match is pervasive and affects students of all backgrounds. Using the NCES' Education Longitudinal Study of 2002 (ELS:2002), Smith et al. (2012) estimated the extent of undermatch, occurring when a student attends an institution

with a selectivity below their academic ability, to be about 41 percent of the college-going population – among the 2002 cohort of tenth grade students. Of the 41 percent that were found to have undermatched, the students possess a range of academic credentials, but the students were primarily from low socioeconomic status families (about half), live in rural areas, and have parents lacking a college degree (Smith et al., 2012). Similarly, Bowen et al. (2009) found the 'big fish-small pond' hypothesis, that is, attending a less selective institution in which a student is overqualified, resulted in lower degree completion rates among its sample of North Carolina high school graduates – a 15 percentage-point shortfall in adjusted degree completion rates for overqualified students. Likewise, in the Chicago Public School System, just one-third of students with four-year institution aspirations actually enrolled in a college that matched their academic qualifications (Roderick et al., 2008). Despite existing research indicating less prepared students struggle academically in higher selectivity schools (Heil, Reisel, & Attewell, 2014; Sander & Taylor, 2012; Sowell, 2003; Thernstrom & Thernstrom, 1997), the extent of other student-college mismatch types – including match or overmatch – are not empirically examined in the current body of literature.

In summary, academic student-college match types, specifically undermatch, has been found to be prevalent in existing studies, but little research exists regarding other scenarios, including match and overmatch. Further, little research exists regarding the relationship between student-college match and a student-level outcome such as bachelor's degree completion. The following section presents the current status of bachelor's degree completion and helps sets the stage for examining student-college match as a factor of bachelor's degree completion.

Degree Completion

While public policy initiatives, such as legislation to ban discriminatory admissions practices and the establishment of need-based financial aid programs, among others, have removed some barriers to higher education, persistence to degree completion is an ongoing concern, relative to the number of students enrolling (Jones, 2013). Due in part to public policy initiatives, increasingly more students are enrolling in college (recent figures indicate a 71 percent increase in overall undergraduate enrollment across the enterprise), but not nearly enough are completing degree programs (Jones, 2013). Since the mid-1990s, six-year completion rates for first-time, full-time students at four-year institutions have remained relatively constant just below 60 percent (Kelly & Schneider, 2012). For a 2003-04 cohort of students and using the most recent nationally-representative Beginning Postsecondary Students (BPS) longitudinal data, just 58 percent of students starting at a four-year college attained a bachelor's degree by 2009 (Radford, Berkner, Wheeless, & Shepherd, 2010). The 1995-96 BPS data revealed six-year completion rates nearly identical to the 2003-04 BPS cohort (Berkner, Choy, & Hunt-White, 2008). Similarly, the National Longitudinal Study of 1972 and the National Education Longitudinal Study of 1988 indicated that the percentage of first-time, full-time college students completing a degree within eight years of graduation declined more than five percentage points between the early 1970s and mid-1990s (Kelly & Schneider, 2012). The data across multiple sources indicates that about half of the students enrolling in a postsecondary institution consistently fail to complete a degree within 150 percent of the time, or six years.

Between 1950 and 2010, the percentage of Americans aged 25 to 29 with a bachelor's degree consistently increased (Kelly & Schneider, 2012) – as much as 22 percent to 32 percent between 1975 and 2010. Much of this growth, however, occurred between 1950 and 1980, prior

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to leveling out in the last decade. To be precise, between 2000 and 2010, degree completion increased just 2.5 percentage points, compared to a 7 percentage point increase in the prior quarter-century (Kelly & Schneider, 2012, p. 3). As of 2014, just 30 percent of adults in each age cohort hold a bachelor's degree (Perna & Finney, 2014). Relatively speaking, this is only a slight improvement over the completion rate of students enrolled a decade earlier (Perna, 2013). Failing to complete degree programs has far-reaching ramifications – notably at the individual and societal levels.

Completing a bachelor's degree program and receiving a degree includes desirable benefits at both societal and individual levels. At the societal level in the United States, the completion of a bachelor's degree is associated with higher rates of voting, adult literacy, charitable giving, volunteerism, lower rates of incarceration, and decreased usage of public assistance (Baum, Ma, & Payea, 2010; Bowen & Bok, 1998). At the individual level, completing a degree program is associated with higher earnings and greater job satisfaction (Baum et al., 2010). Prior research indicates that for the three years following the 2007 recession, individuals who earned a college degree had the lowest unemployment rates and the highest rates of being hired (Carnevale, Smith, & Strohl, 2010). Similarly, from an economic perspective, individuals with a bachelor's degree enjoy lifetime earnings that are $1.1 million higher than an associate's degree holder (Carnevale et al., 2010). Despite the clear benefits at both the societal and individual levels associated with bachelor's degree completion, persistent gaps between enrollment and completion rates persist. Although recent public policy initiatives have improved access to postsecondary institutions and increased undergraduate enrollments, the relatively steady degree completion trend indicates this influx of students is losing focus at some

point in the process and not completing degree programs – this is particularly exacerbated for traditionally underrepresented students.

For traditionally underrepresented groups of students, significant completion rate disparities exist (Bound, Lovenheim, & Turner, 2010; Reason, 2009). According to the U.S. Department of Education (2003), although a vast majority of students (97 percent) of all races and socioeconomic statuses expect to enroll in a postsecondary institution, many do not follow through with initial enrollment, and therefore are ineligible to complete a degree. For those that actually enroll, substantial portions of the population, especially low-socioeconomic (SES) households and racial/ethnic minority groups, are consistently underprepared to succeed in higher education and risk dropping out (Jones, 2013). From 1990 to 2013, the percentage of 25- to 29-year old students who completed a bachelor's degree or higher increased from 26 to 40 percent for White student, from 13 to 20 percent for African American/Black students, and from 8 to 16 percent for Hispanic students (Kena et al., 2014). While positive trends across racial and ethnic groups can be seen in the last decade, these increases are not proportionate to the increasing enrollments across all race and ethnicity groups. Moreover, between 1990 and 2013, the gap in degree completion between White and Black students increased from 13 to 20 percentage points, and the gap between White and Hispanic students widened from 18 to 25 percentage points (Kena et al., 2014). While significant disparities exist among underrepresented groups, the United States overall degree completion rate as compared to international peer organizations has also declined in recent years.

Compared internationally with peer countries, in 2007, the percentage of adults age 25 to 34 that hold at least a bachelor's degree was lower in the United States than in Norway, The Netherlands, Korea, New Zealand, and Denmark (Baum, Ma, & Payea, 2010, as cited in Perna,

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2013). Organisation for Economic Co-operation and Development (OECD) (2010) data

indicates an alarming number of countries will catch or surpass the United States in tertiary

degree completion (including bachelor's degrees and master's degrees) as a result of incomplete

degree programs among the younger segment of adult Americans compared to their peers in

other OCED countries (The Pell Institute, 2011). The United States now ranks twelfth in the

proportion of 25- to 34-year olds who have achieved postsecondary degrees in comparison to

other OECD countries, excluding certificates and other non-degree programs (Callan, 2014).

Without a proportionate increase in degree completion, the nation's ability to remain competitive

in a globally inclusive and complex economy will remain in question (The Pell Institute, 2011).

In addition to an inability to compete on an international level, declining degree completion

poses a threat to the vitality of the American workforce.

Due to the declining degree completion rates, the American workforce will not have an

adequate supply of college-educated individuals to fill critical positions at the current rate of

degree completion. According to the Bureau of Labor Statistics, by 2022, there will be

approximately a 14 percent increase in the number of new and replacement jobs requiring some

college education (Richards & Terkanian, 2013). In just the next two years, Carnevale et al.

(2010) further note that at the current rate of degrees awarded, the demand for employees with

bachelor's degrees will far exceed the supply by 2018. Despite the clear societal- and individual-

level benefits associated with increased bachelor's degree completion, little positive change has

occurred in recent years.

In summary, improving bachelor's degree completion rates to positively correlate with

surging enrollments is a timely focus for researchers, policymakers, and practitioners, most

notably reflected in national policy initiatives designed at regaining the United States' status at

the top of OECD world rankings in degree attainment. While a great deal of research and policy

exists regarding postsecondary degree completion and ambitious goals have been set for

bachelor's degree attainment (Lumina Foundation and the Bill & Melinda Gates Foundation),

little is known regarding policy and practice strategies for significantly raising degree completion

(Kelly & Schneider, 2012, p. 5). The following section suggests examining student-college

match as a factor of bachelor's degree completion.

Student-College Match and Degree Completion

Given the extensive scale of student-college match types, specifically undermatch, further

research should be completed to fully understand the extent of the phenomena. However, among

the few studies examining student-college match, most focus exclusively on undermatch, instead

of all match types – including match, undermatch, and overmatch – and, few, if any, have

examined student-college match and its relationship with a student outcome such as degree

completion. This gap needs to be bridged by better examining each academic match type to

determine the prevalence of each and further determining its relationship with student outcomes.

To that end, despite existing studies identifying the extent of undermatch and finding it to be

prevalent, these studies have not examined the relationship between undermatched students and

student outcomes – possibly due to unavailable data. With the recent availability of student

outcome data points in the most recent ELS:2002 longitudinal dataset update, the potential

relationship between student-college match types and degree completion can be fully explored.

Overview of the Study

Given that approximately 40 percent of students pursuing a bachelor's degree fail to

complete their academic program within 150 percent of the time, a study seeking to examine a

possible predictor, such as student-college match, is needed. This study sought to expand beyond only undermatch to determine the extent of each match scenario, while incorporating an expanded student-college match methodological model that includes: 1) the determination of selectivity categories that account for all students, specifically at the "margins that matter" and 2) the inclusion of additional student-level predictors when determining academic credentials.

This raises the overarching question – given that many students are attending institutions not considered a match, is there a relationship with eventual degree completion?

This study was guided by the following research questions:

1. What is the rate of postsecondary student-college match, including students considered an undermatch, an overmatch, and a match?

2. To what extent do student-college match rates vary by socioeconomic status and race/ethnicity?

3. Controlling for all other factors, is there a relationship between student-college match and bachelor's degree completion? Do such relationships vary by students' socioeconomic status and race/ethnicity? If so, how?

Conceptual Framework

While there are many conceptual models related to college outcomes and degree completion, little exists related to student-college match. To address this study's research questions, two unique models – student-college match and degree completion – were designed and grounded in existing theories and models.

For student-college match, Tinto's Theory of Integration (1993), was selected as it seeks to explain the motivation behind a student's decision to leave a postsecondary institution prior to

degree completion. Given the factors contributing to a student-college match determination and this study's objective to examine the relationship between student-college match and degree completion, Tinto's theory is applicable as student-college match can be viewed as a measurement or natural extension of integration. Tinto's theory further extends to the overarching degree completion outcome.

For degree completion, Terenzini and Reason's (2005) Parsing Model served as a foundational conceptual framework. Although the model was initially developed to study individual effects of specific environments and experiences on first-year student outcomes, particularly student persistence, Terenzini and Reason (2005) argue the framework is applicable to study any college outcome for any group of students. The model assumes students enroll in higher education with existing characteristics and experiences that are critical for understanding a student's progression from initial entry to eventual degree attainment. For this study, Terenzini and Reason's Parsing Model (2005) guided the exploration of existing educational attainment literature and helped identify student-level predictors.

The model includes three overarching components, including student precollege characteristics and experiences, the college experience, and outcomes. Terenzini and Reason (2005) further split the college experience component into three sub-sections, including (1) the organizational context, (2) the peer environment, and (3) individual student experiences. While there is debate regarding traditional measures of institutional characteristics, Terenzini and Reason (2005) defined organizational characteristics as policies, practices, and faculty culture related to student learning and development. For this study, this framework is ideal as it not only accounts for student experiences while enrolled in a postsecondary institution, it also integrates

students' existing characteristics and provides potentially significant factors related to academic college match to better understand the relationship with degree attainment.

Research Design

In order to address this study's research questions, a derived student-college match indicator was developed using ELS:2002 variables. This study used logistic regression to determine which factors contribute to bachelor's degree completion, with a particular focus on each type of student-college match. A baseline "restricted" model was first completed and a likelihood ratio test was completed to determine if a second "unrestricted" model including interaction terms (socioeconomic status*match and race/ethnicity*match) was warranted. Guided by Terenzini and Reason's Parsing Model and existing research outlined in the following chapter, predictor variables were collectively inputted into the model. Factors included self-reported student behaviors as measured in the NCES' ELS:2002. Data was collected from the restricted data file and included variables from the base year (2002), first follow-up (2004), second follow-up (2006), and third follow-up (2012) data files.

Significance of the Study

For educational researchers, public policymakers, and institutional leaders, studying degree completion and its predicting factors is of utmost importance. To that end, this dissertation seeks to fully examine the extent of student-college match and to determine its viability as a predicting factor of successful bachelor's degree completion. Collectively, the exploration of student-college match and a student outcome such as degree completion has the potential to offer significant contributions to policy agendas associated with college access and

completion, practice and assessment for students and institutions at the K12 and postsecondary levels, and higher education research associated with students and institutions. This dissertation will offer relevant contributions to the study of student-college match, policy implications associated with completion agendas, and institutional practices. First, this study's expanded student-college match model for deriving its focal match indicator is briefly explained. Second, a justification for this study's need in the existing degree completion research is offered. Finally, the implications of this study's findings related to policy, practice, and research are presented.

Regarding student-college match, this study will employ an expanded methodological approach to derive a match indicator – including match, undermatch, and overmatch scenarios. From a methodological perspective, existing student-college match studies are generally guided by similar assumptions, specifically using institutional selectivity as a means of differentiating institutions (Rodriguez, 2015). To sort institutions by selectivity, a modified version of the Barron's Admissions Competitiveness Index has been primarily used to differentiate institutions in most existing academic match studies. The Barron's index is compiled based on SAT/ACT scores of admitted students, the GPA and class rank required for admission, and the percentage of applicants accepted (Barron's Educational Series Inc, 2004). Existing research generally collapses the seven Barron's competitiveness categories to just five categories. As Bastedo and Flaster (2014) suggest, to better examine "the margins that matter for student outcomes" further research is required – specifically by using the full Barron's Index to better differentiate between selectivity hierarchies. Currently, studies using the collapsed Barron's index combine the "most competitive" and "highly competitive" categories into a single "very selective" category (Rodriguez, 2015; Smith et al., 2012). Due to this study's analytic sample and desired statistical power, this study also used the Barron's collapsed selectivity structure.

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When determining a student-college match, existing match research typically relies on a few observable characteristics to determine a student's academic ability. Generally, the most frequently used academic performance indicators include standardized SAT/ACT scores, GPA, and advanced coursework (Bowen et al., 2009; Roderick et al., 2011; Rodriguez, 2015; Smith et al., 2012). As suggested by Rodriguez (2015), this study incorporated additional student-level data, including existing academic achievement information, demographic characteristics, and extracurricular activity participation. By using additional student-level factors, the precision of predicted student-college match probability estimates improved. Further explanation related to this study's methodological design is presented in Chapter III.

Regarding degree completion, further examination provides invaluable data regarding the effectiveness and efficiency of postsecondary institutions. Bowen et al. (2009) argue studying degree completion is tantamount to other measures of student growth and persistence; as concerns, including access and enrollment, become moot if students fail to complete degree programs. In other words, those students dropping out of college lack degrees whether they left with exceptional or failing grades or with incomplete coursework (Bowen et al., 2009). Several government agencies and associations (the Obama Administration, the Lumina Foundation for Education, and the Bill & Melinda Gates Foundation) advocate for policy and practice improvements to increase completion. Similarly, this study sought to identify the extent of student-college match and its relationship with completion.

The study's potential policy, research, and practice implications are far-reaching. From a policy perspective, the federal government and private agencies allocate a substantial amount of financial aid to higher education and students enrolling in academic programs each year. If these students are not attending institutions considered to be an academic match, the risk of failing to

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complete a degree program increases substantially. Additionally, findings may help address

ongoing credit portability questions, specifically as it relates to emerging student enrollment

patterns and eventual degree attainment. From a research perspective, this study's findings are

based on the most recent secondary/postsecondary longitudinal data from the NCES and will

provide valuable insight as to how these factors predict degree attainment. Researchers will

benefit from comprehensive findings addressing the extent to which students, from varying

backgrounds, earn a degree from an institution with a similar academic profile. From an

institutional practice perspective, a better understanding of the gap in college-knowledge and

related programs could help secondary school educators and guidance counselors better channel

students to postsecondary institutions considered an academic match.

Although there is no silver bullet (Perna, 2014) to address stagnant bachelor's degree

completion rates, existing research indicates many factors, including student precollege

characteristics, student demographics, the college choice process, social capital, and financial

resources, among others, help predict future degree completion. The degree to which these

factors are related to eventual degree completion varies, but given current degree completion

rates, additional research is warranted – especially for traditionally disadvantaged groups, or

students from low-income families, Black and Hispanic students, first-generation college

students, and students from rural regions of the country (Prescott & Bransberger, 2012).

In summary, while the extent of student-college match, specifically undermatch, has been

examined in prior studies, little research exists regarding: 1) the extent of matching or

overmatching; 2) alternative approaches to estimating and measuring academic match beyond

academic achievement and standardized test performance; and 3) the potential relationship

between student-college match and a student outcome such as degree completion. This study

attempts to address these gaps in the research.

Dissertation Organization

Chapter II provides context for this study and includes a broad and extensive review of

existing literature to identify key factors related to bachelor's degree attainment, with an

emphasis on student-college match as a focal factor. Chapter III includes this study's research

design, which relied on the NCES' ELS:2002. Specific variables were identified to examine

how the factors outlined in the preceding literature review related to eventual degree attainment.

Results of this quantitative study are compiled, presented, and synthesized in Chapter IV.

Chapter V concludes with potential avenues for future research, implications for policy, and

recommendations for practitioners.

CHAPTER II
LITERATURE REVIEW

Research regarding student outcomes, particularly degree completion, is quickly expanding – especially following ambitious completion and attainment goals set by the Lumina Foundation (2009), the College Board (2012), and the Bill and Melinda Gates Foundation (2015). This chapter will start by establishing definitions and conceptualizations of student-college match and degree completion as used in existing literature. It will synthesize existing theoretical and conceptual approaches frequently associated with student-college match and degree completion by analyzing their advantages and limitations. As student-college match in this study is conceptualized and operationalized using a proposed, expanded model, discussion of the determinants of academic match and a thorough examination of existing methodological approaches for estimating academic match are presented. As it relates to degree completion, relevant factors associated will be presented and discussed – with student-college match as a focal predictor. The chapter will conclude by offering this study's proposed framework to understand the potential relationship between student-college match and degree completion. The literature review underscores the need for additional study as gaps in the existing research related to student-college match and student outcomes, particularly degree completion, are identified.

The purposes of this literature review are: 1) to identify how student-college match and degree completion are defined, conceptualized, and used in existing literature; 2) to examine student-college match by identifying its determinants and analyzing prior methodological approaches used for making a match estimation; 3) to critically review and synthesize existing theories and conceptual frameworks associated with degree completion; 4) to ascertain the factors associated with degree completion; and 5) to synthesize existing literature that examined

student-college match and degree completion. Following this review, a summary and critique of the existing literature and this study's proposed framework and model are presented.

While degree completion is a concern for students in both two- and four-year institutions, this review examines the phenomena from the perspective of students in four-year institutions. This limitation is built into the study design as student-college match was only estimated for students with aspirations of attending a four-year institution. The sources of this literature review include material from scholarly books and peer-reviewed journals. Relevant published dissertations were also included to expand the understanding of student-college match as the topic is relatively new and findings are generally inconclusive.

Definitions and Conceptualizations

Prior to extensively examining student-college match and its determinants and estimation methods, an understanding of how critical terms associated with this proposed study are defined, conceptualized, and used in existing literature is warranted. While the extent of student-college match has been estimated in recent studies, its definition and conceptualization varies significantly across existing studies. Similarly, degree completion has been the subject of many studies and is often defined and measured differently.

Student-College Match

The study of student-college match is not new, as it was initially raised with regard to whether students admitted to selective institutions were considered a "match" or "mismatch" as a result of affirmative action policies (Alon & Tienda, 2005; Bowen & Bok, 1998; Rodriguez, 2013). Although varying definitions and methodologies are used to estimate student-college

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match, it generally arises when a student does not attend an institution with a selectivity level that matches their measured academic potential. As a result, students are considered either an undermatch, overmatch, or a match. Undermatch is the most frequently studied measure in the existing literature and is generally defined as "occurring when a student's academic credentials permit them access to a college or university that is more selective than the postsecondary alternative they actually choose" (Smith et al., 2012, p. 247). Roderick, Coca, and Nagaoka (2011) define undermatch as, "enrolling in a four-year college with a selectivity rating below the highest selectivity of a college the student would likely be admitted given his or her qualifications" (p. 187). Often, students who enroll in two-year colleges – but possess the academic credentials that would warrant admission to a four-year institution – are automatically considered an undermatch. Conversely, a student is considered an overmatch if enrolled in a four-year college with a selectivity rating above the highest selectivity of a college the student would likely be admitted given his or her qualifications.

Degree Completion

In simple terms, degree completion, a key indicator of the scope and performance of the higher education system, occurs when a student has earned a college degree (Hauptman, 2012). It is, however, closely related, but different from higher education and degree attainment. The degree completion pipeline is inclusive of high school completion, the college choice process, college enrollment, and persistence to degree. Extending the path further, higher education attainment follows degree completion and Hauptman (2012) notes it is best understood as a pipeline in which attainment rates are the product of high school graduation, higher education participation, and higher education completion. Unlike participation and completion rates, examining attainment rates allows for comparisons and differentiation between bachelor's and

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sub-bachelor's programs (Hauptman, 2012). When examining degree completion, it is important

to distinguish between the different terminologies associated with these student outcomes. For

this proposed study, degree completion is defined as completing a bachelor's degree program.

This study exclusively focuses on first-time, full-time students enrolled at institutions awarding

at least a bachelor's degree.

Student-College Match

As it is currently examined, student-college match is a relatively new phenomenon in the

literature, but with roots to Affirmative Action policy (Alon & Tienda, 2005; Hinrichs, 2014).

That is, as a result of Affirmative Action policy, admissions practices were examined to

determine if students admitted to an institution were considered a "match" or "mismatch". The

following sections present an overview of the determinants of student-college match as

documented in existing literature. In addition, existing student-college match data sources and

methodology are presented, with an emphasis on data source, institutional selectivity

determination, admissions likelihood, and match estimation.

Determinants of Student-College Match

Existing student-college match research examines the determinants and the extent of the

student-college match phenomenon, with an overwhelming focus on undermatch. With

conceptual and empirical foundations in postsecondary choice, prior studies have identified

significant factors that influence student-college match – particularly revolving around students'

demographic and socioeconomic characteristics. The following sections present the three

overarching categories of determinants associated with student-college match, including: 1)

demographic and socioeconomic characteristics; 2) college-related attitudes and expectations; and 3) admissions-related activities.

Demographic and socioeconomic characteristics

Among the most prevalent factors found to determine student-college match, demographic and socioeconomic characteristics are critical. Primary determinants include socioeconomic status (including family income, parental occupation and education), race/ethnicity, and native language. A nationally-representative comparison of lower-socioeconomic students and higher socioeconomic students revealed that students from lower socioeconomic backgrounds undermatched at four-year institutions 49.6 percent of the time, whereas students from higher socioeconomic backgrounds undermatched at four-year institutions 34 percent of the time (Smith et al., 2012). When examining race/ethnicity, Roderick et al. (2008) found that after controlling for demographic, academic, and high school characteristics, Latino/a students undermatched at a higher rate than students from other races/ethnicities. Roderick et al. (2011), however, confirmed prior studies' findings that after controlling for achievement and family income, Black students were more likely to graduate from high school and attend college (Kane, 1999; Manski & Wise, 1983; Rumberger, 1983). Regarding native language, Callahan and Humphries (2016) found that among high-achieving English learner students, only immigrant students who were not in English as a second language (ESL) had an advantage.

College-related attitudes and expectations

When considering college-related attitudes and expectations, various topics emerge throughout the literature. Of utmost importance are factors related to high school course selection, AP/IB course participation, SAT/ACT achievement, and high school grade point

average. Within the literature, one of the most significant predictors of degree persistence is college prep courses in high school (ACT, 2007; Bowen et al., 2009). Adelman (2009) found a rigorous high school curriculum to be particularly critical in ensuring initial persistence beyond a student's first year and ultimately to bachelor's degree completion – more so than college entrance exams such as the SAT or ACT. Specifically, students completing higher level math course in high school were found to have the most success in college and a strong predictor of eventual degree completion (Adelman, 1999). Moreover, Adelman (2006) found that when examined together, socioeconomic status and high school academic resources strongly predicted completion. Specifically, students in the lowest socioeconomic quartile with lower quality academic programs were least likely to persist to graduation (Adelman, 2006).

In addition to a rigorous high school curriculum, students participating in AP/IB courses are often perceived as having an advantage during the college search and application phases. For many years, the AP/IB program was often reserved for the academic elite and focused on specific content areas. In recent years, secondary schools have expanded AP/IB programs to include a range of content areas and include a range of achievement backgrounds (Kelley-Kemple, Proger & Roderick, 2011). Few studies, however, are able to determine the extent to which participating in an AP/IB program benefits the college search process – primarily due to sampling issues and the ability to draw causal inferences (Kelley-Kemple et al., 2011). However, using advanced analytic techniques and data from the Chicago Public Schools, Kelley-Kemple et al. (2011) suggest that AP match and science courses have a significant positive relationship with college outcomes.

Adelman (2006) used NELS 1988/2000 data and found the quality of a student's high school curriculum was more influential than standardized college-entrance scores (SAT or ACT)

for predicting successful completion of the first year of college. Similarly, Bowen et al. (2009) also found high school grades as a far better predictor of both four-year and six-year completion rates than SAT and ACT test scores. DeAngelo et al. (2011) found that pre-college achievement has a large effect on future degree completion, but only students with A/A+ grades have a graduation rate above 50 percent. Further, as students grade point averages decrease, starting as early as A-, the likelihood of degree completion drops when compared to A/A+ students (DeAngelo et al., 2011). Specifically, Adelman (2006) noted that the completion of higher level math courses while in high school was particularly significant and had the greatest effect on college readiness and eventual degree completion. In addition to the quality of high school instruction and course offerings, Adelman (2006) noted the combination of socioeconomic status and high school resources (particularly academic quality) were strongly related to degree completion.

Admissions-related activities

Existing literature emphasizes that enrollment in postsecondary education, particularly at the baccalaureate level, requires that students engage in many precollege activities related to the college search and application processes (Belasco & Trivette, 2015; Tierney & Venegas, 2006). Belasco and Trivette (2015) found that when students visited a school counselor, completed a FAFSA, and submitted an increased number of admissions applications, the likelihood of undermatch decreased.

Existing Student-College Match Data Sources and Methodology

Although studying student-college match is an emerging practice, data sources and methods have widely varied across existing studies. Typically, prior studies examining student-

college match, primarily undermatch, stress that the identification of a student-college match (matched, undermatched, or overmatched) is made after determining the highest level of selectivity for which a student is likely to gain admission (potential) and then comparing it to where a student enrolls (Rodriguez, 2015). This has been accomplished using various large-scale datasets – some nationally-representative and others not – to develop a student-college match estimation (Bowen et al., 2009; Roderick et al., 2011; Smith et al., 2012). The following sections present existing datasets, selectivity definitions, and methodologies employed by prior student-college match studies.

Data

The majority of recent student-college match studies primarily draw data from either the National Center for Education Statistics' (NCES) Education Longitudinal Study of 2002 (ELS:2002) or the earlier National Education Longitudinal Study of 1988 (NELS) (Smith et al., 2012). The ELS:2002 is a newer, nationally-representative, longitudinal study of 10th graders in 2002, with subsequent follow up surveys in 2004, 2006, and 2012 (8 years following high school graduation). The ELS:2002 primary focus is examining students' trajectories from the beginning of high school into postsecondary education, the workforce, and beyond (NCES, 2015).

Researchers from the Consortium on Chicago School Research at the University of Chicago (Roderick et al., 2006, 2008, 2009, 2011) used Chicago Public Schools (CPS) data from 2005 and examined Chicago students and their postsecondary attendance at Illinois institutions – with a focus on student-college match. The CPS dataset is composed of 2005 Chicago graduates, including a large population of low-income, minority populations. Roderick et al. (2011) predominantly relied on four sources of data: (1) official school records, including transcripts, ACT scores (required to be taken by high school juniors in Illinois), and demographic

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data; (2) 2004 and 2005 SEQ data; (3) 2005 CCSR teacher and senior surveys; and (4) NSC college-tracking data.

Bowen et al. (2009) created a detailed, but not nationally-representative, sample that primarily included 125,000 members of the 1999 entering cohort at 21 prestigious research-intensive flagship universities. The 21 universities were selected as they were geographically diverse, contained a desirable level of racial composition, and were of varying selectivity (based on the average SAT/ACT score of enrolled students) (Bowen et al., 2009). In addition to the 21 prestigious research-intensive flagship universities, data on the 1999 entering cohorts at 47 four-year state systems of Maryland, North Carolina, Ohio, and Virginia were included (Bowen et al., 2009).

Determining institutional selectivity

While previous research generally defines student-college match similarly, there is little consistency or consensus regarding definitions of selectivity and estimates of student qualifications (Rodriguez, 2015). To determine higher education institutional selectivity, the majority of existing studies use Barron's Admissions Competitiveness Index with rankings ranging from most-selective to non-selective (Barron's Educational Series Inc., 2004). While most studies relied on some form of Barron's Index for clustering and ranking institutions, selectivity definitions vary across studies and are often based on relative sample institutions, with the exception of Smith et al.'s nationally-representative sample (Bowen et al., 2009; Roderick et al., 2011; Smith et al., 2012).

Table 2-1 provides a comparison of selectivity levels used in existing student-college match literature. Smith et al. (2012) and Roderick et al. (2011) determined selectivity ratings on

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a scale that included very selective, selective, somewhat selective, nonselective, and two-year college categories based on high-school GPA, SAT/ACT scores, and acceptance rates of applicants and enrollees. In another study, Bowen et al. (2009) categorized institutions in their sample as "Flagship and SEL (selectivity) A" and "SEL B" based on combinations of SAT scores and high school GPA as these were "objective measures and commonly used admissions criteria" in North Carolina (Bowen et al., 2009, p. 101).

Table 2-1. Selectivity rating definitions used in existing studies.

Barron's competitiveness index*	Barron's collapsed selectivity level**	Bowen et al. (2009) levels of selectivity***
Most competitive	Very selective	Flagship/SEL A
Highly competitive		
Very competitive	Selective	
Competitive	Somewhat selective	SEL B
Less competitive	Nonselective	
Non-competitive	Two-year college	
Special		

Notes: *Barron's Educational Series Inc. (2004). **Roderick et al. (2006, 2008, 2009, 2011) and Smith et al. (2012) levels of selectivity. ***Based on the selectivity of University of North Carolina Chapel Hill ranked most competitive and North Carolina State University ranked very competitive. SEL B are all other public four-year institutions (Bowen et al., 2009).

Aside from Barron's Admissions Competitiveness Index, other research has used median SAT and ACT scores as a measure of institutional selectivity (Dillon & Smith, 2013; Hoxby & Avery, 2012; Hoxby & Turner, 2013). Dillon and Smith (2013) created their own institutional quality index using mean SAT/ACT scores, percent of applicants who were denied admission, the average salary of instructional faculty, faculty-student ratio, open-access status, and whether the institutions reported SAT/ACT scores of incoming freshmen (Rodriguez, 2015). In similar studies, Hoxby and Avery (2012) and Hoxby and Turner (2013) used the median SAT score to determine whether high-achieving, low-income students' enrollments were matched with

applicable institutions. As discussed further in the limitations section of this review, the varying selectivity definitions employed by prior studies have implications for the determination of a student-college match.

Determining admissions likelihood

As part of a student-college match determination, researchers typically estimate a threshold for admission to each selectivity group based on a combination of college admissions predictors. The factors for defining academic qualifications and admissions likelihood vary widely across existing studies. Generally, the most frequently used academic ability indicators include standardized SAT/ACT scores, GPA, and advanced coursework (Bowen et al., 2009; Roderick et al., 2011; Rodriguez, 2015; Smith et al., 2012). Prior methodologies for estimating academic qualifications generally involve one of three methods, specifically: 1) predicted probability (Smith et al., 2012), 2) enrollment rate (Roderick et al., 2011), and 3) acceptance rate (Bowen et al., 2009).

To determine admissions likelihood, Smith et al. (2012) developed a predicted probability method using several logistic regression models, to create probability scores for each students' likelihood of admission across all selectivity levels using several student academic characteristic variables drawn from the nationally-representative ELS:2002 dataset. Smith et al.'s (2012) method produced estimates that accounted for several characteristics rather than GPA and standardized test scores alone (Rodriguez, 2015). Smith et al. (2012) used a 90 percent likelihood of admission as threshold for determining if a student would theoretically gain admission to each selectivity level. Unlike other methods, this approach did not warrant universal benchmarks (i.e. GPA or SAT thresholds) as admission estimates were predicted for all students at all selectivity levels (Rodriguez, 2015).

Roderick et al. (2006, 2008, 2009, 2011) developed an enrollment rate model to identify the likelihood of a student being admitted to an institution for each of their four selectivity levels. This method used the least amount of postsecondary enrollment student information (that is, only using GPA, SAT/ACT score, and enrollment) to define student qualifications. Roderick et al. (2006, 2008, 2009, 2011) assigned a selectivity to each square in the selectivity grid and identified the selectivity level in which students with each combination of GPA and ACT scores most frequently enrolled (Rodriguez, 2015).

Bowen et al. (2009) used a similar model to Roderick et al. (2006, 2008, 2009, 2011) that included standardized entrance exam scores and GPA to determine student eligibility for admission. Bowen et al. (2009) identified students as likely to gain admission if the combination of their SAT/ACT score and GPA yielded 90 percent acceptance rate at the most selective institutions (Rodriguez, 2015). Bowen et al. (2009) also used an admissions grid that contained GPA and SAT scores to calculate the acceptance rate for each selectivity level throughout the matrix. Bowen et al. (2009) assigned a selectivity level to each square on the grid by identifying the most selective level with an acceptance rate greater than 90 percent.

Determining student-college match

Following the definition and construction of selectivity and academic qualification elements, the final methodological step of the student-college match indicator process in prior studies is the determination of a student-college match. For many existing studies (Bowen et al., 2009; Roderick et al., 2006, 2008, 2009, 2011; Smith et al., 2012), undermatch is the only outcome measured, and is made after evaluating if the student enrolled in a college selectivity that is below the college selectivity to which their credentials would permit them access. Generally, prior studies compare the selectivity of actual institution a student enrolled to the

selectivity level where a student's credentials would likely warrant admission (potential) – the result being a determination of student-college match.

Theories and Models for Studies on Degree Completion

Braxton (2000) notes there is a great deal of research related to student persistence, attrition, and degree completion, but there is no single overarching theory prevailing in the literature. Rather, there are many theories and models that focus on particular aspects of student outcomes (Noel-Levitz, 2008; Pascarella & Terenzini, 2005). As theoretical frameworks and conceptual models are mutually dependent, the following section of the literature review examines both theories and models for student-college match and degree completion.

For this review, Tinto's theory of integration is first presented as this study seeks to argue that student-college match can be viewed as a measurement for integration. An overview of college impact models is then presented, with a particular focus on Astin's I-E-O and Weidman's undergraduate socialization models. To further expand this study's theoretical and conceptual understanding, Cabrera, Castaneda, Nora, and Hengstler's (1992) ability to pay model integrates financial aid as a predictor of persistence and degree completion.

Tinto's Theory of Integration

While no existing theory or model specifically examines academic match and a student outcome such as degree completion, examining Tinto's (1987, 1993) theory of integration was considered when developing this study's framework. Generally, Tinto's theory of integration (1993) seeks to explain the motivation behind a student's decision to leave a postsecondary institution prior to degree completion. According to Tinto (1993), student departure is primarily

motivated as a result of interactions between a student and the institutional environment

(inclusive of social and academic components). Given that the determination of an academic

match for this study was based on: 1) institutional selectivity and 2) the predicted probability of

admission given several student-level determinants – clustered around demographic and

socioeconomic characteristics, college-related attitudes and expectations, and admissions related

activities, Tinto's theory was applicable to academic match it can be viewed as a measurement or

natural extension of integration.

Tinto (1993) asserted that students are more likely to become integrated in college if they

become connected to the social and academic life of their institution. Students who are actively

involved within the institution and become integrated with the campus community, by

developing connections with individuals, participating in campus organizations, or engaging in

academic activities, are more likely to persist than those who remain on the outskirts. For those

students on the periphery, *incongruence*, or a lack of institutional fit, and *isolation*, or failing to

engage in social interactions, may lead to a lack of integration (Tinto, 1993). That is, students

that do not feel comfortable at an institution, do not believe the institution is beneficial to

meeting their goals, and do not make social connections are not likely to persist to degree

completion.

Tinto clarified that student integration into an institution occurs along two dimensions –

the academic and the social – and both formally and informally (Tinto, 1993). Academic

integration occurs when students become engaged with the intellectual and academic rigor of the

institution, whereas social integration occurs when students foster relationships and establish

connections outside of the classroom (Karp, Hughes & O'Gara, 2008). While these two

concepts are independent of each other, Tinto (1993) found them to interact and enhance one

another. For students to maximize their likelihood of integration, and therefore persistence and degree completion, both the academic and social dimensions must be satisfied. Astin (1984), however, noted that the academic and social dimensions do not require equal emphasis for students to be fully integrated into an institution.

College Impact Models

In an extensive review of empirical research related to higher education student outcomes, Pascarella and Terenzini (1991, 2005) identified a group of conceptual models as "college impact models" (2005, p. 52). The models reviewed by Pascarella and Terenzini are based on sociological traditions and primarily examine how college environments interact with students' experiences and how it results in change (Renn & Reason, 2013). These models are often rooted in Astin's I-E-O model (1970a, 1970b, 1991) and John Weidman's undergraduate socialization model (1989) and seek to explain the particular college experiences that predicate student growth and learning. A majority of college impact models have been used in studies related to student retention, but are also often used to study additional college student outcomes, including degree completion.

College impact models offer insight into environmental and sociological origins of change in college students associated with student persistence and ultimately degree completion (Pascarella & Terenzini, 2005; Renn & Reason, 2013). In Pascarella and Terenzini's (1991, 2005) extensive review, college impact models are identified as relying heavily on student actions, thoughts, institutional structures, policies, programs, services, and the attitudes, values, and behaviors of others who occupy institutional environments. Pascarella and Terenzini (1991, 2005) note college impact models are less specific than theories of individual development in their explanation of specific changes students undergo, but college impact models concentrate

more on the origins and processes of change. Similar to other theoretical frameworks and models, the sociological impact models also acknowledge the environment as an "active force" that contributes to a student's progress toward persistence and degree completion (Pascarella & Terenzini, 2005, p. 60). Moreover, college impact models note that change is influenced by not only whether and how the student responds, but also by the nature and intensity of the environmental stimulus (Pascarella & Terenzini, 2005).

Astin's I-E-O model

Astin's input-environment-outcome (I-E-O) model (1970a, 1970b, 1991) attempted to explain the effects of environmental influences (at either the individual- or aggregate-level) on student outcomes, with a particular focus on the factors for which college faculty and administration have some level of programmatic and policy control (Pascarella & Terenzini, 2005). The model suggests that to fully understand the factors related to college student outcomes, researchers must have an understanding of what qualities students bring to college and the environments within each institution.

Astin's I-E-O guides the study of college effects by evaluating outcomes as a function of three sets of elements – inputs, environment, and outcomes. Inputs relate to the demographic characteristics, family backgrounds, and academic and social experiences that students bring to college; environments relate to the full range of people, programs, policies, cultures, and experiences that students encounter in college; and outcomes relate to students' characteristics, knowledge, skills, attitudes, values, beliefs, and behaviors as college outcomes (Pascarella & Terenzini, 2005).

Astin (1985) found student involvement and established connections to be the most influential factors related to student change, development, and ultimately persistence to degree completion. His "theory of involvement" (Astin, 1985, p. 135-136) suggests five postulates:

1. Involvement requires the investment of psychological and physical energy in "objects," such as tasks, people, or activities

2. Involvement is a continuous concept – level of participation varies by the individual

3. Involvement has both quantitative and qualitative features

4. The amount of learning or development is directly proportionate to the quality and quantity of involvement

5. Educational effectiveness of any policy or practice is related to its capacity to induce student involvement

With regard to academic involvement, the primary measures include time spent on academic studies and tasks, and the development of higher cognitive skills, such as understanding, application, analysis, synthesis, and evaluation (Noel-Levitz, 2008). Co-curricular involvement includes participation in campus activities, academic organizations, honor societies, and other social clubs. From Astin's (1985) perspective, connection refers to bonds across the campus community – including peers, faculty, and administration – and embodying institutional values (Noel-Levitz, 2008).

Although Astin's I-E-O model offers higher education faculty and administrators the conceptual and analytic underpinnings related to student growth and change, its validity as a theory has been questioned (Kerlinger, 1986). Instead of offering a detailed, systemic description of the behaviors being predicted or specific variables believed to be factors in student change, Astin offered general dynamics or principles to guide the search (Pascarella & Terenzini,

2005). While it is generally less a theoretical treatment of student outcomes, Astin's I-E-O is

methodologically- and conceptually-grounded (Renn & Reason, 2009). Thus, the framework is

often used as the methodological and conceptual foundation of many college impact models

(Renn & Reason, 2013).

Weidman's Undergraduate Socialization Model

Incorporating both psychological and social-structural influences on student change,

Weidman's model of undergraduate socialization (1989) emphasized the noncognitive changes,

including lifestyle preferences, values, and aspirations, associated with student change,

persistence, and degree completion (Renn & Reason, 2013). The model is particularly helpful

for understanding the effects of campus environments on college student outcomes. Rooted in

sociology, Weidman's model is heavily influenced by his own research as well as research by

Chickering (1969) and Astin (1977, 1984). The model explicitly outlines the process of college

student socialization, specifically addressing the acquisition of knowledge, attitudes, and skills

that are valued by society (Pascarella & Terenzini, 2005).

Weidman makes several critical hypotheses related to undergraduate socialization. First,

he believes that students bring important background and demographic characteristics, including

socioeconomic status, academic ability, career goals, aspirations, and values, to college.

Additionally, students bring "normative pressures" to college settings from parents and other

related groups, including peers, employers, and community (Pascarella & Terenzini, 2005, p.

58). Collectively, these characteristics and forces establish predispositions and constraints on

students' choices in the college setting (Weidman, 1989). Second, Weidman predicted critical

external, noncollege influences on students, including parents, peers, current and potential

employers, and community organizations (Pascarella & Terenzini, 2005; Weidman, 1989).

Lastly, according to Weidman, the socialization process allows students to realize aspirations by carefully evaluating and balancing various normative influences (Weidman, 1989).

As it relates to degree completion, Weidman's socialization model incorporates the influence of college contexts on student outcomes. That is, Weidman focused on the pressures that campus environments exert over students to conform to institutional missions and values (Renn & Reason, 2013). As a result of these influences, students either conform to these systems of values and the institutional environment (that is, become socialized) or remain isolated. Similar to Astin, Weidman believes increased socialization into the institutional environment will yield positive outcomes, including ultimate degree completion (Renn & Reason, 2013). Moreover, the college experience components, including the organizational context, peer environment, and individual student experiences, often found in college impact models are rooted in Weidman's model.

Cabrera, Stampen, and Hansen's Ability-to-Pay Model

While Tinto's theory of integration acknowledged financing as a contributor to persistence, the specific role of financial aid is not stressed. Cabrera, Stampen, and Hansen (1990) combined Tinto's theory with the economic rationale for providing student subsidies on a need-basis to establish their ability-to-pay model (Chen, 2007). Cabrera et al. (1990) define ability to pay as students' satisfaction regarding the cost of attendance and their socioeconomic status. Cabrera et al. (1990) found that a student's ability to pay is a critical component related to student persistence and eventual degree completion, but also operated on the assumption that a student's ability to pay indirectly tempers the effects of commitments, academic performance, and institutional variables (Chen, 2007). Further, Cabrera et al. (1990) found that ability to pay moderates the effects of student motivational variables on the likelihood to persist to degree

completion (Chen, 2007). A later version of the model, created by Cabrera, Castaneda, Nora, and Hengstler (1992) found that finances increase the likelihood of persistence to degree completion because of their "role in increasing cost-related benefits while at the same time, finances facilitate the social and academic integration of the student on campus, which in turn reduces students' intentions to leave" (Chen, 2007, p. 25).

Thus far, this review of the literature has provided an overview of student-college match, a detailed synthesis of prior methodological approaches for estimating student-college match, and a summary of existing theories and conceptual models related to degree completion. In the following sections, the review continues its focus on degree completion by clustering the determinants of degree completion and examining the relationship between student-college match and degree completion.

Determinants of Degree Completion

The following section of the literature review incorporates elements of theoretical and conceptual frameworks and previous studies associated with degree completion. With roots in Tinto's Theory of Integration, factors presented are measured at the student level and are clustered, including 1) demographics; 2) aspirations; 3) pre-college achievement; 4) postsecondary achievement; 5) postsecondary engagement; 6) financial; and 7) institutional.

Student Background Characteristics

Students enrolling in higher education institutions have varying demographic and background characteristics (Reason, 2009). The majority of existing research indicates socioeconomic status, race/ethnicity, and gender as significantly related to educational

attainment (Peltier, Laden, & Matranga, 1999; Reason, 2013). Pascarella and Terenzini (1991, 2005) found that socioeconomic status and income background remain significantly related to persistence and eventual degree completion after controlling for gender, race, and ethnicity.

Socioeconomic status

In an ACT report (2004), it was found that students' socioeconomic status was the second most powerful predictor of degree completion, beyond high school grade point average, even when controlling for many other demographic factors. Using data from the NELS 1988/2000, Bowen et al. (2009) found that even among students at four-year institutions, lower-socioeconomic students are significantly less likely than higher socioeconomic students to earn a bachelor's degree by age 26. Moreover, completion rates ranged from nine percent for the least advantaged group to 68 percent for the most advantaged group (Bowen et al., 2009). Similarly, using data from the Beginning Postsecondary Students Longitudinal Study of 2004-09 (BPS:04/09), just 13.6 percent of students in the lowest socioeconomic group attained a bachelor's degree; compared to 52 percent from the middle socioeconomic group and about 34.4 percent from the highest category (NCES, 2016a).

Race/ethnicity

With regard to race, Reason (2009) found that Asian and White students often persist at higher rates when compared to underrepresented minority groups, or African American, Hispanic, and Native Americans. Other studies, however, found that after controlling for important demographic variables, primarily socioeconomic status, racial differences disappear or are reversed, indicating that differences in income or preparation might be at the root of differences in completion and ultimately attainment (Hu & St. John, 2001). This disparity is of

utmost concern to this study as both student-college match, degree completion, and the relationship between the two are being considered. Using a national dataset, Leppel (2002) found race and situational variables, like marriage and number of children in a household, affected the persistence and completion of men and women differently. In addition to race/ethnicity, a prior study by Garnett (2010) identified covariate-adjusted results indicating native language is related to timely completion at the baccalaureate level.

Gender

Regarding gender, completion rates for males plateaued in the 1980s, but females have steadily increased (Bowen et al., 2009). In the 2013-14 academic year, 57.2 percent of bachelor's degrees were conferred to females, whereas between 1999-2000, 57.5 percent of bachelor's degrees were awarded to females (NCES, 2016b). There are slightly more significant gender variations, however, when examining differences across race and ethnicity. In the 2013-14 academic year, among female students, Black students were awarded 11.5 percent and Hispanic students were awarded 11.4 percent of the bachelor's degrees (NCES, 2016b). Comparatively, among female students in 2013-14, White students earned 63.9 percent of the bachelor's degrees (NCES, 2016b). Moreover, Bowen et al. (2009) note similar differences among African American male and female students. Of those students in Bowen et al.'s (2009) sample that attended a four-year institution and received a bachelor's degree by age 26, the attainment rate of African American females is almost twice that of African American males. In the same study, more Hispanic males graduated high schools and enrolled in college, but Hispanic females had a higher completion rate than their male counterparts (Bowen et al., 2009).

Aspirations

During the college search and application process, students are faced with several thoughts regarding future postsecondary attendance and the concept of college aspirations emerges. Engberg and Wolniak (2010) examined the effects of high school contexts on postsecondary enrollment and measured student's cultural capital – inclusive of a student's aspiration to continue their education beyond high school. Engberg and Wolniak (2010) found that student aspirations, including perceptions from family and friends, significantly predicted college enrollment and persistence for students seeking admission to four-year institutions. Similarly, Cooper (2009) found that while aspirations of postsecondary enrollment can vary throughout high school, student aspirations in the 10th grade were a significant predictor of aspirations in the 12th grade, even when controlling for all other variables. As it relates to student-college match, Belasco and Trivette (2015) found that increased aspirations of postsecondary attainment resulted in increased college matching. That is, students expecting to earn a four-year or graduate degree were less likely to underamtch (Belasco & Trivette, 2015).

Pre-College Achievement

Similar degree completion results are seen as a result of standardized test performance. DeAngelo et al. (2011) found that 62.2 percent of students with SAT total scores of 1300 or higher graduate within four years. For students that score just 100 points lower, degree completion rates fall to 51.9 percent within four years (DeAngelo et al., 2011). Of utmost importance, Bowen et al. (2009) found that standardized test performance (as compared to high school grade point average) is less likely to predict degree completion after six years.

Postsecondary Achievement

When examining four-year degree completion, prior research stresses the importance of grade point average – specifically during the first year – and academic major as predictors of future success. Similar to pre-college achievement, student achievement while enrolled in college is related to eventual degree completion (Gershenfeld, Hood, & Zhan, 2016). Specifically, a student's GPA following the first year is found to be indicative of future persistence and eventual degree completion. Flynn (2013) found that a student's first-year college grade point average had a strong positive association with persistence and later degree completion.

Regarding individual student experiences, curricular experiences include students' coursework patterns, choice of academic major and minor, and involvement with internships, cooperative education, or study abroad experiences (Reason, 2009). Prior research indicates students' academic major and course selection are key factors related to degree completion, but their relevance varies by academic program. In several existing studies, students enrolled in science, technology, engineering, and mathematics (STEM) fields were found to be more likely persist and complete their degree when compared to students majoring in education or the social sciences, after controlling for all other factors (Adelman, 1999; Leppel, 2002; Pascarella & Terenzini, 2005).

Postsecondary Engagement

From an academic campus climate perspective, students' peer environments related to academics influenced virtually all student outcomes, including degree completion (Astin, 1993). Reason (2009) noted little literature and research exists that links student academic peer

environments specifically to student outcomes, but rather it links student peer environments to student behaviors presumed to be related to persistence and degree completion.

Academic engagement

From a student perspective, individual experiences are a critical component of degree completion. Terenzini and Reason (2005) strongly argued that students' experiences during college are significantly related to student outcomes, particularly degree completion. Much of the existing research groups student experiences into three primary areas, including curricular experiences, classroom experiences, and co-curricular experiences. The following section of the literature review presents each of these individual student experiences and its relationship with degree completion.

Regarding early college experiences, Cuseo (2007) researched first-year seminar programs and student persistence and found that first-year seminar participation positively influenced students' persistence between the first and second year of college, and ultimately to degree completion. While tangentially related to degree completion, Pascarella and Terenzini (2005) studied developmental and remedial programs and found these programs helped increase student persistence in the early years of college, but the relationship with eventual degree completion was not significant.

Classroom experiences. In theory, Tinto (1993) suggested classroom experiences are closely related to persistence and eventual degree completion via academic integration. In practice, however, existing empirical research regarding the link between students' in-class learning experiences and graduation is scarce. Braxton et al. (Braxton, 2008; Braxton, Bray, &

Berger, 2000; Braxton, Milem, & Sullivan, 2000) sought to understand the relationship between classroom experience and social integration with persistence and attainment.

Following Tinto's (1993) theory, Braxton et al. (2000) found both direct and indirect relationships between in-class experiences, social integration, and students' intent to persist to graduation (Reason, 2009). In particular, Braxton et al. (2000) identified links between positive teacher behaviors, including clarity and logically presented course material, and student persistence. Moreover, Braxton et al. (2000) found active classroom discussion to be a factor related to increased persistence. The same study found instruction involving "passive pedagogy" to have a negative relationship (Reason, 2009, p. 673). Pascarella, Seifert, and Whitt (2008) examined student exposure to organized and clear faculty instruction and found a positive, direct relationship with persistence, specifically from the first to second year of college, but also to eventual degree attainment.

Social engagement

Terenzini and Reason (2005) argued a student's peer environment includes the dominant and normative values, beliefs, attitudes, and expectations that characterize a campus' student body. From a student perspective, the peer environment is often characterized by feeling a "sense of place" that includes what others in the social and academic campus community value and expect from a behavioral perspective (Terenzini & Reason, 2005). Braxton, Milem, and Sullivan (2004) extended Tinto's initial student departure theory to account for the role of social interaction in student persistence and eventual degree completion. In a study involving student persistence and degree attainment, Braxton and Lee (2005) found social integration and institutional commitment to be significant predictors.

While the language for student involvement has evolved, including terms like involvement and integration, the recent literature suggests researchers refer to the extent to which students have invested themselves in college life and activities as *engagement* (Kuh, Kinzie, Schuh, & Whitt, 2005). Reason (2009) found much research indicated a positive relationship between out-of-class engagement and persistence, specifically noting, "the greater the student engagement in college, as measured by time and effort put into educationally purposeful activities, the more likely the student will graduate" (p. 674). Astin (1993) found that the time a student spent preparing or studying for a particular class, also a measure of academic engagement, had a strong, positive relationship related to persistence to graduation. While several factors, including positive interaction with faculty outside the classroom and participation in educationally-purposeful student academic groups, are found to positively impact persistence and attainment, the direction and strength of involvement in general student groups, including fraternity and sorority life, and organizations is mixed and indirect (Pascarella & Terenzini, 1991, 2005).

Financial

The literature examining financial aid and college access and choice is well developed – often focused on need-based programs and emphasizing the positive impact financial aid has on the likelihood of postsecondary enrollment. However, the literature examining the effects of financial aid on college outcomes is less robust (Bettinger, 2012). Most notably, the majority of research focuses on need-based programs. Bettinger (2012) found that a $1,000 increase in aid generally improves retention by 3.6 percentage points. Moreover, Pell Grants increase students' persistence during their first year of college, that is, a $1,000 increase in Pell Grant awards leads to a 3 percent increase in persistence in a student's first year in college (Bettinger, 2012).

Using a randomized experiment in Wisconsin, Goldrick-Rab, Kelchen, Harris, and Bensen (2016) increased aid to some students after their initial enrollment in a postsecondary institution in an effort to examine the effects of need-based awards on students' outcomes. Goldrick-Rab, Harris, and Trostel (2009) found the first two years of the additional aid had no effect on persistence, but after receiving the grant for two years, students were more likely to have completed 60 credits. Despite its importance, little research exists that directly links current federal financial aid policies and degree completion.

Institutional

Existing research indicates disparities exist in degree completion when accounting for institutional control and urbanicity. While prior research suggests that a majority of the difference in degree completion rates between public and private institutions can be attributed to the differing characteristics of the enrolled students, institutional control remains a significant predictor of eventual degree completion (Scott, Bailey & Kienzl, 2006). Private universities generally have the highest four-year completion rates, whereas public four-year institutions have the lowest. This is particularly apparent when examining institutions by selectivity and control – the more selective the private institution, the higher the completion rate (NCES, 2015).

When examining degree completion within six years, the different in graduation rates between public and private institutions appears to shrink considerably, but private institutions generally retain and graduate more students that initially matriculate at the institution (DeAngelo, Franke, Hurtado, Pryor, & Tran, 2011). By the sixth year, however, public institutions generally have a degree completion rate comparable than all types of private institutions (DeAngelo et al., 2011).

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In addition to institutional control, urbanicity, or whether a student is from a rural, suburban, or urban location, research indicates rural settings (as compared to urban settings) are more often associated with undermatching (Smith et al., 2012; Roderick et al., 2011). Smith et al. (2012), however, found the coefficient for rural high schools to not be statistically different than zero, "implying that high school location is not a good predictor of substantial undermatch" (p. 255).

Student-College Match and Degree Completion

While no empirical research was found that specifically examined student-college match and a student outcome such as degree completion, there is a body of literature examining college selectivity or quality (a critical factor associated with making an academic match determination) and degree completion (Cohodes & Goodman, 2012). Much of this research, however, primarily focuses on the community college sector, and often presents conflicting conclusions regarding access to and quality of community colleges and its relationship with degree completion (Rouse, 1995; Leigh & Gill, 2003; Sandy et al., 2006; Calcagno et al., 2008; Stange, 2009; Reynolds, 2012). Throughout the existing literature, from a methodological perspective, the primary challenge associated with estimating the relationship between college quality or selectivity and degree completion is the non-random selection of students into institutions of different quality (Cohodes & Goodman, 2012).

Using a Massachusetts merit aid program to examine the relationship between college quality and completion rates, Cohodes and Goodman (2012) drew three conclusions: 1) students have a poor understanding of the importance of college quality, especially when measured by on-

time graduation rates; 2) students are willing to forego college quality for relatively small amounts of grant or scholarship funding; and 3) choosing a lower quality (selectivity) institution significantly lowers on-time completion rates. The latter finding is of particular interest to this study as Cohodes and Goodman (2012) found the decrease in on-time graduation rates across institutions was primarily driven by high-performing students attending lower quality institutions who would otherwise have attended an institution of more quality or higher selectivity. To examine the impact of college quality on completion, Cohodes and Goodman (2012) use scholarship eligibility (the Adams Scholarship – a Massachusetts merit aid program) as an instrument for different measures of college quality. For a marginal student induced by the scholarship attending an in-state public college, the probability of graduating on time decreased by 26 percentage points, or more than 40 percent (Cohodes & Goodman, 2012, p. 17). Similarly, for a marginal student induced to forego a most or highly competitive college, attending such an institution would have increased the probability of graduating on-time by 75 percentage points (Cohodes & Goodman, 2012). While Cohodes and Goodman's (2012) study provides a critical link between institutional quality/selectivity and on-time completion rates, it is important to stress that institutional quality was defined by a variety of measures, but most notably on-time graduation rates.

<div align="center">Summary and Critique of the Literature</div>

The prior research reviewed makes numerous assumptions related to student-college match and its relationship with degree completion and is subject to several limitations, including: 1) the lack of student-college match studies examining student outcomes; 2) the lack of an existing student-college match theoretical framework or conceptual model; 3) inconsistent

definitions and determinations of institutional selectivity and admissions academic

qualifications; 4) challenges associated with estimating student-college match; and 5) limited

data. The following sections briefly summarize these concerns.

Lack of Student-College Match and Student Outcomes Research

The existing student-college match research examines the extent of the one facet of the

phenomena, specifically undermatch, with a nationally-representative study indicating nearly 40

percent of students undermatch (Smith et al., 2012). Prior studies do not, however, examine the

relationship between a student-college match estimation and a student outcome, such as degree

completion. Further, existing studies do not examine the extent to which the non-undermatched

students attend either an institution considered a match or an overmatch. By examining the

extent of all three student-college match scenarios and its potential relationship with degree

completion, this study seeks to expand the literature related to college choice and student

outcomes. Thus, this literature review suggests that future research address this shortfall by

using a nationally-representative data source to derive a student-college match and include it as a

focal factor predicting degree completion.

Lack of Theoretical Framework or Model

One of the primary issues associated with existing academic match studies, evident by the

studies presented in this review, is the lack of foundation in an established, empirically-based

student-college match theoretical framework or model. Several theoretical frameworks and

conceptual models, however, exist for student persistence and degree completion. A theoretical

framework and conceptual model, however, for examining student-college match does not

specifically exist, but Tinto's theory of integration as a foundation of an expanded model is

promising. To that end and in response to the lack of an established model, this study proposes a comprehensive framework grounded in existing theories and models, but with the inclusion of additional determinants found to be significant in related academic match and degree completion studies.

<p style="text-align: center;">*Inconsistent Institutional Selectivity and Admissions Qualifications Definitions*</p>

Within the examined body of literature, there is little consistency regarding selectivity definitions and estimations of student academic qualifications and subsequent admissions likelihood estimates (Rodriguez, 2015). Prior studies have used various definitions of institutional selectivity and their subsequent eligibility requirements in different ways and used datasets with differing populations. As a result of the inconsistent institutional selectivity and admissions qualifications definitions across studies, existing academic match studies have found varying levels of academic match.

The majority of existing academic match studies rely on the Barron's Admissions Competitiveness Index to determine institutional selectivity levels. Prior studies vary, however, in their application and use of the Barron's Admissions Competitiveness Index. Due to "thinness of data and for ease of interpretation," Smith et al. (2012) and other studies have re-categorized the Barron's groups and essentially combined most- and highly-competitive institutions as a very selective ranking, retained the very competitive ranking, retained the competitive ranking, and combined less competitive and noncompetitive as a nonselective ranking (p. 250). In a study regarding conceptual issues regarding undermatch estimation, Bastedo and Flaster (2014) note the ambiguous and fluid nature of institutional selectivity, particularly among less selective institutions.

Regarding academic qualification and an admissions likelihood determination, existing research varies significantly. Smith et al. (2012) used four criteria, including honors-weighted GPA, SAT or ACT scores, and whether the student participated in an AP or IB program, from the ELS:2002 to determine a student's academic credentials. Smith et al. (2012) noted there are several other predictors available, but many are correlated with the measures used in their model and the academic credential variables used are the primary predictors of a students' likelihood of being admitted by an institution. Rodriguez's (2015) study, however, also used the ELS:2002 dataset, but added several academic credential predictors, many of which account for underrepresented students' lack of formal academic predictors, such as SAT or AP/IB participation. For Smith et al. (2012) the choice of academic credentials predictors has implications for the precision of their probability estimates for determining admissions likelihood at each selectivity level. Depending on the academic credentials used in a model, if qualifications for admission into selectivity levels is too narrow, a determination of an academic match will be underestimated, whereas lax definitions may result in higher academic match rates (Rodriguez, 2015).

Similarly, the variation in the admissions qualification definitions has implications, particularly for historically disadvantaged groups. One study using ELS:2002 found African American students were less likely to undermatch than White students (Smith et al., 2012), yet a study using Chicago Public Schools data found no difference between African American and White students likelihood to undermatch (Roderick et al., 2011). The inclusion of some predictors, including academic program track participation and advanced coursework completion, in the admissions likelihood determination can yield skewed academic match results, particularly for historically disadvantaged groups (Adelman, 2006; Bell et al., 2009;

College Board, 2012). Rodriguez (2015) notes, "the use of GPA and SAT/ACT score benchmarks may adversely impact African American, Latino, low-income, and potential first-generation students and may not reflect other considerations given in the admissions process, particularly at selective institutions" (p. 6). Rodriguez (2015), however, found that by including additional academic credential predictors and by using multiple imputation of the ELS:2002 dataset to account for missing academic credentials, the predicted probability approach for measuring admissions likelihood increased Latino student representation to 11.1 percent of the students qualified to attend the most selective institutions, whereas just 1.6 percent were qualified using the acceptance rate method.

Challenges Associated with Estimating Student-College Match

While the existing academic match research indicates the phenomena is pervasive, Rodriguez (2015) notes regional differences embedded in the college choice process are a challenge for student-college match studies. Rodriguez (2015) adds, the regional landscape of postsecondary institutions, the use of observed application data, and regional enrollment based on institutional-feeding behaviors (i.e. secondary schools channeling students to regional institutions) as problematic for estimating student-college match.

Almost all existing studies estimated student-college match, specifically undermatch, based solely on observed characteristics. As a result, students missing any required academic performance data, specifically standardized test scores, were removed from all reviewed samples, with the exception of Bowen et al. (2009). Rodriguez (2015) notes, this listwise deletion approach threatens external validity as underrepresented student groups participate in college entrance exam-taking less than their non-underrepresented counterparts. To remedy the missing academic performance data, imputing standardized exam scores could increase the

number of students for whom an academic match estimation can be estimated. Rodriguez (2015) adds, the addition of these students would increase the sample and provide a more robust understanding of academic qualification and academic match for students who did not complete standardized tests, but completed high school and continued their education at a four-year institution.

<div align="center">*Limited Data*</div>

While several of the most recent academic match studies used the longitudinal ELS:2002 dataset, the ELS:2002 dataset is not without limitations. Some primary concerns noted in existing studies using ELS:2002 relate to: 1) abbreviated questionnaires that covered fewer policy area for some base year and first follow-up respondents; 2) sampling issues associated with certain groups of individuals; and 3) many regional and vocational secondary schools were not included and students who may have attended a four-year institution would not have been surveyed. From a methodological perspective, many of the existing academic match studies examined in this literature review use ELS:2002 data and depend on the estimates of student access to varying selectivity levels. As a result of the various sampling procedures employed in prior studies, the effects of selection bias should be carefully considered.

<div align="center">Proposed Framework</div>

The existing theoretical approaches related to student-college match and degree completion provide a foundation for this study. Existing studies related to student-college match, however, are problematic as there is a lack of connection with an outcome, but also a lack of methodological consistency regarding an student-college match determination, specifically

related to institutional selectivity levels and the prediction of an admissions offer. Thus, two models, one for determining a student-college match estimate and another for degree completion, are warranted.

The synthesized student-college match model contains three overarching clusters of variables related to: 1) demographic and socioeconomic characteristics; 2) college-related attitudes and expectations; and 3) admissions-related activities. These variable clusters are used to derive the student-college match indicator, or the outcome variable. The comprehensive degree completion model that will include academic match as a focal predictor contains an outcome variable and seven overarching clusters of variables related to: 1) student background characteristics; 2) aspirations; 3) pre-college achievement; 4) postsecondary achievement; 5) postsecondary engagement; 6) financial; and 7) institutional. The following sections briefly discus how relevant variables from existing conceptual frameworks models are integrated into this study's two proposed synthesized models.

Student-College Match Indicator Model

Prior to deriving the student-college match indicator, a consistent approach for identifying institutional selectivity will need to be addressed. For this study's student-college match indicator model, the selectivity of institutions was determined based on the Barron's Admissions Competitiveness Index. The Barron's Index includes accredited "four-year colleges that grant bachelor's degrees and admit freshmen with no previous college experience" (Barron's Educational Series Inc., 2004). In 2004, Barron's selectivity levels were based on several criteria, including: 1) median entrance exam scores for the 2004-04 freshmen class; 2) percentage of 2003-04 freshmen scoring 500 and above and 600 and above on both the verbal and mathematics sections of the SAT or percentage of 2003-04 freshmen scoring 21 and above

and 27 and above on the ACT; 3) percentage of 2003-04 freshmen who ranked in the upper fifth

of their high school class and percentage who ranked in the upper two-fifths; 4) minimum class

rank and grade point average required for admission; and 5) percentage of applicants to the

2003-04 freshmen class who were accepted (Barron's Educational Series Inc., 2004).

Given the selection criteria, Barron's categorizes institutions into seven selectivity levels,

including: 1) Most competitive; 2) Highly competitive; 3) Very competitive; 4) Competitive; 5)

Less competitive; 6) Noncompetitive; and 7) Special. Table A-1 (located in the appendix)

includes the exact criteria, including thresholds for SAT, ACT, GPA, and class rank, used to

categorize institutions by selectivity level. Table 2-2 shows the total number of institutions by

selectivity level.

Table 2-2. Distribution of postsecondary institutions by Barron's Admissions Competitiveness Index selectivity level, 2004.

Selectivity category	Full Barron's Index	Collapsed Barron's Index
All combined	1,528	1,437
Most competitive	70	174
Highly competitive	104	
Very competitive	284	284
Competitive	633	633
Less competitive	239	239
Non-competitive	107	107
Special	91	

Source: Barron's Educational Series Inc. (2004).

Based on the existing literature, the process of creating a student-college match indicator

is multifaceted and includes several preparatory steps. This methodological process is fully

described in Chapter III, but an overview follows. First, to determine the highest selectivity to

which a student is eligible, four-year institutions attended were assigned a selectivity rating

based on the Barron's Admissions Competitiveness Index. This is referred to as the student's *enrolled selectivity level*. Second, a student's highest selectivity level for admission was identified using the proposed academic match model (see Figure 2-1). A predicted probability approach would be used to determine the likelihood of admission to each selectivity level, with the highest selectivity being noted as the student's *potential selectivity level*. Lastly, the student-college match indicator was derived to determine if a student overmatched (potential is lower than enrolled selectivity), matched (potential equals enrolled selectivity), or undermatched (potential is higher than enrolled selectivity). The following sections highlight the variables included in the proposed student-college match indicator model.

Demographic and socioeconomic characteristics

Demographic characteristics include gender, race/ethnicity, native language, urbanicity, dependent status, and socioeconomic status. Socioeconomic status is inclusive of parental income, parental education level, and occupation. By adding demographic characteristics, background effects can be controlled when assessing the influence of other variables in the model. The demographic and socioeconomic characteristics precede the model's other variables.

College-related attitudes and expectations

To best predict a student-college match, students' college-related attitudes and expectations should be fully considered – ranging from academic achievement to extracurricular activities. Achievement-related variables in this model include highest high school level math course completed, number of AP/IB courses, high school grade point average, college application activity, and the ELS cognitive test.

Admissions-related activities

The literature reiterates the importance of engaging in relevant activities related to the postsecondary admissions process. Admissions-related activity determinants include guidance counselor interaction, teacher interaction, peer interaction, parental interaction, college publication/website usage, college representative interaction, use of college search guides, and FAFSA completion.

Figure 2-1. Student-College Match Proposed Model.
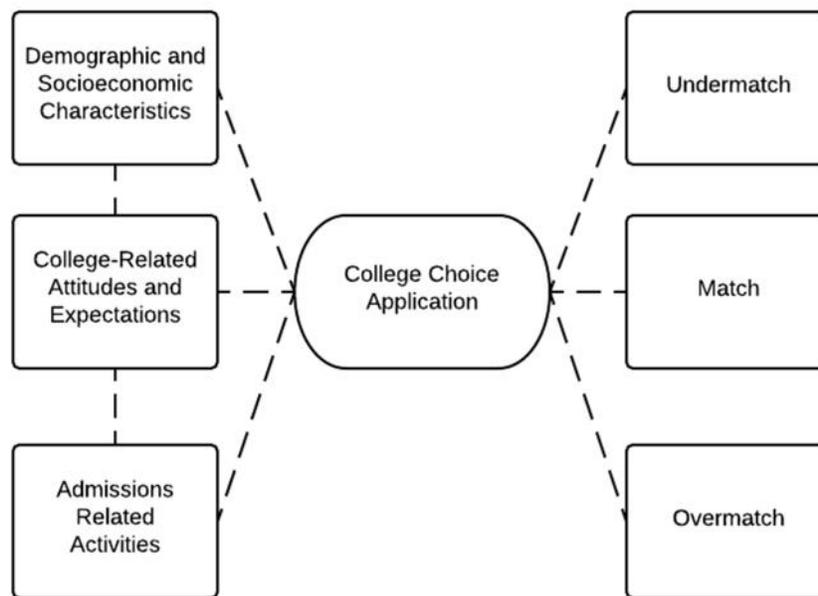
Degree Completion Model

To better understand degree completion, with an emphasis on academic match as a predicting factor, a comprehensive model is proposed. The degree completion model will include bachelor's degree completion as an outcome variable, with academic match as a focal predictor, in addition to seven overarching clusters of predictors related to: 1) student background characteristics; 2) aspirations; 3) pre-college achievement; 4) postsecondary

achievement; 5) postsecondary engagement; 6) financial; and 7) institutional. Figure 2-2 provides a representation of this study's proposed degree completion model.

Student background characteristics

The model contains several student background characteristics that primarily encompass demographic information. Variables include gender, age, race/ethnicity, native language, and socioeconomic status (inclusive of parental education, parental income, and occupation). Similar to the student-college match indicator model, by adding demographic characteristics, background effects can be controlled when assessing the influence of other variables in the model. The demographic and socioeconomic characteristics precede the model's other variables.

Aspirations

When examining student trajectory and the propensity for degree completion, a student's educational aspirations should be considered. To understand future goals, students' educational aspirations are included. Aspirations range from attending college, but not completing a degree program to completing a graduate-level degree program.

Pre-college achievement

Pre-college achievement is consistently cited as an indicator for future educational success. For this proposed degree completion model, a student's SAT score and high school grade point average are included. Critical to this study's proposed model, this study's derived academic match indicator will be included as a measure of pre-college achievement as it is primarily based on high school related activities, including student demographics, college-related attitudes and expectations, and admissions-related activities.

Postsecondary achievement

Of utmost importance to degree completion is achievement while a student is enrolled in a degree program. This proposed model includes factors related to a student's postsecondary grade point average as well as their major discipline as predictors of degree completion.

Postsecondary engagement

When considering degree completion as a student outcome, engagement measures should be considered. For this proposed model, engagement is clustered as either academic or social. For academic engagement, behavioral frequency factors related to student communication with faculty outside the classroom (in-person or via email), faculty advisement, physical library usage, and online library usage are considered. For social engagement, behavioral frequency factors related to extracurricular activity participation, intramural sports participation, and varsity sport participation are included.

Financial

A consideration throughout existing degree completion literature relates to student financial matters, specifically as it relates to student aid, college pricing, and overall affordability. This study's proposed framework seeks to incorporate student financial aid usage by including student Pell grants, Stafford, Perkins, and PLUS loans, and grant or scholarship aid.

Institutional

As suggested in the literature institutional characteristics are related to a student's interaction and engagement. As the study's sample is focused on students in four-year

institutions, institutional characteristics included in the proposed model include institutional control (public or private, non-profit and for-profit institution).

From a methodological perspective, this study differentiated itself by using the full seven-category Barron's Competitiveness Index and using multiple imputation to address the issue of missing data within the ELS:2002 dataset. By using multiple imputation, the sample size was expanded in an effort to better address the study's research questions.

Interaction effects

When examining degree completion given several predictors, interaction effects should be considered. Interactions generally allow the effects of variables to depend on the level of other independent variables (Hinkle et al., 2003). This is important as implications of this proposed study's findings would better inform research, policy, and practice by explaining variation, particularly across student demographics such as socioeconomic status and race/ethnicity.

Figure 2. Degree Completion Proposed Model.
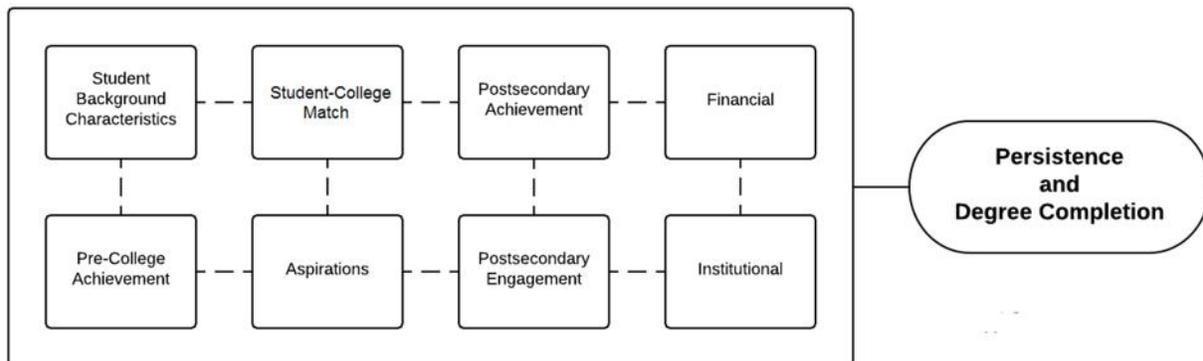
Conclusions

This literature review has addressed five critical objectives related to student-college match and degree completion. First, definitions, conceptualizations, and uses of student-college match and degree completion were presented and analyzed. Second, existing theories and conceptual frameworks associated with student-college match and degree completion were detailed and synthesized. Third, an examination of the full extent of student-college match and its determinants was provided. Further, the tradeoffs and limitations associated with existing methodological approaches for calculating a student-college match indicator were discussed. Fourth, the factors associated with degree completion were categorized and presented. Lastly, the existing literature examining the relationship between student-college match and an outcome such as degree completion was provided.

Given the existing literature, a framework to estimate student-college match and a model for examining degree completion, with student-college match as a focal factor, was proposed. The intention is that this proposed framework could address the existing gap in the literature related to student-college match and its relationship with eventual degree completion. With a comprehensive framework, the relationship can ideally be better examined and further inform future research, policy, and practice.

CHAPTER III

RESEARCH DESIGN

The primary focus of this study was to identify the extent of several student-college match scenarios and to examine the relationship between student academic match and bachelor's degree completion. By leveraging existing studies' methodologies and addressing notable limitations, this study sought to provide a more comprehensive understanding of student-college match and its relationship with degree completion.

This chapter begins with an overview of this study's research model, reiterates the research questions guiding the study, details the data source and sample examined, presents the research variables, illustrates relevant research methods, and details the quantitative analyses used to address the study's research questions.

Research Model

This study was guided by two interdependent conceptual models – one for creating a student-college match indicator and another that uses the derived student-college match indicator as a focal predictor related to student bachelor's degree completion. Both conceptual models guiding this study integrate several empirical foundation factors from existing theoretical frameworks and include additional elements to address existing model limitations.

The major constructs of the proposed student-college match indicator model include:

- Demographic (age, gender, race/ethnicity, and socioeconomic status)
- College-related attitudes and expectations

- Admissions-related activities

The major constructs of the proposed degree completion model include:

- Student background characteristics

- Aspirations

- Pre-college achievement

- Postsecondary achievement

- Postsecondary engagement

- Financial factors

- Institutional factors

Research Questions

This study sought to determine which factors contribute to bachelor's degree completion, with a particular focus on student-college match. Using the National Center for Education Statistics' (NCES) Education Longitudinal Study of 2002 (ELS:2002), descriptive statistics and logistic regression was used to address this study's research questions:

1. What is the rate of postsecondary student-college match, including students considered an undermatch, an overmatch, and a match?

2. To what extent do student-college match rates vary by socioeconomic status and race/ethnicity?

3. Controlling for all other factors, is there a relationship between student-college match and bachelor's degree completion? Do such relationships vary by students' socioeconomic status and race/ethnicity? If so, how?

Hypotheses

The exploration of this study's research questions related to student-college match – specifically undermatch, overmatch, and match – is based on the following three hypotheses. In the subsequent analysis chapter, each of these three hypotheses are tested to address the study's research questions.

Hypothesis I – Regarding the rate of student-college match, Smith et al. (2012) identified about 41 percent of students undermatch, including students with a range of academic credentials. Given this finding, it is likely that a portion of the remaining students overmatched, and the remainder attended institutions considered to be an academic match considering their academic credentials. I hypothesize, however, that the extent of undermatch will vary from Smith et al.'s findings as additional variables will be included in the model to better account for college preparation activities of traditionally underrepresented students.

Hypothesis II – Regarding student-college match and demographic factors, specifically socioeconomic status and race, and given the existing literature related exclusively to undermatch finds a strong relationship with socioeconomic status and race, I hypothesize that the other types of student-college match (that is, match and overmatch) with also vary by both factors. Smith et al. (2012) found significant differences across race and SES when examining only students that undermatch. Of those students that undermatched, students below the median socioeconomic status undermatched 49.6 percent of the time, while those students in the median socioeconomic group undermatched 34 percent of the time (Smith et al., 2012). Regarding race, Smith et al. (2012) found that African American, Hispanic, and Asian students were less likely to

undermatch than white students. I hypothesize that when examining all aspects of student-college match – including undermatch, match, and overmatch – similar patterns regarding socioeconomic status and race will emerge, but will vary based on the type of student-college match.

Hypothesis III – There is a relationship between the type of student-college match and subsequent degree completion. In other words, those students attending less selective institutions than their academic potential will be less likely to complete degree programs within a six-year period when compared to students whose credentials match the selectivity of their institution. Bowen et al. (2009) reinforce this hypothesis as they found the "big-fish-little-pond" scenario often resulted in a decreased likelihood of bachelor's degree completion. Similarly, I hypothesize those students attending institutions considered an overmatch, or having academic potential lower than the selectivity of the institution attended, will be less likely to complete bachelor's degree programs when compared to students whose credentials match the selectivity of their institution. Put another way, when compared to students undermatching and overmatching, those students considered an academic match, meaning their academic potential is congruent to institutional selectivity, are more likely to complete degree programs within a six-year period.

Data Source and Sample

This study used data from the National Center for Education Statistics' Education Longitudinal Study of 2002 (ELS:2002). The ELS is a nationally-representative, multilevel longitudinal survey that was specifically designed to track high school students as they progress

from 10th grade through high school and on to postsecondary education or the workforce, or both (Ingels et al., 2014). Specifically, ELS:2002 was used for this study as it is the most comprehensive source of nationally-representative data that includes: (1) pre-college academic achievement; (2) postsecondary aspirations; (3) postsecondary enrollment information; and (4) postsecondary degree completion status. Given the existing literature, capturing data regarding a student's pre-college academic achievement, their desire to attend a postsecondary institution, and actual enrollment information are likely critical components for estimating the degree of student-college match. ELS:2002 has a great deal of data on students' demographic characteristics, attitudes and impressions of attending a postsecondary institution, and information regarding the college search, choice, and application process, which are important for creating college-match indicator. The data also include information related to college experience, and graduation, the focal outcome in the study.

The ELS:2002 was initially administered to high school sophomores in 2002, again when the cohort were high school seniors in 2004, two years following the cohort's scheduled high school graduation in 2006, and lastly in 2012, or ten years following initial survey collection. Data collection in 2006 captured self-reported information regarding postsecondary institutions to which students applied and were admitted, including information about the institution where they enrolled. This study included student information in 2004 during the college application process (first follow-up), information in 2006 regarding postsecondary enrollment (second follow-up), and information in 2012 regarding degree completion (third follow-up).

The ELS initial (base year) study collected data regarding seven areas of focus, including student performance in reading and mathematics, parental characteristics, teacher demographics and perspectives, school characteristics, library and media resources, and the condition of school

equipment and facilities. Of particular interest to the models used in this study were the student demographic factors and the ELS cognitive test. To facilitate the ELS cognitive test, students were administered math assessments in both the 10th and 12th grades, as part of the base-year and first follow-up surveys. To further gather data regarding student achievement, NCES collected transcript data from 91 percent of the weighted sample six months following scheduled student high school graduation (Ingels et al., 2014).

For the first follow-up study (the senior year of high school for students who remained in school), data regarding students' postsecondary intentions and academic achievement were gathered. Specifically, students' educational aspirations, cumulative high school grade point average, academic achievement, and college-related activities and expectations were gathered. Of note, the ELS sample was freshened during the first-follow up study. These additional respondents did not complete the initial base-year questionnaire, but they received an expanded new participant questionnaire.

As part of the second follow-up study (2 years following high school graduation), data regarding students' postsecondary enrollment or workforce status was gathered. The second follow-up gathered information about postsecondary educational access and choice, or the student's transition to the workforce for those students that elected not to enroll in postsecondary education. For those students enrolling in postsecondary education, the ELS provides data regarding their choice of institution, their persistence and degree completion. This study's student-college match indicator model relied heavily on data from the second follow-up, most notably the postsecondary institution in which the student attended.

The third follow-up study (8 years following high school graduation) focused on gathering data regarding outcomes, particularly related to postsecondary education activity and

the labor market. Regarding postsecondary education, the third follow-up focused on enrollment and attainment at all credential levels, including sub-baccalaureate, baccalaureate, and graduate and professional enrollment (Ingels et al., 2014). Respondents were asked to identify the postsecondary institution(s) they attended and identify any credentials earned. Shortly after the third follow-up, postsecondary transcript information for about 77 percent of eligible survey members were added (Ingels et al., 2014). The third follow-up provides critical data for this study's degree completion model.

ELS:2002 Full Sample and This Study's Sample

The ELS:2002 full, established base year sample size includes approximately 17,754 students across about 750 secondary institutions, yielding an 87 percent weighted student response rate and a 68 percent school response rate (Ingels et al., 2014). Eligible sample members who had not responded in the prior follow-up were not contacted for subsequent follow-ups, that is, a respondent who had not responded in the second follow-up and in the first follow-up were not fielded for the third follow-up. The first follow-up sample was freshened and yielded a response rate of 89 percent. The second follow-up consisted of about 15,900 members, of which 14,200 completed the appropriate questionnaire – yielding an 88 percent response rate. For the third follow-up, the full sample consisted of 16,176 members.

To address this study's research questions, only first-time full-time high school graduates in 2004 immediately entering a four-year institution were included in the analytic sample – students attending a two-year or specialized institution, regardless of student-college match type, were excluded. NCES categorizes these students in ELS:2002 as standard enrollees by virtue of immediately enrolling in postsecondary education and continuing their enrollment into 2006. To identify these students, the ELS:2002 contains a second follow-up respondent type indicator that

will be used to help frame this study's sample. For ELS:2002, immediate enrollment is defined as enrolling in a postsecondary institution by October following high school completion/exit year. By narrowing the sample frame and using the standard enrollees that continued to four-year postsecondary institutions and students who participated in the ELS:2002 third follow-up, the weighted analytic sample for this study included 6,455 students. Detailed descriptive analysis of this study's sample is presented in Chapter IV.

Moreover, as with many national, longitudinal datasets, sampling issues exist in ELS:2002 – including unequal probabilities of selection and small sample sizes for certain groups of individuals. In an effort to offset this sampling concern, this study used the ELS:2002 panel weight to account for student demographics when examining relevant research questions. As this study used variables ranging from the base year to the third follow-up, the F3BYPNLWT weight variable was used as it accounts for students who fully or partially completed the ELS questionnaire in both 2002 and 2012 (Ingels et al., 2014).

Deriving the Student-College Match Indicator

Prior to completing any statistical analysis, the conceptual definition of student-college match outlined in this study was operationalized. This student-college match variable was derived using the Barron's Admissions Competitiveness Index and existing ELS:2002 variables. This derived student-college match indicator was then used to address research questions one and two and subsequently used as an independent variable in the logistic regression equation for research question three.

The construction of the proposed student-college match indicator used in this study is rooted in existing match literature and included demographic, socioeconomic, and college-related attitudes and expectations. As presented in Chapter II, several "admissions-related" emerging empirically-supported activities were added to the model for this study. The following section outlines the specific methodology – including determining institution selectivity, determining a student's academic potential, and making an academic match determination – used for deriving this study's student-college match indicator.

Determine enrolled institution selectivity

All four-year institutions are assigned a selectivity level as part of the Barron's Admissions Competitiveness Index[1], including six overarching selectivity categories encompassing the most competitive, highly competitive, very competitive, competitive, less competitive, and non-competitive (Barron's Educational Services, 2004). The selectivity of each respondent's first-attended postsecondary institution will be coded as a derived categorical variable according to the following scale: 1) two-year college; 2) nonselective; 3) somewhat selective; 4) selective; or 5) very selective.

Determine student's academic potential

Similar to Smith et al. (2012) and Rodriguez (2015), this study used a logistic regression model to calculate predicted probabilities based on available students' application and admission

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[1] Examples of most competitive institutions include Harvard University and University of Notre Dame. Examples of highly competitive institutions include Northeastern University and Brigham Young University. Examples of very competitive institutions include Ohio State University and University of South Carolina. Examples of competitive institutions include Temple University and Arizona State University. Examples of less competitive institutions include Indiana State University and California State-Fresno. Examples of non-competitive institutions include University of Arkansas at Little Rock and Wilmington College.

data from the ELS:2002. Using this approach, the probability of being admitted to each selectivity level based on demographic and socioeconomic characteristics, college-related attitudes and expectations, and admissions-related activities was calculated for each student. A student's qualification level was determined based on the highest selectivity level to which they were accepted, given a probability of admission greater than 80 percent. In prior studies, Smith et al. (2012) used a 90 percent threshold, while Rodriguez (2015) used 80 percent. An 80 percent qualification level was selected for this study as the model incorporated additional predictors and, thus, the likelihood of more precise estimates is increased. Rodriguez (2015) notes, "the predicted probability approach yields the highest level of precision in determining the likelihood of student qualifications compared to other approaches" (p. 12).

Once the predicted probability model was run for each student at each selectivity level, the highest selectivity category to which they were found eligible will be identified and the computed potential variable will be coded accordingly. The potential categorical variable will be coded for the student's highest eligible selectivity level as either: 1) two-year college; 2) nonselective; 3) somewhat selective; 4) selective; or 5) very selective.

The following outlines the variables used in the predicted probability model to determine admission for each student at each selectivity level.

Demographic and socioeconomic characteristics

- Gender – a categorical variable indicating student gender. In this study, gender was coded as male = 0 and female = 1. (BYSEX).

- Race/ethnicity – a series of dummy variables were created to represent Asian, Black, Hispanic, White, and other students (BYRACE_R). White students were treated as the reference group.

- Native language is English – a dummy variable in response to the question: "Is English your native language (the first language you learned to speak when you were a child)?" (BYSTLANG).

- Socioeconomic status – initially a categorical variable indicating five equally-weighted, standardized components: 1) father's education; 2) mother's education; 3) family income; 4) father's occupation; and 5) mother's occupation. It was recoded into three dummy variables, "Lowest;" "Middle;" and "Highest". (BYSES1QU). Highest was treated as the reference group.

College-related attitudes and expectations

- Highest math course attempted – a series of dummy variables representing the highest level of half a year or more of math coursework attempted by the 12th grade; derived from courses completed, including no math, Pre-algebra, Algebra I, Algebra 2, Geometry, and Pre-calculus/Trigonometry or Calculus. It was recoded into three dummy variables, "No Math/Pre-Algebra;" "Algebra I/II and Geometry;" and "Trigonometry or Calculus". (F1HIMATH). Trigonometry/Calculus was treated as the reference group.

- Number of AP or IB courses – a continuous variable indicating the number of Advanced Placement or International Baccalaureate courses reported on students' transcripts, in Carnegie units, over the course of high school. The minimum value is 0 and the maximum value is 18. (F1RAPIB).

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- ELS cognitive test – a continuous variable representing the standardized test composite score of averaged reading and math scores in T-score. The minimum value is 20.91 and the maximum value is 81.04. (BYTXCSTD).

- SAT score – a continuous composite variable measuring the respondent's most recent SAT score as provided by College Board, American College Testing, or the respondent's high school transcript. ACT scores were converted by NCES. The minimum value is 400 and the maximum value is 1600. (TXSATC).

- Grade point average – a series of dummy variables representing high school grade point average. It was recoded into three dummy variables, "Less than 2.0;" "2.01-3.0;" and "3.01-4.0" (F1RGPP). 3.01-4.0 was treated as the reference category.

Admissions-related activities

- Number of applications submitted – a categorical variable indicating the number of postsecondary students to which a student completed an application for admission in their first round of applications (during high school). The variable ranges from 0 to 11 or more. It was recoded into three dummy variables, "Apply-Low" for 1-3 applications; "Apply-Mid" for 4-6 applications; and "Apply-High" for 7 or more applications (F2NAPP2P). Apply-High was treated as the reference group.

- FAFSA completed – initially a categorical variable indicating whether or not the respondent has associated records in the Central Processing System, which houses the Free Application for Federal Student Aid (FAFSA). Recoded as a

dichotomous variable indicating no = 0 and yes = 1 (F2CPSTAT). The affirmative was treated as the reference group.

- Has gone to a counselor for college information – a dichotomous variable in response to the question: "Where have you gone for information about the entrance requirements of various colleges?" no = 0 and yes = 1 (F1S48A). The affirmative was treated as the reference group.

- Has gone to a teacher for college information – a dichotomous variable in response to the question: "Where have you gone for information about the entrance requirements of various colleges?" no = 0 and yes = 1 (F1S48B). The affirmative was treated as the reference group.

- Has gone to a parent for college information – a dichotomous variable in response to the question: "Where have you gone for information about the entrance requirements of various colleges?" no = 0 and yes = 1 (F1S48D). The affirmative was treated as the reference group.

- Has gone to college publications/website for information – a dichotomous variable in response to the question: "Where have you gone for information about the entrance requirements of various colleges?" no = 0 and yes = 1 (F1S48I). The affirmative was treated as the reference group.

- Has gone to college representatives for information – a dichotomous variable in response to the question: "Where have you gone for information about the entrance requirements of various colleges?" no = 0 and yes = 1 (F1S48H). The affirmative was treated as the reference group.

- Has used college search guides for information – a dichotomous variable in response to the question: "Where have you gone for information about the entrance requirements of various colleges?" no = 0 and yes = 1 (F1S48J). The affirmative was treated as the reference group.

Academic match derived variable

Once the derived potential (highest selectivity eligible) and enrolled (actual enrolled selectivity) variables were created, this study's key student-college match indicator variable was derived. This variable was computed by comparing the derived variable representing the selectivity of the actual enrolled institution with the derived variable representing the highest selectivity potential. For cases where **potential** is less than **enrolled**, the case was coded as an undermatch; for cases where **potential** is greater than **enrolled**, the case was coded as an overmatch; and for cases where **potential** equals **enrolled**, the case was coded as a match. This key academic match indicator variable was coded as 0 = undermatched; 1 = matched; and 2 = overmatched.

Research Variables

For this study's proposed expanded degree completion model, several independent predictor variables and a degree completion indicator outcome variable were needed. Details regarding the construction of an outcome degree completion variable are presented in the next section. Moreover, factors from the expanded degree completion model – including student background characteristics, aspirations, pre-college achievement, academic match,

postsecondary achievement, postsecondary engagement (academic and social), financial, and institutional – were collected as part of the ELS:2002 and included in this study.

Outcome Variable

The outcome variable in this study is categorical and indicated degree completion or persistence as measured during the ELS:2002 third follow-up (in 2012, or eight years following high school graduation). This study's degree completion indicator from the ELS:2002 considered a student's status in 2012 relative to their first-attended postsecondary institution (PSI). Respondents were considered to have completed or persisted at the first-attended PSI if they: 1) earned a bachelor's degree from their initial postsecondary institution and are no longer attending; 2) earned a bachelor's degree from their initial postsecondary institution and continued at the same institution to earn an advanced degree; or 3) did not earn a bachelor's degree from their initial PSI, but continued attending as of 2012 (persistence). As the persistence category in this study's sample was small and these students had not transferred nor dropped out, the original ELS variable was recoded into a dummy variable with completion and persistence combined and coded as 1.

Factors Predicting Degree Completion

To address research question two, several independent predictor variables identified from existing literature and integrated into this study's expanded degree completion model were used to predict degree completion. The following outlines the variables used as part of this study.

Student background characteristics

- Gender – a categorical variable indicating student gender. In this study, gender was coded as male = 0 and female = 1 (BYSEX).

- Race/ethnicity – a series of dummy variables were created to represent Asian, Black, Hispanic, White, and other students (BYRACE_R). White students were treated as the reference group.

- Native language is English – a dummy variable in response to the question: "Is English your native language (the first language you learned to speak when you were a child)?" (BYSTLANG).

- Socioeconomic status – initially a categorical variable indicating five equally-weighted, standardized components: 1) father's education; 2) mother's education; 3) family income; 4) father's occupation; and 5) mother's occupation. It was recoded into three dummy variables, "Lowest;" "Middle;" and "Highest." (BYSES1QU). Highest was treated as the reference group.

Aspirations

- Postsecondary aspiration during high school – Initially a categorical variable indicating the respondent's highest postsecondary degree aspiration in 2004, or senior year of high school. It was recoded into dummy variables, including "Aspiration – 2Yr/4yr;" and "Aspiration – Graduate School". (F1STEXP). Four-year college was treated as the reference group.

Pre-college achievement

- SAT score – A continuous composite variable measuring the respondent's most recent SAT/ACT score as provided by College Board, American College Testing, or the respondent's high school transcript. ACT scores were converted by NCES. The minimum value is 400 and the maximum value is 1600. (TXSATC).

Student-college match

- Student-college match – a series of dummy variables were created based on the derived student-college match categorical variable to represent students who enrolled in an institution considered either a match, overmatch, or undermatch. Additional information about how this variable was derived is presented is in the Deriving the Student-College Match Indicator section of this Chapter. Students considered a match were treated as the reference group.

Postsecondary achievement

- Postsecondary grade point average – A continuous variable measuring the respondent's grade point average at all known postsecondary institutions attended as of June 2013. Pulled from the postsecondary education transcript data. The minimum value is 0 and the maximum value is 4.0. (F3TZGPAALL).
- Academic major field – initially a categorical variable that included student majors clustered by discipline. It was recoded to represent school/college

clusters, including "Arts/Sciences;" "Business;" "Communication;"
"Education;" "STEM;" "Other;" and "Vocational". (F2MAJOR2). Arts and
sciences was treated as the reference group.

Postsecondary engagement

- Academic

    o High-impact education activities – a continuous variable measuring the
      respondent's involvement in high-impact educational activities while
      enrolled in a postsecondary institution. High-impact educational
      activities include internships, collaborative research projects with
      faculty, study abroad experiences, mentorship program, or a
      senior/capstone project. The minimum value is 0 and the maximum
      value is 6. (F3HIIMPACT).

    o Talk with faculty about academic matters outside of class – Initially a
      categorical variable indicating the student's frequency of interacting
      with a faculty member outside the classroom (including via email). It
      was recoded into dummy variables, including "never" and "sometimes
      or often." (F2B18A).

    o Meet with advisor about academic plans – Initially a categorical
      variable indicating the student's frequency of meeting with an advisor
      about academic plans. It was recoded into dummy variables, including
      "never" and "sometimes or often." (F2B18B).

- Social

  o Participate in other extracurricular activities – Initially a categorical
  variable indicating the student's frequency of participation in other
  extracurricular activities. It was recoded into dummy variables,
  including "never" and "sometimes or often." (F2B18G).

  o Participate in varsity or intercollegiate sports – Initially a categorical
  variable indicating the student's frequency of participation in varsity
  or intercollegiate sports. It was recoded into dummy variables,
  including "never" and "sometimes or often." (F2B18F).

Financial factors

- Pell grants ever received – A continuous variable representing the cumulative
  Pell grant amount received from the time of postsecondary enrollment through
  completion or departure (as of third ELS:2002 follow-up). Data sourced for
  ELS:2002 from the National Student Loan Data System (NSLDS). The
  minimum value is 0 and the maximum values is 40,114. (F3PELLCUM).

- Stafford, Perkins, PLUS amount – A continuous variable representing the
  cumulative Stafford loan (subsidized and unsubsidized), Perkins loans, and
  Parent Loans for Undergraduate Students (PLUS) received cumulatively as of
  the fall of 2006. Data sourced for ELS:2002 from the National Student Loan
  Data System (NSLDS). The minimum value is 0 and the maximum value is
  111,000. (F2SPPCUM).

- Scholarship received during first term – A dichotomous variable indicating whether the respondent received merit-based grants/scholarships during their first term at their first-attended postsecondary institution. (F3A23).

- Scholarship received during last term – A dichotomous variable indicating whether the respondent received merit-based grants/scholarships during their last term at their last-attended postsecondary institution. (F3A25).

Institutional

- Control – initially a categorical variable indicating the control of the first postsecondary institution attended. It was recoded into two dummy variables including "Public;" "Private not-for-profit or Private for-profit." (F2PS1CTR). Public schools were treated as the reference group.

- Urbanicity – initially a categorical variable indicating school urbanicity. It was recoded into three dummy variables including "Urban;" "Suburban;" and "Rural." (BYURBAN). Urban schools were treated as the reference group.

Prior to running the logistic regression analysis, all categorical variables were recoded to dummy variables as part of data preparation. Appendix table A-1 includes a variable chart for all variables in both the student-college match and degree completion models.

Statistical Model

To address research question three, a binary logistic regression analysis was completed. Binary logistic regression analysis was the ideal choice as this study's outcome is nominal and it contains one level. The model's independent predictor variables were both nominal and

continuous. The following sections briefly present the assumptions and conditions of binary logistic regression and discuss multicollinearity.

Assumptions and Conditions of Binary Logistic Regression

In general, binary logistic regression has few assumptions and is ideal as this study's method of analysis as the outcome is dichotomous. Similar to other linear regressions, the binary logistic regression is a predictive analysis used to describe data and explain the relationship between the dependent and several independent variables (Hinkle, Wiersma & Jurs, 2003). Prior to completing a binary logistic regression, six assumptions were verified. First, the dependent variable was nominal and contained two categories. Second, the independent predictors are continuous, ordinal, or nominal. Third, independence of observations should exist and the dependent variable should contain mutually exclusive and exhaustive categories (Hinkle et al., 2003). Fourth, there should be no multicollinearity, that is, independent variables are not highly correlated. Fifth, a linear relationship must exist between the independent variables and the logit transformation of the dependent variable (Hinkle et al., 2003). Lastly, the data was checked to identify descriptive measures of central tendency to determine if it contains any outliers. Prior to running the multinomial logistic regression, the dataset was checked to ensure there are an adequate number of cases per predictor.

Multicollinearity

As with all forms of regression, the likelihood of high correlations among independent predictors can be problematic. Multicollinearity generally comes in two forms – either extreme or near extreme (Allison, 1999). Extreme multicollinearity indicates that at least two of the independent variables in the model is perfectly related by a linear function; making it impossible

to obtain separate estimates for the coefficients (Allison, 1999). Near-extreme multicollinearity indicates strong (but not perfect) linear relationships with the independent predictor variables and it poses a threat as it makes it challenging to reliably estimate the coefficients of collinear variables (Allison, 1999). For this analysis, the variance inflation factor (VIF) test was used to diagnose multicollinearity among independent predictor variables; VIF scores above 10 indicate multicollinearity. After examining this study's variables, the VIF test did not indicate multicollinearity for the student-college match or degree completion models.

Data Preparation

Prior to completing data analysis using a longitudinal data set, several preparatory steps were first be completed. Of utmost importance was the handling of missing data, an inevitable concern for any empirical study using large-scale secondary data. Moreover, as this study closely examined student-college match, this indicator was derived based on the proposed student-college match model presented in Chapter II, rooted in existing literature and prior studies' recommendations. The following sections outline the methods used for each of the preparatory steps and outline this study's data analysis strategy.

Missing Data

Missing data is a universal concern across quantitative studies using large national datasets. In an examination of existing student-college match research and the methods researchers have used to estimate undermatch and its implications on underrepresented students, Rodriguez (2015) used multiple imputation to address missing data in the ELS:2002. All information within the dataset was used to impute values across relevant variables within the

dataset. Rodriguez (2015) averaged ten datasets to produce a single dataset of imputed values to address research questions related to differing definitions of selectivity and academic qualifications. Unlike Smith et al. (2012), listwise deletion was not used by Rodriguez (2015) as missing data was not completely random – specifically for Latino students; whose parents do not college degrees; and students from lower income families less likely to take a college entrance exam. Rodriguez's (2015) study, however, did assume that data are missing at random and designed subsequent imputations to account for the missing cases. As college entrance exam performance is an element within all existing academic match studies and critical to the determination of an academic match, eliminating cases without either an SAT or ACT score could suppress the full extent of academic match and threaten external validity (Rodriguez, 2015). By using multiple imputation, Rodriguez (2015) preserved 459,450 weighted student cases, a 30 percent increase, that would have been eliminated from the sample. The preserved cases included students missing academic credentials from Latino and African American students, students whose families made less than $50,000 annually, and students whose parents did not have a college degree (Rodriguez, 2015). Moreover, Rodriguez's imputed sample contained an increase in students with lower academic performance (GPA less than 2.5 and SAT scores below 1,000), but who completed high school and indicated intentions of enrolling in a postsecondary institution (Rodriguez, 2015).

Prior to completing this study's binary logistic regression or analyzing the sample, multiple imputation was used to address missing data from this study's ELS:2002 sample. Multiple imputation was used as the imputed values are drawn from a distribution and inherently contain variation. Multiple imputation addresses single imputation's limitations by including an additional form of error based on the variation in the parameter estimates across the imputation,

or "between imputation error" (Soley-Bori, 2013; Von Hippel, 2004; Allison, 1999). The multiple imputation process is a similar-based procedure that replaces each missing value with potential values, which represent a distribution of possibilities (Schafer, 1997). I used SPSS to run a Markov Chain Monte Carlo (MCMC) algorithm known as fully conditional specification (FCS) or chained equations imputation to complete the imputation process (Von Hippel, 2004).

Prior to imputing the dataset, I identified the variables with missing cases and computed the proportion of missing values for each variable. To complete these initial preparatory steps, I used SPSS' missing value analysis feature to detect missing value patterns and examine descriptive variable statistics. This analysis confirmed the data appeared to be arbitrarily missing. This is important as multiple imputation provides consistent, asymptotically efficient, and asymptotically normally estimates when the data is found to be missing at random (Soley-Bori, 2013; Von Hippel, 2004). Further, I completed an exploratory analysis to assess MCMC convergence. While SPSS offers limited diagnostic functions, an understanding of how many iterations are needed for two imputations apart at least far enough to be independent can be achieved. The MCMC convergence analysis was performed using an autocorrelations feature and time series plot of imputation result of successive iterations (Von Hippel, 2004). To use the SPSS diagnostic, the imputations were specified to 2 and the maximum iterations were set to 1000. This produced limited diagnostic information, but it included P-step means and standard deviations (Von Hippel, 2004).

After establishing convergence, MCMC was run a second time to generate the twenty imputed data sets (Allison, 2012; Von Hippel, 2004). To complete the imputation, SPSS imputed incomplete variables one at a time and used the imputed variable from one step as a predictor in all subsequent steps. SPSS used linear regression to impute responses for any

missing continuous variables and logistic regression to impute responses for any missing categorical variables (Von Hippel, 2004).

Analysis

The first stage of the data analysis used this study's derived student-college match indicator to primarily explore descriptive statistics of the sample. To address this study's first and second research questions and better understand the extent of student-college match types, all scenarios – undermatch, match, and overmatch – were considered. A demographic snapshot of students in each category was provided, with an emphasis on predominant student-college match determinants. Further, the extent of each student-college match type with an emphasis on socioeconomic status and race/ethnicity was examined. Descriptive analyses included measures of central tendency, including frequencies, means, standard deviations, minimum, maximums, and cross-tabulations.

To address this study's third research question, a binary logistic regression – controlling for all factors in the proposed degree completion model – was completed. The outcome variable was inputted as the dependent variable. The predictor variables were inputted as either factors (dummy variables) or covariates (continuous) using SPSS' binary logistic regression analysis function. As part of the analysis, pseudo R-square, step summary, model fitting information, cell probability, classification table, and goodness-of-fit model specifications were selected. Parameter estimates, likelihood ratio tests, and confidence intervals (95 percent) were selected.

By selecting the goodness-of-fit, the output was used to assess how well the model fit the data (Hinkle et al., 2003). Further, the Pearson chi-square statistic and supporting p-value were

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provided. For a binary logistic regression, a large chi-square value and a significant result ($p <$ .05) typically indicates a poor fit for the model (Hinkle et al., 2003). The model fitting information indicated whether or not the full model predicted the dependent variable better than just the intercept-only model. The parameter estimates output indicated which predictor variables were significant for each of the outcome variable's four categories.

In addition to the baseline model, subgroup analysis was performed to identify variation by select demographic factors, including socioeconomic status and race/ethnicity. Following the subgroup analysis, the "restricted" baseline model was evaluated by including interaction terms between student-college match types and socioeconomic status and race/ethnicity using likelihood ratio tests for each of the 20 imputed datasets. The likelihood ratio tests were used to determine if differences between student-college match types and socioeconomic status and race/ethnicity significantly improved the baseline model, or form the "unrestricted" final model.

Limitations

This study has several limitations from data and methodological perspectives that warrant discussion. While the ELS:2002 provides invaluable data to explore this study's research questions, the data have substantive and methodological limitations that warrant discussion. Most notably, while the ELS:2002 spans from a student being in 10th grade to 10 years later, the ELS:2002 sample is limited in its generalizability to three overall groups or populations: 1) spring 2002 high school sophomores; 2) spring 2004 high school seniors; or 3) spring 2002 10th grade schools.

From a methodological perspective, it is important to consider that a student-college match determination, regardless of how it is derived, should be considered strictly an estimate. As detailed in Chapter II and reiterated by Bastedo and Flaster (2014), a student-college match determination contains many notable assumptions. Most notably, a student-college match determination relies exclusively on a given set of observable characteristics which may not fully account for student potential. Further, the method for stratifying institutions by selectivity is generally consistent for elite, selectivity institutions, but variance among less selective institutions is often problematic. While this study used the collapsed Barron's Admissions Competitiveness Index, the potential for local or regional institutional reputations associated with less selective colleges can skew selectivity ratings. As noted in Chapter II, this is often a concern when considering Historically Black Colleges and Universities (HBCU). That is, an institution's cultural reputation may be more highly valued by a prospective student over its institutional selectivity, despite the student's predicted potential for admission to a more selective institution (Smith et al., 2012). Similarly, some HBCUs may be more selective than the academic profile (as measured by test scores, class rank, and GPA) of its applicant pool.

CHAPTER IV

RESULTS

The results presented in this chapter are arranged into three sections that parallel this study's research questions. This chapter begins with a description of this study's sample and focuses on identifying the rate of postsecondary student-college match scenarios, while also describing the profile of students found to either undermatch, match, or overmatch. The second section continues the exploration of the study's sample, but specifically explores the extent to which student-college match types differ by student background characteristics, including socioeconomic status and race/ethnicity. The final section uses the study's full sample of college-going students to report the relationship between each type of student-college match and bachelor's degree completion – with a particular emphasis on variations by socioeconomic status and race/ethnicity.

Research Questions

To reiterate, this study seeks to determine which factors contribute to bachelor's degree completion, with a particular focus on the three types of student-college match. Using the National Center for Education Statistics' (NCES) Education Longitudinal Study of 2002 (ELS:2002), descriptive statistics and binary logistic regression, this study sought to address the following research questions:

1. What is the rate of postsecondary student-college match, including students considered an undermatch, an overmatch, and a match?

2. To what extent do student-college match rates vary by socioeconomic status and race/ethnicity?

3. Controlling for all other factors, is there a relationship between student-college match and bachelor's degree completion? Do such relationships vary by students' socioeconomic status and race/ethnicity? If so, how?

Data and Sample

Prior to addressing research questions one and two, the study's sample was identified and all available application and admission data for eligible ELS:2002 participants was aggregated. This resulted in 6,455 weighted cases, each with multiple student and transcript-reported application and admission data points. This included institutions to which students applied, admissions decisions, and enrollment information – resulting in approximately 10,380 viable data points. By using all available admissions-related data from all respondents – including students that may have applied and been accepted to a four-year institution, but attended a two-year institution – the predicted probability method used for determining a student's potential, or the selectivity level to which a student is likely to be granted admission given observable characteristics, is more precise (Rodriguez, 2015). To address research question three, the sample of 6,455 weighted cases of students enrolled in four-year institutions was also used. The independent variables in the degree completion model were checked for multicollinearity and the variance inflation factor (VIF) analysis revealed no multicollinearity among the predictors.

Before addressing this study's research questions, several preparatory steps to prepare this study's ELS:2002 subset were completed. First, eligible students with application and admissions data were identified from among the full ELS:2002 sample. Second, categorical variables were recoded as indicated in Chapter III. Third, missing data were identified and examined to determine the manner in which values were missing. Across all variables, the percent of missing data ranged from none to 39.24% (SAT score). As a result of the data

missing at random, multiple imputation was used to generate twenty imputed datasets containing consistent, asymptotically efficient, and asymptotically normal estimates for missing values (Soley-Bori, 2013; Von Hippel, 2004). SPSS software imputed incomplete variables individually and used the preceding imputed value as a predictor in subsequent steps. Linear regression was used to impute responses for missing continuous values, whereas logistic regression was used for missing categorical values (Von Hippel, 2004). Following the imputation of missing data, the adjusted weight was calculated using the NCES-provided panel weight that includes cases across the base year, first-, second- and third-follow ups. Following these preparatory steps, the ELS:2002 subset was generated to address this study's research questions.

Table 4-1 includes descriptive statistics for each variable included in the student-college match model. Of the study's full sample (N= 6,455), the cases were split by gender – 54.6% female and 45.4% male. When examining by socioeconomic status, 14.3% were in the lowest category, 44.5% were in the middle category, and 41.2% were in the highest category. By race/ethnicity, 68.4% identified as White, 11.8% as Black, 8.8% as Hispanic, 5.6% as Asian, and 5.4% as other race/ethnicity.

Table 4-1. Student-college match model summary statistics.

| Variable | ELS:2002 (N= 6,455) | | | |
	Mean	Std. Dev.	Min.	Max.
Background Characteristics				
Gender				
Male	.45	.497	0	1
Female	.55	.497	0	1
Race/Ethnicity				
White	.63	.457	0	1
Black	.12	.318	0	1
Hispanic	.11	.318	0	1
Asian	.08	.254	0	1
Other	.06	.289	0	1

English as Native Language				
English	.89	.321	0	1
Non-English	.11	.321	0	1
Socioeconomic Status				
Lowest	.14	.353	0	1
Middle	.44	.498	0	1
Highest	.42	.457	0	1
College-Related Attitudes & Expectations				
Highest Math				
No Math/Pre-Algebra	.02	.140	0	1
Algebra I/II, Geometry	.28	.448	0	1
Trigonometry or Calculus	.70	.457	0	1
Applications Submitted				
1-3	.69	.463	0	1
4-6	.24	.429	0	1
7 or more	.07	.254	0	1
AP/IB Courses	1.39	2.099	0	18
ELS Cognitive Test	56.27	8.348	25.35	81.04
SAT Composite Score	1047.40	187.779	400	1600
High School GPA				
Less than 2.0	.06	.247	0	1
2.01-3.0	.30	.464	0	1
3.01-4.0	.64	.475	0	1
Admissions-Related Activities				
FAFSA Completed				
Completed	.64	.479	0	1
Not completed	.36	.479	0	1
College Counselor				
Often/Sometimes	.81	.404	0	1
Never	.19	.404	0	1
Teacher				
Often/Sometimes	.44	.497	0	1
Never	.56	.497	0	1
Parent				
Often/Sometimes	.64	.477	0	1
Never	.36	.477	0	1
College Publication/Website				
Often/Sometimes	.78	.421	0	1
Never	.22	.421	0	1
College Representatives				
Often/Sometimes	.68	.458	0	1
Never	.32	.458	0	1
College Guides				
Often/Sometimes	.60	.489	0	1
Never	.40	.489	0	1

Notes: Weighted sample. Means may not equal 100% due to rounding.

Student-College Match Rates

What is the rate of postsecondary student-college match, including students considered an undermatch, an overmatch, and a match?

As presented in Chapter III, to address research question one, a three step process was used. First, each student's potential for admission was predicted using 13 variables – including variables from categories such as demographic and socioeconomic characteristics, college related attitudes and expectations, and admissions-related activities. Figure 4-1 provides the distribution by highest predicted potential selectivity level the student would be eligible for admission given the variables in the model.

Figure 4-1. Distribution of highest selectivity level potential (percent).
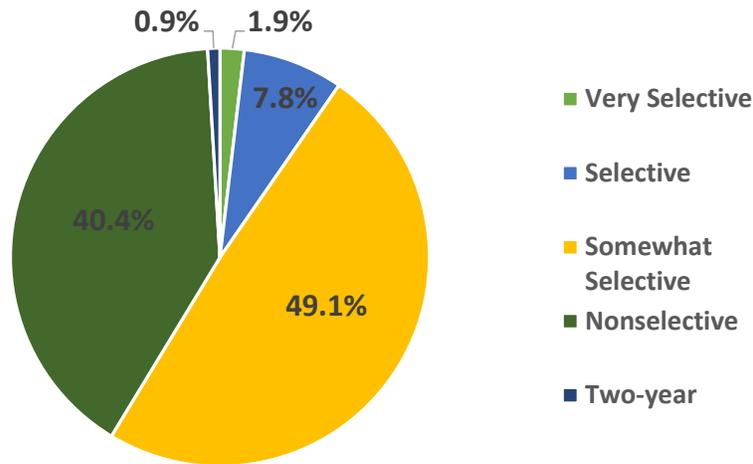
Notes: Weighted sample (N=6,455)
Source : Analyses of Education Longitudinal Study of 2002 (ELS:2002)

Table 4-2 details the distribution of background characteristics by predicted potential selectivity levels. Among high socioeconomic students, about 18% qualified for either a very selective or selective institution; whereas among middle socioeconomic students, just about 4% were eligible for the same levels. Students in the lowest socioeconomic category, however, were often predicted eligible for the lowest selectivity levels – somewhat selective and nonselective – about 28% and 65%, respectively. Similar results were found for students in the middle socioeconomic group. That is, about 45% had a predicted selectivity potential of somewhat selective and about 50% had a predicted potential of nonselective. As it relates to race/ethnicity, among the White students – the largest group – the majority of students (about 56% and about 33%) had a predicted potential of admission at either a somewhat selective or nonselective institution, respectively. Similar findings emerged regarding race/ethnicity – specifically with the majority of students eligible for the lower selectivity categories. Among Black and Hispanic students, the majority were predicted eligible for nonselective institutions – that is, 69% of Black students and about 69% of Hispanic students. For White students, about 57% were predicted in the somewhat selective category and about 33% in the nonselective category. Among Asian students, however, the distribution by predicted selectivity level shifted and approximately 9% and 20% achieved a predicted potential in the very selective and selective categories, respectively.

Table 4-2. Select demographic characteristics of ELS:2002 respondents enrolled in four-year institutions by *highest potential* selectivity level (percent).

Variable	N	Very Selective	Selective	Somewhat Selective	Nonselective	Two-year
Gender						
Male	2932	1.94	8.18	45.99	42.69	1.20
Female	3523	1.79	7.41	51.60	38.47	0.73
Race/Ethnicity						
White	4415	1.69	8.36	56.84	32.75	0.34
Black	765	0.31	1.31	24.07	69.15	5.18
Hispanic	564	0.83	5.21	24.29	68.69	0.90

Asian	364	9.09	19.97	47.88	22.80	0.36
Other	347	1.53	5.65	46.43	46.51	0.00
English as Native Language						
English	5746	1.55	7.45	50.73	39.22	1.04
Non-English	709	4.37	10.20	35.44	49.84	0.16
Socioeconomic Status						
Lowest	922	0.38	3.08	28.50	64.62	3.42
Middle	2868	0.36	3.57	45.29	49.75	1.03
Highest	2665	3.99	13.87	60.21	21.93	0.01

*Notes:*Weighted; Row percentages may not equal 100% due to rounding.
Source: Analyses of Education Longitudinal Study of 2002 (ELS:2002)

Second, using the Barron's Admissions Competitiveness Index, each student's institutional selectivity level was determined based on their actual enrollment. Figure 4-2 provides the distribution by selectivity level. Unlike Figure 4-1, no students in the sample were enrolled in a two-year institution, despite the 1.3% that were predicted to be eligible for just a two-year institution. These respondents enrolled in a four-year institution, likely within the nonselective category. Of those students in the sample, 15.6% enrolled in a very selective institution, 23% in selective, 39.4% in somewhat selective, and 22% in a nonselective institution.

Figure 4-2. Distribution of actual enrolled selectivty (percent).
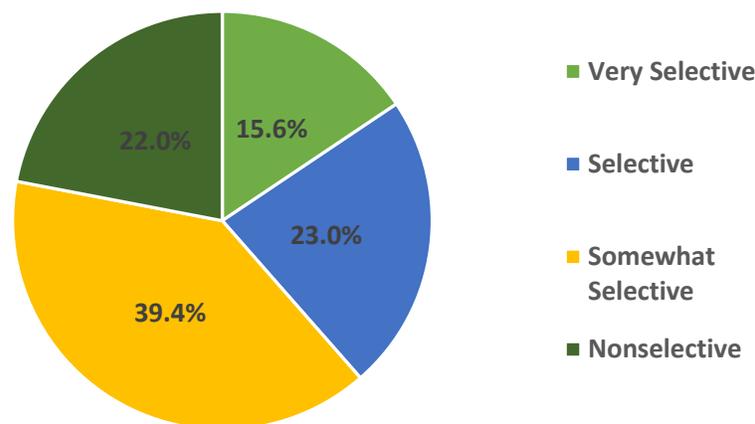
Notes: Weighted sample (N=6,455)
Source : Analyses of Education Longitudinal Study of 2002 (ELS:2002)

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Table 4-3 provides a snapshot of the demographic and background characteristics for students by actual enrolled selectivity levels. When examining low socioeconomic status students, about 38% and 37% enrolled in somewhat selective institutions or nonselective institutions, respectively. In contrast, among high socioeconomic students, the spread among very selective, selective, and somewhat selective institutions increased. That is, about 24%, 28%, and 35% enrolled in very selective, selective, or somewhat selective institutions, respectively. Similar to the predicted student potential, an increased number of Asian students (about 29%) enrolled in a very selective institution, about 27% in a selective institution, and about 31% in a somewhat selective institution. In contrast, just 6% of Black students enrolled in very selective institutions – the majority enrolled in somewhat selective (about 43%) or nonselective (about 40%). Similarly, about 30% and 40% of Hispanic students enrolled in somewhat selective or nonselective institutions, respectively. For White students, the distribution by selectivity levels varied – with the majority in selective or somewhat selective institutions. Specifically, among White students, approximately 16%, 26%, and 41% were enrolled in very selective, selective, or somewhat selective institutions, respectively.

Table 4-3. Select demographic characteristics of ELS:2002 respondents enrolled in four-year institutions by actual enrolled selectivity level (percent).

Variable	N	Very Selective	Selective	Somewhat Selective	Nonselective	Two-year
Gender						
Male	2932	15.86	23.58	37.63	22.93	0.00
Female	3523	15.37	22.46	40.96	21.22	0.00
Race/Ethnicity						
White	4415	16.40	25.71	40.71	17.17	0.00
Black	765	5.87	11.83	42.86	39.48	0.00
Hispanic	564	14.01	15.59	30.02	40.41	0.00
Asian	364	28.93	26.54	30.69	13.90	0.00
Other	347	15.30	20.89	40.37	23.43	0.00
English as Native Language						
English	5746	14.98	23.36	40.36	21.30	0.00
Non-English	709	20.56	19.75	32.07	27.63	0.00
Socioeconomic Status						

Lowest	922	7.39	18.15	37.62	36.85	0.00
Middle	2868	9.99	19.82	44.46	25.73	0.00
Highest	2665	24.46	28.02	34.69	12.84	0.00

Notes: Weighted; Row percentages may not equal 100% due to rounding.
Source: Analyses of Education Longitudinal Study of 2002 (ELS:2002)

Lastly, the highest potential selectivity level was compared to the actual enrolled selectivity level for each student to determine the type of student-college match. Figure 4-3 provides the distribution by student-college match type. Of the 6,455 students in the sample, 40.6% undermatched, 35% overmatched, and 24.4% matched. This study's undermatch finding (40.6%) is consistent with existing literature (Smith et al., 2012; Rodriguez, 2015) and suggests that many students attend four-year institutions that are not congruent with their academic potential. Similarly, and perhaps more notably, a similar number of students (35%) are found to overmatch, or attend an institution with a selectivity level above their academic credentials.

Figure 4-3. Distribution of students by student-college match type (percent).
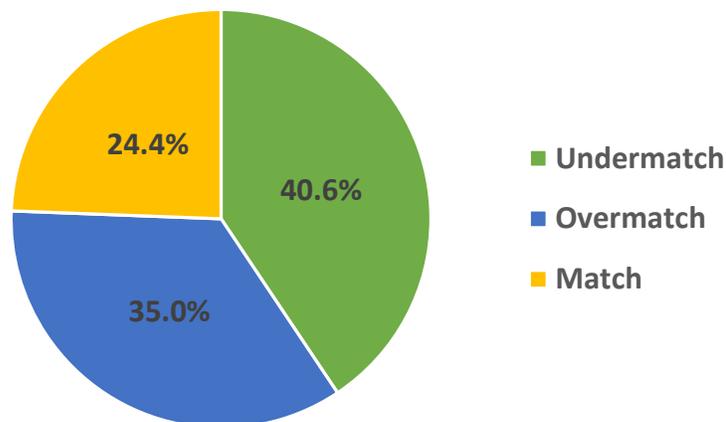
Notes: Weighted sample (N=6,455)
Source : Analyses of Education Longitudinal Study of 2002 (ELS:2002)

Student College-Related Attitudes and Expectations by Match Type

Similar to the demographic factors considered, some of this study's college-related attitudes and expectations and admissions-related activities emerged by student-college match type. As detailed in Table 4-4, the distribution of highest math varied by student-college match type. Specifically, for students that took lower level math courses, ranging from pre-algebra to geometry, the majority undermatched. For students that took advanced math (trigonometry or calculus), about 26% undermatched, 28% matched, and 46% overmatched. A similar pattern emerged across college application activity. That is, among students that submitted few applications (1-3), 50% undermatched, and the remaining 50% were split about evenly across match and overmatch types. For students who submitted 4-6 or 7 or more applications, about 51% and 79% overmatched, respectively. Given the findings, it appears students who overmatch typically submit several more applications than their peers. Moreover, the academic profile of students appears to correlate with match type. Specifically, among students with a high school GPA below 2.0, about 74% undermatched. Similarly, among students with a high school GPA between 2.01-3.0, about 66% undermatched. For students with a 3.01-4.0 GPA, however, about 47% overmatched, with about equal shares undermatching and matching.

Table 4-4. Select college-related attitudes and expectations of ELS:2002 respondents enrolled in four-year institutions by student-college match type (percent).

Variable	N	Undermatch	Match	Overmatch
Highest Math				
No Math/Pre-Algebra	136	75.44	8.82	15.37
Algebra I/II, Geometry	1802	73.81	16.59	9.43
Trigonometry or Calculus	4517	26.29	27.96	45.77
Applications Submitted				
1-3	4441	50.46	24.67	24.88
4-6	1568	21.77	27.24	50.99
7 or more	446	9.15	11.57	79.30
High School GPA				
Less than 2.0	434	74.42	12.63	12.81

2.01-3.0	1897	66.18	19.57	14.27
3.01-4.0	4124	25.33	27.83	46.84

*Notes:*Weighted; Row percentages may not equal 100% due to rounding.
Source: Analyses of Education Longitudinal Study of 2002 (ELS:2002)

Table 4-5 presents admissions-related activities by student-college match type – with an emphasis on FAFSA completion and sources of college information. For students who submitted a FAFSA, about 42% undermatched, 25% matched, and 33% overmatched. Among students who sought college information from high school counselors, about 40% undermatched, 25% matched, and 35% overmatched. Of note, among students who did not seek information from high school counselors, almost half (46%) undermatched. Similarly, among students who did not use college publications or institutional websites as information sources, about 60% undermatched, and a collective 40% matched or overmatched. In contrast, among students who used college publications or websites, almost 40% overmatched and 35% undermatched.

Table 4-5. Select admissions-related attitudes and expectations of ELS:2002 respondents enrolled in four-year institutions by student-college match type (percent).

Variable	N	Undermatch	Match	Overmatch
FAFSA Submitted				
Completed	4145	42.85	24.54	32.61
Not completed	2310	36.67	24.10	39.24
Information Sources				
College counselor				
Often/Sometimes	5231	39.37	24.95	35.68
Never	1224	46.06	21.97	31.98
Teacher				
Often/Sometimes	2869	40.20	24.87	34.92
Never	3586	40.98	23.99	35.03
Parent				
Often/Sometimes	4128	37.39	25.43	37.17
Never	2327	46.39	22.53	31.10
College Publication/Website				
Often/Sometimes	5045	35.30	25.64	39.06
Never	1410	59.72	19.87	20.38
College Representatives				
Often/Sometimes	4383	36.80	25.34	37.86

Never	2072	48.75	22.36	28.90
College Guides				
Often/Sometimes	3852	36.66	24.67	38.68
Never	2603	46.52	23.97	29.51

Notes: Weighted; Row percentages may not equal 100% due to rounding.
Source: Analyses of Education Longitudinal Study of 2002 (ELS:2002)

While the extent of undermatch, match, and overmatch are each substantial, the following research question explored the variation in this study's ELS:2002 subset by socioeconomic and race/ethnicity differences among these students.

Student-College Match by Socioeconomic Status and Race/Ethnicity

To what extent do student-college match rates vary by socioeconomic status and race/ethnicity?

To better understand and identify the students found to undermatch, overmatch, and match, additional cross-tabulation descriptive analyses were conducted, with a specific emphasis on differences by socioeconomic status and race/ethnicity. Following the descriptive statistics, a logistic regression was complete to control for all factors in the model and further examine the variations by socioeconomic status and race/ethnicity. The following sections further explore these variations by providing an overview of demographic characteristics and a specific focus on college-related attitudes and expectations and admissions-related activities by socioeconomic status and race/ethnicity.

Socioeconomic Status

Figure 4-4 presents the distribution of student-college match types by socioeconomic status. Among students from the low socioeconomic category, about 64% -- the majority – undermatched, while just 17% and about 19% matched or overmatched, respectively. Similarly,

among middle socioeconomic students, about 50% undermatched and the remainder of the students matched or overmatched by about 25% each. Conversely, among the high socioeconomic students, about 51% overmatched, while just 22% undermatched and 27% matched.

Figure 4-4. Distribution of student-college match type by socioeconomic status type (percent).
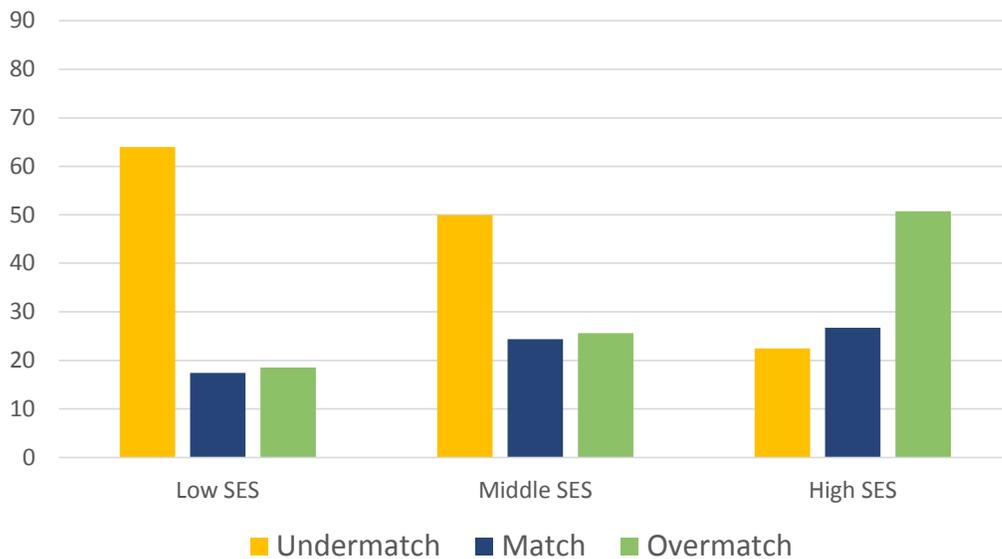
Notes: Weighted sample (N=6,455)
Source: Analyses of Education Longitudinal Study of 2002 (ELS:2002)

Using a logistic regression and controlling for all factors in the student-college match model, both low- and mid-socioeconomic status were found significantly related to undermatch. Specifically, compared to high socioeconomic students, the odds of students undermatching were 223% and 129% higher for low- and mid-socioeconomic students, respectively (odds-ratio = 3.229/2.288, p < .001). Conversely, compared to high socioeconomic students, the odds of students overmatching were 52% and 40% lower for low- and mid-socioeconomic students, respectively (odds-ratio = .476/.597, p < .01). The following sections provide additional details regarding the variation found by races/ethnicity.

When examining variation by race/ethnicity, figure 4-5 details the distribution by student-college match type. For White students, the distribution by match type was somewhat subtle; that is, 33% undermatched, 28% matched, and about 39% overmatched. In contrast, among Black students, approximately 71% undermatched, 16% matched, and 13% overmatched. Similarly, among Hispanic students, about 63% undermatched, 13% matched, and 24% overmatched. Among Asian students, however, the majority overmatched – that is, about 54% -- and just 25% undermatched or matched (21%). Students that identified as an other race/ethnicity often undermatched (45%), but about 34% overmatched and 21% matched.

Figure 4-5. Distribution of student-college match type by race/ethnicity (percent).
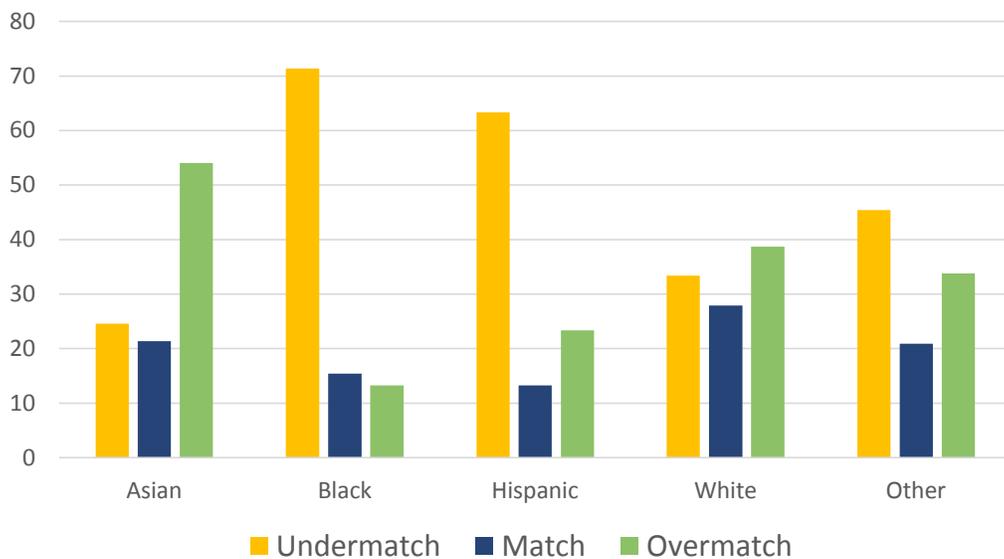
Notes: Weighted sample (N=6,455)
Source: Analyses of Education Longitudinal Study of 2002 (ELS:2002)

Race/Ethnicity

When examining race/ethnicity and student-college match types, some patterns emerge. Figure 4-5 details the distribution of student-college match type, inclusive of the variation by race/ethnicity and reflects that for typically underrepresented minorities (Black and Hispanic

students), undermatch is the predominant finding. For White students, many students undermatch, but of the remaining students, the distribution of overmatch and match is about equal. In contrast to other race/ethnicities, the majority of Asian students overmatched and the fewest undermatched. The following sections detail the differences across student-college match types by race/ethnicity – with a specific emphasis on high school math course completion, number of college applications submitted, high school grade point average, FAFSA completion, and sources of college information.

Using a logistic regression and controlling for all factors in the student-college match model, significant relationships between Black and Hispanic students and undermatch emerged. Specifically, compared to White students, the odds of Black students undermatching were 90% higher (odds-ratio = 1.899, $p < .01$). For Hispanic students – compared to White students – the odds of undermatching increased 123% (odds-ratio = 2.231, $p < .01$). For students considered a match, however, Black and Hispanic students were found significantly negatively related. Compared to White students, the odds of students matching were 36% and 39% lower for Black and Hispanic students, respectively (odds-ratio = .641/.609, $p < .05$). However, for overmatched students, a significant relationship for Asian students surfaced. Compared to White students, the odds of overmatching for Asian students increased 79% (odds-ratio = 1.788, $p < .05$).

Student-College Match and Degree Completion

Controlling for all other factors, is there a relationship between student-college match and bachelor's degree completion? Do such relationships vary by students' socioeconomic status and race/ethnicity? If so, how?

To address research question three, a binary logistic regression was completed. The dependent variable consisted of students identified as completing or persisting toward their baccalaureate degree requirements at their initial postsecondary institution as of the final ELS:2002 data collection point (2012), or six years following initial postsecondary enrollment. A logistic regression analysis was used to better understand the relationship between the derived student student-college match indicator and bachelor's degree completion, after controlling for all other factors. Prior to completing the logistic regression, however, descriptive analysis was conducted to examine the distribution of student-college match type and degree completion.

Descriptive Results

Table 4-6 presents model summary statistics for each of the variables in the degree completion analysis. The mean, standard deviation, minimum and maximum values are included for each categorical and continuous variable.

Table 4-6. Degree completion model summary statistics.

	ELS:2002 (N= 6,455)			
Variable	Mean	Std. Dev.	Min.	Max.
Outcome				
Degree completion/Persisted	.52	.500	0	1
Incomplete	.48	.500	0	1
Background Characteristics				
Gender				
Male	.45	.497	0	1
Female	.55	.497	0	1
Race/Ethnicity				
White	.69	.457	0	1
Black	.13	.318	0	1
Hispanic	.11	.318	0	1
Asian	.08	.254	0	1
Other	.07	.289	0	1
English as Native Language				
English	.89	.321	0	1
Non-English	.11	.321	0	1
Socioeconomic Status				
Lowest	.14	.353	0	1

Middle	.46	.498	0	1
Highest	.43	.497	0	1

Aspirations
College Aspirations

Two/Four-Year college	.45	.498	0	1
Graduate School	.54	.498	0	1

Pre-College Achievement

SAT Composite Score	1047.40	187.779	400	1600

Academic Match

Undermatch	.41	.491	0	1
Match	.24	.429	0	1
Overmatch	.35	.477	0	1

Postsecondary Achievement

Postsecondary GPA	2.89	.755	0	4
Academic Major Category				
Arts & Sciences	.32	.468	0	1
Business	.18	.376	0	1
Communication	.11	.315	0	1
Education	.11	.310	0	1
STEM	.22	.416	0	1
Other	.06	.237	0	1

Postsecondary Engagement - Academic

High Impact Educational Activities	1.65	1.468	0	6
Faculty interaction outside class				
Interaction	.86	.347	0	1
None	.14	.347	0	1
Meet with advisor				
Interaction	.89	.311	0	1
None	.11	.311	0	1

Postsecondary Engagement - Social

Extracurricular activity participation				
Participant	.72	.447	0	1
Non-participant	.28	.447	0	1
Varsity sports participation				
Participant	.18	.380	0	1
Non-participant	.82	.380	0	1

Financial

Cumulative Pell	5,142.28	6,392.485	0	40,114
Cumulative Stafford, Perkins, PLUS	6,805.32	11,083.816	0	111,000

Grants/Scholarships - First term				
Grants/Scholarships	.66	.474	0	1
None	.34	.474	0	1
Grants/Scholarships - Last term				
Grants/Scholarships	.40	.489	0	1
None	.60	.489	0	1
Institutional				
Control				
Public	.67	.471	0	1
Private/For-Profit	.33	.470	0	1
Urbanicity				
Urban	.31	.464	0	1
Suburban	.50	.500	0	1
Rural	.18	.386	0	1

Notes: Weighted sample. Means may not equal 100% due to rounding.
Source: Analyses of Education Longitudinal Study of 2002 (ELS:2002)

Additional descriptive analysis – specifically cross-tabulations – between the student-college match indicator and degree completion were completed. Table 4-7 details the distribution of degree completion by student-college match type for all students. Of the students in the study's full sample, 6,435 cases had data regarding degree completion. As the study's outcome variable was not imputed, this represents a difference of 110 respondents from the study's full sample. Of all students, 52% completed their degree program. When examining students by academic-match type, just 39% of undermatched students completed their degrees – compared to the majority (61%) who did not complete their degree program. Among matched students, about 56% completed their degrees. However, among overmatched students, the largest share (65%) completed their degrees.

Table 4-7. Distribution of degree completion by student-college match type (percent).

Match Type	N	Complete	Incomplete
Undermatch	2608	38.61	61.41
Match	1569	55.65	44.35
Overmatch	2258	64.67	35.32

Table 4-8 presents the distribution of students who *completed* their degree by match-type and socioeconomic status. Among undermatched students, about 21% were from the lowest socioeconomic category, 53% from the middle category, and approximately 26% from the highest category. Among matched students, about 10% were from the lowest socioeconomic category, 44% from the middle category, and about 46% from the highest category. Among students who overmatched, 8% were from the lowest socioeconomic status, about 31% from the middle category, and 61% from the highest socioeconomic category.

Table 4-8. Distribution of complete degrees by socioeconomic status and student-college match type (percent).

		Completed Degree (N= 3,340)		
	N	Low SES	Mid SES	High SES
Match Type				
Undermatch	1007	21.70	52.99	25.31
Match	873	10.03	44.26	45.71
Overmatch	1460	8.40	30.93	60.67

Notes: N=6,435 with degree completion data; Weighted.
Source: Analyses of Education Longitudinal Study of 2002 (ELS:2002)

Among students with incomplete degrees who undermatched, about 23% were from the lowest socioeconomic category, about 56% from the middle, and 21% from the highest category. Among students who matched, about 11% were from the lowest socioeconomic category, 45% from the middle, and 44% from the highest socioeconomic status category. Among overmatched

students, about 6% were from the lowest socioeconomic status category, 36% from the middle, and about 58% from the highest.

Table 4-9 details the distribution of students who completed their degree by match-type and race/ethnicity. Among undermatched students, about 61% were White, 16% Black, 14% Hispanic, 4% Asian, and about 5% identified as another race/ethnicity. For matched students, about 77% were White, 7% Black, 5% Hispanic, 5% Asian, and almost 6% identified as another race/ethnicity. For overmatched students, about 76% were White, 5% Black, 6% Hispanic, 8% Hispanic, and about 5% identified as another race/ethnicity.

Table 4-9. Distribution of complete degrees by race/ethnicity and student-college match type (percent).

	Completed Degree (N= 3,340)					
	N	White	Black	Hispanic	Asian	Other
Match Type						
Undermatch	1007	60.54	16.31	14.49	4.34	4.61
Match	873	76.87	7.39	4.66	5.21	5.89
Overmatch	1460	75.75	4.92	6.05	8.47	4.84

Notes: Weighted; Row percentages may not equal 100% due to rounding.
Source: Analyses of Education Longitudinal Study of 2002 (ELS:2002)

Among undermatched students, about 54% were White, 24% Black, 12% Hispanic, 3% Asian, and 7% as another race/ethnicity. For matched students, about 79% were White, 8% Black, 5% Hispanic, 5% Asian, and 3% as another race/ethnicity. Among overmatched students, about 76% were White, 4% were Black, 5% Hispanic, 9% Asian, and about 6% as another race/ethnicity.

Following the descriptive analysis, the inferential binary logistic regression was completed. Generally, the results of the logistic regression based on the twenty imputed datasets revealed expected patterns of significance for several predicting variables and four-year degree

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completion. Of utmost importance, the focal factors of this study, undermatch and overmatch –

relative to cases of student-college match, were found significantly related to four-year degree

completion. Other variables in the model, including factors related to academic and social

engagement, postsecondary achievement, and institutional, were also found to predict four-year

degree completion. To best address this research question, table 4-10 presents the logistic

regression results and the following sections present this study's results for the full sample.

All Students (Full Sample)

As it relates to this study's focal student-college match indicator and controlling for all

other factors, the odds of four-year degree completion for undermatched students – compared to

matched students – are 26% lower (odds-ratio = .741, $p < .001$). This finding confirms this

study's hypothesis, that is, students attending less selective institutions than their academic

potential are less likely to complete degree programs within a six-year period when compared to

students whose credentials match the selectivity of their institution. Similarly, the odds of four-

year degree completion for overmatched students – compared to matched students – are 19%

higher (odds-ratio = 1.190, $p < .05$). This finding also confirms this study's hypothesis, that is,

students attending institutions exceeding their academic potential are more likely to complete

degree programs within a six-year period when compared to students whose credentials match

the selectivity of their institution.

Table 4-10. Analysis of the binary logistic regression.

	ELS:2002 (N= 6,455)		
	Odds	Standard	
Variable	Ratio	Error	Sig.
Background Characteristics			
Gender			
Female	0.741	0.065	***
Race/Ethnicity			
Black	0.886	0.110	

Hispanic	1.170	0.124	
Asian	1.151	0.150	
Other	1.121	0.137	
English as Native Language	0.983	0.131	
Socioeconomic Status			
Lowest	0.989	0.119	
Middle	0.926	0.069	

Aspirations
College Aspirations

Two/Four-Year college	1.139	0.620	*

Pre-College Achievement

SAT Composite Score	1.077	0.043	

Academic Match

Undermatch	0.741	0.094	**
Overmatch	1.190	0.086	*

Postsecondary Achievement

Postsecondary GPA	1.764	0.053	***
Academic Major Category			
Business	1.064	0.137	
Communication	1.001	0.186	
Education	0.866	0.171	
STEM	0.971	0.110	
Other	0.783	0.186	

Postsecondary Engagement - Academic

High Impact Educational Activities	1.165	0.023	***
Faculty interaction outside class	1.319	0.088	**
Meet with advisor	1.675	0.098	***

Postsecondary Engagement - Social

Extracurricular activity participation	1.221	0.068	**
Varsity sports participation	0.860	0.075	*

Financial

Cumulative Pell	1.094	0.034	**
Cumulative Stafford, Perkins, PLUS	1.097	0.030	**
Grants/Scholarships - First term	1.044	0.068	
Grants/Scholarships - Last term	1.043	0.063	

Institutional
Control

Private	0.684	0.063	***
Urbanicity			
Suburban	1.004	0.064	
Rural	1.058	0.084	

The role of engagement factors – both academic and social – emerged as predicting factors associated with four-year degree completion. As it relates to academic engagement and controlling for all other factors, faculty interaction, academic adviser interaction, and high-impact educational activities were found to significantly predict four-year degree completion. Specifically, and as it relates to faculty interaction, the odds of four-year degree completion for students that interact with faculty – compared to students that do not – are 32% higher (odds-ratio = 1.319, p < .01). Similarly, but related to interaction with an academic adviser, the odds of four-year degree completion for students that meet with an academic adviser – compared to students that do not – are 68% higher (odds-ratio = 1.675, p < .001). For high-impact educational activities, each one-unit increase in participation is related to a 17% increase in the odds of four-year degree completion (odds-ratio = 1.165; p < .001).

Measures of social engagement – including extracurricular activity participation and varsity or intercollegiate sports participation – also emerged as predicting factors linked with four-year degree completion. Most notably and controlling for all other factors, the odds of four-year degree completion for those involved in extracurricular activities – compared to students not involved – are 22% higher (odds-ratio = 1.221, p < .01). Further, the odds of four-year degree completion for those participating in varsity or intercollegiate sports – compared to students not participating in either types of formalized sports – are 14% lower (odds-ratio = .860, p < .05).

In addition to student-college match and engagement, postsecondary achievement, financial, and select institutional factors were found related to four-year degree completion. Controlling for all factors and for every one unit increase in postsecondary GPA, the odds of

four-year degree completion increase by 76% (odds-ratio = 1.764, p < .001). Related to student financial borrowing and controlling for all factors, for every one dollar increase of Stafford, Perkins, and PLUS loans received, the odds of four-year degree completion increased by about 10% (odds-ratio = 1.097, P < .01). Similarly, for every dollar increase of Pell grants received, the odds of four-year degree completion increased by 9% (odds-ratio = 1.094; p < .01). However, the results of the logistic regression revealed unexpected patterns between institutional control and degree completion. That is, and controlling for all factors, the odds of four-year degree completion for students enrolled in private and for-profit institutions – compared to students in public institutions – are 32% lower, respectively (odds-ratios = 0.684, p < .001).

Socioeconomic Status

To further investigate the relationship between student-college match and degree completion, separate logistic regressions using the twenty imputed datasets were completed for a comparison across different SES groups. Generally, the results revealed expected patterns of significance for several predicting variables, but some noteworthy variations across socioeconomic status levels was observed. For this study's focal factor, student-college match, undermatch presented itself as a significant predictor of four-year degree completion for only students in the middle socioeconomic level and overmatch was only visible for students in the highest socioeconomic group. Postsecondary achievement (GPA) and high impact educational activities (one measure of academic engagement) consistently emerged as significant predictors of four-year degree completion, regardless of socioeconomic status. Other variables in the model, including factors related to background characteristics (race), academic major, additional academic engagement indicators, and financial factors were also found to predict four-year

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degree completion. Table 4-11 presents the logistic regression results by socioeconomic status

and the following sections summarize select findings related to socioeconomic status variations.

Table 4-11. Analysis of the binary logistic regression by socioeconomic status.

Variable	Lowest (N= 922)			Middle (N= 2,868)			Highest (N= 2,665)		
	Odds Ratio	Std. Error	Sig.	Odds Ratio	Std. Error	Sig.	Odds Ratio	Std. Error	Sig.
Background Characteristics									
Gender									
Female	0.982	0.199		0.576	0.093	***	0.898	0.089	
Race/Ethnicity									
Black	0.839	0.290		0.710	0.158	*	1.299	0.178	
Hispanic	1.602	0.291		0.965	0.174		1.092	0.221	
Asian	0.935	0.439		1.382	0.232		1.172	0.222	
Other	1.166	0.392		1.235	0.187		0.691	0.225	
English as Native Language	0.881	0.312		1.093	0.186		1.054	0.205	
Aspirations									
Two/Four-Year college	1.178	0.180		1.114	0.089		1.235	0.092	*
Pre-College Achievement									
SAT Composite Score	1.166	0.141		1.092	0.067		1.039	0.060	
Academic Match									
Undermatch	0.838	0.321		0.731	0.113	**	0.722	0.128	*
Overmatch	1.580	0.369		0.959	0.123		1.333	0.107	**
Postsecondary Achievement									
Postsecondary GPA	1.996	0.172	***	1.730	0.073	***	1.790	0.077	***
Academic Major Category									
Business	1.145	0.330		0.970	0.104		1.034	0.120	
Communication	1.006	0.395		1.133	0.136		1.031	0.122	
Education	1.044	0.371		0.956	0.142		0.974	0.138	
STEM	1.092	0.271		0.935	0.105		1.120	0.103	
Other	0.912	0.452		0.618	0.104	***	0.837	0.113	
Postsecondary Engagement - Academic									
High Impact Educational Activities	1.189	0.084	*	1.288	0.034	***	1.054	0.032	
Faculty interaction outside class	1.106	0.252		1.540	0.129	**	1.191	0.141	
Meet with advisor	1.458	0.292		1.783	0.139	***	1.596	0.157	**
Postsecondary Engagement - Social									
Extracurricular activity participation	0.955	0.197		1.329	0.100	**	1.236	0.111	*
Varsity sports participation	0.969	0.279		0.832	0.117		0.833	0.109	

Financial									
Cumulative Pell	1.207	0.085	*	1.167	0.046	**	0.984	0.059	
Cumulative Stafford, Perkins, PLUS	1.343	0.122	*	1.088	0.047		1.078	0.040	
Grants/Scholarships - First term	1.551	0.234		1.008	0.099		0.957	0.095	
Grants/Scholarships - Last term	0.992	0.195		0.993	0.093		1.122	0.095	
Institutional									
Control									
Private	0.713	0.199		0.632	0.099	***	0.763	0.095	**
Urbanicity									
Suburban	1.089	0.216		1.085	0.101		0.879	0.096	
Rural	0.854	0.267		1.037	0.127		1.127	0.136	

Notes: Significance: *** $p < .001$; ** $p < .01$; * $p < .05$. Weighted sample.
Source: Analyses of Education Longitudinal Study of 2002 (ELS:2002)

While student-college match (both undermatch and overmatch scenarios) emerged as significant predictors associated with four-year degree completion among all students, variation appeared by socioeconomic status. Controlling for all factors and for students in the middle socioeconomic group, the odds of four-year degree completion for students considered an undermatch – compared to those that match – are 27% lower (odds-ratio = .731, $p < .01$). For students in the highest socioeconomic group and controlling for all other factors, the odds of four-year degree completion for students considered an undermatch – compared to those that match – are about 28% lower (odd-ratio = .722, $p < .05$). Conversely, and controlling for all factors for students in the highest socioeconomic group, the odds of four-year degree completion for students considered an overmatch – compared to those that match – are about 33% higher (odds-ratio = 1.333, $p < .01$). For students in the lowest group and controlling for all other factors, the student-college match indicator was not statistically significant.

To further investigate the relationship between student-college match and degree completion, separate logistic regressions using the twenty imputed datasets were completed to identify differences by race/ethnicity. Generally, the results revealed expected patterns of significance for several predicting variables, but some noteworthy variations across race/ethnicites was observed. For this study's focal factor, student-college match, undermatch presented itself as a significant predictor of four-year degree completion for only students identified as White or other race/ethnicity, but overmatch was visible for students identified as White, Black, and Hispanic. Several factors persisted across the five race/ethnicities categories, but only postsecondary achievement (GPA) consistently emerged across race/ethnicities as a significant predictor of four-year degree completion. Other variables in the model, including factors related to background characteristics (race), academic major, additional academic engagement indicators, and financial factors were also found to predict four-year degree completion. Table 4-12 presents the logistic regression results by race/ethnicity and the following sections summarize select findings related to race/ethnicity variations.

Table 4-12. Analysis of the binary logistic regression by race/ethnicity.

Variable	White (N= 4,415)			Black (N= 765)			Hispanic (N= 564)			Asian (N= 364)			Other (N= 347)		
	Odds Ratio	Standard Error	Sig.	Odds Ratio	Standard Error	Sig.	Odds Ratio	Standard Error	Sig.	Odds Ratio	Standard Error	Sig.	Odds Ratio	Standard Error	Sig.
Background Characteristics															
Gender															
Female	0.770	0.071	***	0.602	0.206	*	1.012	0.192		0.865	0.267		0.932	0.352	
English as Native Language	0.729	0.241		1.145	0.438		1.130	0.183		1.508	0.276		0.199	0.716	*
Socioeconomic Status															
Lowest	0.865	0.147		0.666	0.293		0.900	0.207		0.752	0.407		1.696	0.576	
Middle	0.969	0.073		0.578	0.235	*	0.645	0.195		0.938	0.304		2.020	0.366	*
Aspirations															
Two/Four-Year college	1.167	0.070	*	1.482	0.207	*	1.387	0.181		1.095	0.276		0.955	0.342	
Pre-College Achievement															
SAT Composite Score	1.113	0.050	*	0.988	0.147		1.125	0.126		1.089	0.159		0.752	0.254	
Academic Match															
Undermatch	0.789	0.091	**	0.517	0.287	*	1.336	0.258		1.112	0.402		0.139	0.471	***
Overmatch	1.222	0.087	*	2.224	0.369	*	2.187	0.280	**	0.829	0.363		0.422	0.451	*
Postsecondary Achievement															
Postsecondary GPA	1.598	0.059	***	3.074	0.164	***	1.754	0.145	***	1.288	0.229		4.641	0.309	***
Academic Major Category															
Business	0.978	0.087	**	2.347	0.260	**	0.533	0.213	**	1.706	0.341		0.521	0.481	
Communication	1.051	0.100		1.469	0.319		1.403	0.278		1.324	0.366		0.312	0.413	**
Education	1.023	0.104		1.645	0.343		0.602	0.281		3.912	0.925		0.268	0.651	*
STEM	1.016	0.083		1.312	0.237		1.083	0.206		1.420	0.292		0.476	0.421	
Other	0.679	0.082	***	0.393	0.298	**	0.529	0.199	**	0.497	0.333	*	4.254	0.490	**
Postsecondary Engagement - Academic															
High Impact Educational Activities	1.191	0.026	***	1.067	0.071		1.160	0.065	*	1.073	0.092		0.904	0.121	

	Est.	SE	Sig.	Est.	SE	Sig.	Est.	SE	Sig.	Est.	SE	Sig.	Est.	SE	Sig.
Faculty interaction outside class	1.234	0.106	*	1.434	0.350		2.513	0.244	***	0.827	0.350		3.891	0.470	**
Meet with advisor	1.722	0.112	***	1.170	0.438		1.696	0.324		1.386	0.389		0.852	0.538	
Postsecondary Engagement - Social															
Extracurricular activity participation	1.265	0.082	**	1.353	0.220		1.149	0.197		1.674	0.314		0.861	0.414	
Varsity sports participation	0.915	0.088		0.911	0.250		0.651	0.257		0.644	0.434		0.765	0.390	
Financial															
Cumulative Pell	1.092	0.043	*	1.163	0.081		1.180	0.082	*	1.128	0.119		1.684	0.178	**
Cumulative Stafford, Perkins, PLUS	1.101	0.035	**	1.195	0.103		1.011	0.090		1.137	0.156		1.727	0.191	**
Grants/Scholarships - First term	0.952	0.076		1.020	0.229		1.208	0.195		1.388	0.296		1.339	0.409	
Grants/Scholarships - Last term	1.099	0.073		0.954	0.200		1.230	0.189		0.667	0.278		0.519	0.381	
Institutional															
Control															
Private	0.677	0.076	***	0.477	0.222	**	0.709	0.198		1.333	0.302		0.558	0.350	
Urbanicity															
Suburban	0.967	0.081		1.108	0.195		1.249	0.184		0.977	0.267		1.081	0.375	
Rural	1.091	0.099		1.016	0.358		0.850	0.272		0.712	0.553		0.675	0.523	

Notes: Significance: *** $p < .001$; ** $p < .01$; * $p < .05$. Weighted sample.
Source: Analyses of Education Longitudinal Study of 2002 (ELS:2002)

While student-college match (both undermatch and overmatch) emerged as a significant predictor associated with four-year degree completion among all students, either or both factors appeared as significant for all race/ethnicities except Asian students. Controlling for all factors and for White, Black, and students identified as other race/ethnicity, the odds of four-year degree completion for students considered an undermatch – compared to those that match – are 21%, 48%, and 87% lower (odds-ratios = .789/.517/.134, $p < .01/.05/.001$). Specifically, if a minority student undermatches, there are significantly decreased odds of completing a four-year degree. Conversely, and controlling for all factors for White, Black, and Hispanic students, the odds of four-year degree completion for students considered an overmatch – compared to those that match – are about 22%, 122%, and 188% higher (odds-ratios = 1.222/2.224/2.187, $p < .01/.01/.05$). That is, if a minority student overmatches, there are significantly increased odds of completing a four-year degree.

Interaction Effect Tests

Estimates from the degree completion baseline model assume that student-college match and socioeconomic status and race/ethnicity do not interact with each other. The subgroup analyses, however, seem to indicate that the relationship between student-college match and degree completion seems to be different across different student groups. In an effort to determine if such differences are statistically significant, a likelihood ratio test was conducted to examine whether the full model with interaction terms between student-college match types and socioeconomic status and race/ethnicity would significantly improve the baseline model.

Table 4-13 presents the likelihood ratio test results (distributed chi-squared) for the interactions between socioeconomic status and student-college match, and between race/ethnicity and student-college match for each of this study's 20 imputed datasets.

Table 4-13. Likelihood-ratio tests on imputed datasets.

| | ELS:2002 (N= 6,455) | | | |
Variable	SES*Match	Sig.	Race*Match	Sig.
Imputed Dataset	Chi-square		Chi-square	
Imputed Data 1	9.698	*	39.450	
Imputed Data 2	6.391		31.591	*
Imputed Data 3	6.256		20.235	
Imputed Data 4	12.686	*	48.142	*
Imputed Data 5	4.939		32.310	
Imputed Data 6	9.344	*	20.792	
Imputed Data 7	2.421		21.715	*
Imputed Data 8	4.827		24.566	
Imputed Data 9	7.590		33.729	
Imputed Data 10	5.581		32.040	
Imputed Data 11	5.393		13.095	
Imputed Data 12	1.570		32.829	*
Imputed Data 13	2.157		41.267	
Imputed Data 14	7.112		36.665	*
Imputed Data 15	7.610		36.612	
Imputed Data 16	6.365		23.628	
Imputed Data 17	3.708		23.221	
Imputed Data 18	5.118		44.619	
Imputed Data 19	2.775		21.438	
Imputed Data 20	9.231		25.535	

Notes: Significance: *** $p < .001$; ** $p < .01$; * $p < .05$. Weighted sample.
Source: Analyses of Education Longitudinal Study of 2002 (ELS:2002)

Across the 20 imputed datasets, the likelihood ratio test results indicated the interaction to be significant for some of the imputed datasets between socioeconomic status and student-college match and some of the imputed datasets for race/ethnicity and student-college match. However, among the 20 imputed datasets, only three (socioeconomic status) and five (race/ethnicity) of them show significant likelihood ratio test result, meaning that the model with interaction terms (unrestricted model) did not significantly improve the baseline model (restricted model). It is concluded that the likelihood ratio test did not support the inclusion of interaction effect terms in the final model, and that the "restricted" model without the terms provides a better fit. Therefore, the baseline model without interaction effect terms serves as the final model for this study. Specifically, although the subgroup analyses indicated some

differences in the relationship between student-college match and degree completion, the final likelihood ratio test provides evidence that such differences are not statistically significant, demonstrating that the relationship between student-college match and degree completion is the same across socioeconomic and race/ethnicity groups.

CHAPTER V

CONCLUSIONS AND IMPLICATIONS

In recent years, the concept of student-college matching, specifically undermatching, has emerged as an area of interest that spans across both college search and access research and policy agendas. This existing research, however, has not studied other types of student-college matches – specifically overmatch and match scenarios – and has not linked the phenomena to a student outcome such as degree completion. This study sought to address this gap in the literature by examining the extent of each student-college match type and the relationship between the three types of student-college match and degree completion – with an emphasis on variation by socioeconomic status and race/ethnicity.

The primary focus of this study was to develop a student-college match indicator using a comprehensive model of predictor variables, apply it to a national and longitudinal sample, and examine the socioeconomic and racial/ethnic variation in degree completion. The research questions that guided this study include:

1. What is the rate of postsecondary student-college match, including students considered an undermatch, an overmatch, and a match?

2. To what extent do student-college match rates vary by socioeconomic status and race/ethnicity?

3. Controlling for all other factors, is there a relationship between student-college match and bachelor's degree completion? Do such relationships vary by students' socioeconomic status and race/ethnicity? If so, how?

This study's framework attempted to account for the lack of theoretical or conceptual frameworks directly associated with student-college matching by synthesizing several existing theories – including Tinto's Theory of integration (1993), Pascarella and Terenzini's notion of college impact models (2005), Astin's I-E-O model (1985), Weidman's undergraduate socialization model (1989), and Cabrera, Stampen, and Hansen's ability-to-pay model (1990) – to devise a framework to determine student-college matching. This resulted in the creation of this study's student-college match model that included broad categories inclusive of demographic and socioeconomic characteristics, college-related attitudes and expectations, and admissions-related activities. Further, this study proposed a degree completion framework – inclusive of the newly devised student-college match indicator – that incorporated student background characteristics, pre-college achievement, aspirations, postsecondary achievement, postsecondary engagement, financial, and institutional factors.

The primary data source used for this study came from the National Center for Education Statistics' Education Longitudinal Study of 2002 (ELS:2002), a nationally-representative longitudinal study that tracked high school sophomores beginning in 2002, again as high school seniors in 2004, for a third time as college sophomores in 2006, and for a fourth time six years later in 2012. This data source is ideal for this type of study as it is inclusive of student pre-college activities, particularly with rich details related to college search and application, and includes data about student-level outcomes. Additionally, the Barron's Admissions Competitiveness Index was used to categorize postsecondary institutions by selectivity level.

Following the student-college match model, I used a three-step method for determining the type of student-college match. First, the selectivity level of each student's enrolled institution was coded according to the adapted Barron's index. Second, the predicted likelihood

of admission to each Barron's selectivity level was determined for each student. Probabilities were based on student-level data that included background characteristics, college-related attitudes and expectations, and admissions-related activities. The highest selectivity level, or student potential, to which a student would likely be granted admission was recorded. Lastly, the selectivity level to which the student actually enrolled was compared to the highest potential selectivity. This resulted in a student-college match determination of either undermatch, overmatch, or match.

Once the student-college match indicator was derived, descriptive statistics provided insight to better understand the population and identify variation among the student-college match types, specifically variations by socioeconomic status and race/ethnicity. Further, the student-college match indicator was used as a focal factor to address this study's third research question related to the relationship between student-college match and degree completion. Descriptive statistics and a binary logistic regression was completed to understand this relationship and the logistic regression analysis included the focal student-college match factor, but also background characteristics, pre-college achievement, aspirations, postsecondary achievement, postsecondary engagement, financial, and institutional predictors. Sub-group analysis was completed to better examine differences between socioeconomic status and race/ethnicity.

This chapter briefly summarizes the findings presented in Chapter IV. It then presents contributions of the study and implications related to policy, practice, theory, and future research.

Conclusions

This study has unique descriptive and inferential findings that complement and extend existing literature related to student-college match and four-year degree completion. The descriptive analyses focused primarily on better understanding the extent of each student-college match type. Results indicated that approximately 40.6% of students in the sample undermatched, 35% overmatched, and 24.4% matched. The undermatch findings are consist with existing literature (Smith et al., 2012; Rodriguez, 2015) and of the three student-college match types, this is the most prevalent scenario. Of particular interest, and an area largely not explored in the current student-college match literature, is the percentage of students found to overmatch and match – that is, 35% and 24.4%, respectively. To further examine differences by student-college match type, variation by demographic characteristics was investigated initially using subgroup analysis and later using likelihood ratio tests.

Differences by Socioeconomic Status

When accounting for socioeconomic status, the distribution of undermatched students appears most prevalent among students from the low- and middle socioeconomic categories. A positive correlation was found for overmatched students by socioeconomic status. That is, the number of students found to overmatch progressively increased as socioeconomic status increased – 18%, 25%, and 50% of students from the low, middle, and high socioeconomic categories, respectively. For students that had a matched student-college type, just 17% of the students in the lowest socioeconomic category, whereas about 24% of students in the middle and another 26% of students from the highest socioeconomic status.

Variation by Race/Ethnicity

When examining student-college match type by race/ethnicity and accounting for the large representation of White students in the study's sample, Black and Hispanic students were found to undermatch more than they overmatched or matched. That is, of the Black and Hispanic students, abobut 71% and 63% undermatched, respectively. Of the Asian students in the sample, however, the majority overmatched or matched, when compared to the number that undermatched. In other words, of the Asian students, about 54%, 21%, and 24% overmatched, matched, or undermatched, respectively. After better understanding the extent of student-college match by type and further differentiating differences by socioeconomic status and race/ethnicity, the study sought inferential findings.

Student-College Match and Degree Completion – Descriptive Analysis

Following the descriptive analysis of each student-college match type, the study sought to examine the relationship between student-college match types and four-year degree completion, after controlling for all other factors. Prior to running the logistic regression analysis, descriptive statistics related to the distribution of degree completion by student-college match type were presented. Of interest, among the students who completed their degree, about 43% were considered an overmatch and 30% an undermatch. When examining by socioeconomic status among students who completed degrees, students from the lowest and middle categories were more often an undermatch, compared to high socioeconomic students who completed, despite being an overmatch. Among students who failed to complete their degree, however, an overwhelming majority were undermatched, regardless of socioeconomic status. Similarly, when examining by race/ethnicity among students who completed degrees, White and Asian students who overmatched were often most successful. When examining students who did not

complete degrees, for all races – except Asian students – the overwhelming majority were considered undermatched. For Asian students who did not complete a degree, however, about 48% were an overmatch, 30% an undermatch, and 22% a match.

Student-College Match and Degree Completion – Inferential Analysis

Of focal interest to this study was using inferential statistics to examine the relationship between the derived academic match indicator and four-year degree completion. After completing the analysis, the results indicated that among all students in the sample, undermatch was a significant negative predictor of four-year degree completion; whereas overmatch was a significant positive predictor for all students. Specifically, compared to students that were identified as a student-college match, the odds of four-year degree completion for undermatched students were 26% lower. Similarly, and also compared to matched students, the odds of four-year degree completion for overmatched students were 19% higher. While this finding is contradictory to this study's Hypothesis III, the relationship between overmatch and degree completion is in alignment with research regarding institutional selectivity and graduation (Light & Strayer, 2000). Both the undermatch and overmatch findings extend the current literature regarding student-college match by connecting the phenomena to a student outcome and complement existing research that links college selectivity and degree completion (Light & Strayer, 2000; Bowen et al., 2009; Horn & Carroll, 2006).

In addition to the student-college match types, other factors emerged as related to four-year degree completion among the full student sample. Generally, postsecondary achievement, educational activities, academic engagement, social engagement, and financial factors emerged. Regarding postsecondary achievement, for every point increase in postsecondary grade point average, the odds of four-year degree completion increased by 76%. Of the types of factors in

the degree completion model, measurements of academic engagement proved to be overwhelmingly related to degree completion. Specifically, as students were more involved in "high-impact" educational activities, the odds of four-year degree completion increased by 16%.

Student-College Match and Degree Completion – Variation by Socioeconomic Status

When examining the relationship between student-college match and four-year degree completion by socioeconomic status, and controlling for other factors, the student-college match indicator emerged as significant for middle and highest socioeconomic groups. Specifically, for students in the middle socioeconomic category and compared to students that matched, the odds of four-year degree completion for undermatched students decreased by 27%. For students in the highest socioeconomic status category, both undermatch and overmatch scenarios arose as significant predictors of four-year degree completion. That is, compared to students considered a match, the odds of four-year degree completion for undermatched students decreased by 28%; whereas the odds of four-year degree completion for overmatched students increased by 33%. While several factors (measures of academic and social engagement and financial-related predictors) were found significant in at least one socioeconomic category, postsecondary grade point average was found as significant across all socioeconomic categories. That is, for each point increase in postsecondary grade point average, the odds of four-year degree completion increased by 99%, 73%, or 79% for low, middle, and high socioeconomic students, respectively.

Student-College Match and Degree Completion – Variation by Race/Ethnicity

After controlling for other factors, when examining the relationship between student-college match and four-year degree completion by race/ethnicity, at least one student-college match type was found significantly related across groups, with the exception of Asian students.

Specifically, compared to matched students, the odds of four-year degree completion for undermatched students decreased by 22%, 48%, and 86% for White, Black, and other race/ethnicity students, respectively. Conversely, and compared to matched students, the odds of four-year degree completion for overmatched students increased by 22%, 122%, and 118% for White, Black, and other race/ethnicity students, respectively. Similar to differences by socioeconomic status, a similar pattern surfaced regarding postsecondary grade point average across race/ethnicities. That is, for each point increase in grade point average, the odds of four-year degree completion increased by 59%, 207%, and 75% for White, Black, and Hispanic students, respectively.

Likelihood Ratio Tests

Estimates from the degree completion baseline model assume that student-college match and socioeconomic status and race/ethnicity do not interact with each other. While the subgroup analyses indicate the relationship between student-college match and degree completion seem to vary by socioeconomic status and race/ethnicity, likelihood ratio tests revealed the inclusion of interaction terms was not warranted in the final model. That is, the "restricted" model without the socioeconomic status and race/ethnicity terms provides a better fit. Further, although the subgroup analysis indicated some differences between student-college match and degree completion, the likelihood ratio test indicates that such differences are not statistically significant and confirm that the relationship between student-college match and degree completion is consistent across socioeconomic and race/ethnicity groups.

Contributions of the Study

This study sought to fully examine the extent of each type of student-college match and determine its relationship as a predicting factor of bachelor's degree completion. By using an expanded selection of factors that are more inclusive of low-income and historically underrepresented groups and incorporating an expanded methodological approach to derive student-college match types beyond undermatch, this study differentiated itself from the existing literature. Collectively, this study reinforced existing undermatch rates, but contributed to the understanding of overmatch and match types. Findings related to overmatch are particularly evident when variation by socioeconomic status are examined. That is, the number of students found to overmatch progressively increased as socioeconomic status increased. When examining by race/ethnicity, Asian students emerged as especially different from their peers as the majority of these students overmatched.

Further, this study contributes to the student-college match literature by examining its relationship with a student outcome – bachelor's degree completion. Using logistic regression analysis, this study found that undermatch – relative to match – was a significant negative predictor of four-year degree completion and overmatch – relative to match – was a significant positive predictor of four-year degree completion. Jointly, these findings further the existing student-college match literature by linking the phenomena to an outcome which better informs future research, policy, and practice related to the long-term effects associated with postsecondary application and enrollment.

Implications for Policy and Practice

Policy Implications

Although this study's student-college match rates mirror existing undermatch rates (Smith et al., 2012), it extended its focus to measure the prevalence of alternative student-college match scenarios – overmatch and match – with an emphasis on differences by socioeconomic status and race/ethnicity. While 40.6% of all students were identified as undermatched, about 23% of undermatched students were from the lowest socioeconomic category and about a third of undermatched students identified as a historically underrepresented minority (that is, Black or Hispanic). Given these findings, it appears that current policies related to college choice, college access, and degree completion are not fully realized, particularly for low income and minority students. Further, the disparities that emerged for the subgroup analysis across socioeconomic status and race/ethnicity indicate a renewed investigation of Affirmative Action policies may be needed. The distinct variations observed across student-college match types and disparities by group in relation to four-year degree completion emphasize the need for policymaker and practitioners to seek innovative measures to equalize educational opportunities.

Of utmost importance, the disproportionate student-college match rates – specifically related to undermatch – warrant policy and programs for faculty and administration at both the K-12 and postsecondary levels. At the K-12 level, policy initiatives should seek awareness of the student-college match phenomena to foster a culture among students to work with faculty and administration to make postsecondary choices that are congruent with their academic potential. At the postsecondary level, institutional initiatives designed to encourage persistence and retention should be explored – with a specific emphasis on student qualifications and institutional profiles. Similarly, initiatives designed to raise awareness related to geographic

mobility and the college choice process – specifically in areas dubbed as education deserts (Hillman, 2016), or places lacking any postsecondary institutions within close proximity to low income and minority students – should be considered in light of the number and profile of students found to undermatch.

Further, this study's findings emphasize the need to carefully examine current federal and private policies related to postsecondary enrollment. Specifically, the federal government and private agencies allocate a substantial amount of financial aid to higher education students each year, but existing studies – with an additional contribution from this study – suggest that many of these students are not attending schools considered an appropriate match based on institutional selectivity and student potential for success. Given the number of students found to undermatch, a renewed interest in linking federal financial aid policies to students enrolled in appropriate schools could be considered. This is, when accounting for the disconnect between student-college match and four-year degree completion, this study's findings introduce the need to consider ways to associate aid awards to student enrollment choice. Moreover, the disconnect between enrollment selectivity and student potential lends itself to policy discussions surrounding ongoing credit portability questions, specifically as it relates to emerging student enrollment patterns and eventual degree attainment.

Practice Implications

From a practice perspective, this study's findings related to admissions-related activities – specifically college counselor interaction – raised some noteworthy findings, especially when examined by student-college match type. Across all match types, about 81% of students indicated they received information and recommendations regarding college from college counselors at the high school level. Specifically, when examined by student-college match type,

almost 40% of students that undermatch indicated receiving information from high school college counselors. When examining variation among students that undermatched by socioeconomic status, however, 50% of students from the lowest socioeconomic group and 41% of students from the lowest socioeconomic group sought information from college counselors. Similarly, when examining differences by race/ethnicity, underrepresented minorities had similar increased undermatch rates despite interacting with college counselors, that is, about 58% of Black students and 47% of Hispanic students.

The prevalence of each match type – particularly for cases of undermatch – indicates a potential disconnect between secondary school practitioner expectation and postsecondary institution reality. That is, and potentially due to a lack of resources and increasing student loads, secondary school counselors are either recommending or not discouraging students from applying to postsecondary institutions below their potential, given several academic factors. From an institutional practice perspective, a better understanding of institutional selectivity, ideal candidate profile, and college access programs (particularly financial-related) could better prepare secondary school educators and guidance counselors to best channel students to postsecondary institutions considered an appropriate student-college match. Further, existing guidance counselor preparation and ongoing professional development could be created and tailored to help counselors better understand options available to all college-going students; that is, opportunities that incorporate students' academic ability with a congruent postsecondary institution.

Moreover, although this study relied on a national dataset to derive its student-college match indicator, practitioners should diligently collect school-level data related to student application and enrollment decisions. When collected at the school- or district-level, both

application and enrollment data components can better inform and drive future practitioner

decision making; ideally raising awareness of college access, choice, and student-college match.

Theoretical Implications

While this study relied on a synthesis of several existing student theories – including

theories associated with integration, persistence, socialization, and degree completion – little

exists in the research with regard to student-college match. Tinto's Theory of Integration,

however, provided a foundation for examining the idea of student-college match under an

integration lens. For future research, a comprehensive theory would provide increased

understanding of the motivations for why students make decisions regarding application

behavior and subsequent enrollment decisions. A more enlightened conceptual framework

guiding the college search, application, and enrollment phases would better inform future studies

related to student-college match.

Future Research Implications

This study sought to remedy some of the research limitations noted in existing student-

college match studies as described in Chapter II. The findings suggest that educational

researchers should take a renewed interest in examining student-college match, by: 1) further

refining methodologies associated with deriving a student-college match indicator examining

selectivity level variations and incorporating additional predictor variables; 2) compare results

related to student-college match and degree completion by using alternative data sources; and 3)

explore additional student outcomes beyond degree completion.

First, the methodological process associated with determining a student-college match

could be further expanded by using alternative selectivity ratings and incorporating additional

student-level predicting factors. Related to selectivity ratings, this study relied on a collapsed version of the Barron's Admissions Competitiveness Index which combined the original most competitive and highly competitive categories into a very selective category. By combining these categories, the student-college match indicator can be misrepresented. Perhaps future research could build on this study's student-college match and degree completion models by using alternative selectivity level arrangement as a sensitivity test. By considering alternative frameworks for clustering institution selectivity, the likelihood of better capturing students across all selectivity levels and differentiate across the "margins that matter" will likely increase (Bastedo & Flaster, 2014). Related to student-level predictors, although this study expanded on existing studies and incorporated additional student-level observed characteristics such as the ELS cognitive test, college application activity, highest math, FAFSA completion, and sources of college information, future studies could include additional factors to better predict student potential by selectivity level.

Further, and while this study attempted to bridge some of the gap, the variation in admissions qualifications has implications for historically disadvantaged groups. Future student-college match models should seek to include additional predictors that are inclusive of low-income, minority students. That is, future studies should ideally utilize datasets rich in observable characteristics that include additional college-related attitudes and expectation characteristics and admissions-related activities.

Second, a future study could replicate this study's student-college match design, but using an alternative data source to comparatively examine the rates for each student-college match type and further examine the relationship between match and degree completion. When examining the extent of undermatch, Smith et al. (2012) primarily used ELS:2002 to arrive at its

41% undermatch rate, but the authors compared the findings using the NCES' National Education Longitudinal Study of 1988 (NELS:1998) dataset. As noted in Chapter II, the ELS:2002 has notable limitations, including: 1) abbreviated questionnaires that covered fewer policy areas for some base year and first follow-up respondents (critical points for determining a student-college match); 2) sampling issues associated with certain groups of individuals (evident in the number of underrepresented minority students in this study's sample); and 3) many regional and vocational secondary schools were not included and students who may have attended a four-year institution would not have been surveyed (likely to affect the distribution by student-college match type). Potential NCES data sources to consider in a future comparative analysis include the High School and Beyond (HS&B) study, Beginning Postsecondary Students Longitudinal Study (BPS), and the in-progress High School Longitudinal Study of 2009 (HSLS:09).

Third, while student-college match – specifically undermatch and overmatch – were found to be significant negative or positive (respectively) predictors of degree completion, additional student persistence and completion-related scenarios should be explored. While this study combined continued persistence and degree completion in its outcome, a future study with a larger sample could more closely examine persistence by separating it from completion and include additional student outcomes such as transfer and system dropout. A multinomial logistic regression analysis using a multi-category outcome variable would provide insight into the relationship between each student-college match type and alternative outcomes. By learning more about the relationship between each alternative outcome, additional implications for future policy, practice, and research would likely emerge.

Summary

With roots in Affirmative Action policy, this study reaffirms the prevalence of student-college match as a phenomena associated with both the K-12- and postsecondary-levels. Although federal and state policies have made strides in equalizing access to postsecondary institutions, questions surrounding college choice and postsecondary student outcomes continue to surface. Specifically related to the college choice process, this study found that just about 24% of students attended an institution considered a match with their academic credentials, about 41% of students attended an institution considered below their academic match, and approximately 35% attended an institution with an academic profile that exceeds their measured academic potential. Understanding the prevalence of these student-college match types is an area of opportunity for policymakers, researchers, and practitioners to bridge the gap related to the college choice process.

Despite growing enrollments across the majority of four-year postsecondary institutions, a student outcome such as degree completion continues to be problematic – that is, about 40% of students fail to complete degree programs. This study's findings associated with four-year degree completion and student-college match indicate the relevance and importance of expanding the study of student-college match beyond examining rates or determinants. Rather, the study of student-college match will ideally evolve, expand, and be linked to student outcomes to better inform future research, policy, and practice.

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APPENDIX

Table A-1. Barron's 2004 college admission selector ratings.

Selectivity Level	2004
Most competitive	
Grade average	B+ to A
Class rank	Top 10 to 20%
Median SAT	655 to 800
Median ACT	29 or higher
Applicants admitted	Less than 33%
Highly competitive	
Grade average	B to B+
Class rank	Top 20 to 35%
Median SAT	620 to 654
Median ACT	27 to 28
Applicants admitted	33 to 50%
Very competitive	
Grade average	B- or above
Class rank	Top 35 to 50%
Median SAT	573 to 619
Median ACT	24 to 26
Applicants admitted	50 to 66%
Competitive	
Grade average	C to B-
Class rank	Top 50 to 65%
Median SAT	500 to 572
Median ACT	21 to 23
Applicants admitted	75 to 85%
Less competitive	
Grade average	Below C
Class rank	Top 65%
Median SAT	Below 500
Median ACT	Below 21
Applicants admitted	Top 85%
Non-competitive	
Grade average	
Class rank	
Median SAT	
Median ACT	
Applicants admitted	
Special	
Grade average	
Class rank	
Median SAT	
Median ACT	
Applicants admitted	

Source: Barron's Educational Series Inc. (2004).

Table A-2. Variables in the student-college match model.   * Reference group

Demographic and Socioeconomic Characteristics

Name	Description	Type	Original Coding	Recode Name(s)	Coding Structure
BYSEX	Student sex-composite	Categorical	1 Male 2 Female -4 Nonrespondent -8 Survey component legitimate skip/NA	FEMALE (2)	0 Male 1 Female
BYRACE_R	Student's race/ethnicity-composite	Categorical	1 American Indian/Alaska Native 2 Asian, non-Hispanic 3 Black or African American, non-Hispanic 4 Hispanic, no race specified 5 Hispanic, race specified 6 More than one race, non-Hispanic 7 Native Hawaiian/Pac. Islander, non-Hispanic 8 White, non-Hispanic -4 Nonrespondent -8 Survey component legitimate skip/NA	RACE_ASIAN (2, 7) RACE_BLACK (3) RACE_HISPANIC (4, 5) RACE_WHITE (8)* RACE_OTHER (1, 6)	0 Not 1 Group
BYSTLANG	Whether English is student's native language-composite	Categorical	0 No 1 Yes -4 Nonrespondent -8 Survey component legitimate skip/NA	ENGLISH (1)	0 Not 1 Yes
BYSES1QU	Quartile coding of SES variable	Categorical	1 Lowest quartile 2 Second quartile 3 Third quartile	SES_LOW (1) SES_MID (2, 3) SES_HIGH (4)*	0 Not 1 Yes *for each recode*

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			4 Highest quartile -4 Nonrespondent -8 Survey component legitimate skip/NA		

College Related Attitudes and Expectations

F1HIMATH	Highest math course of a half year or more	Categorical	1 No math course or math course is other 2 Pre-algebra, general or consumer math 3 Algebra I 4 Geometry 5 Algebra II 6 Trionometry, pre-calculus, or calculus -4 Nonrespondent -8 Survey component legitimate skip/NA -9 Missing	MATH_LOW (1, 2) MATH_MID (3, 4, 5) MATH_HIGH (6)*	0 Not 1 Yes *for each recode*
F2NAPP2P	Number of schools respondent applied to	Categorical	0 0 - did not apply 1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9 10 10	APPLY_LOW (0, 1, 2, 3) APPLY_MID (4, 5, 6) APPLY_HIGH (7, 8, 9, 10, 11)*	0 Not 1 Yes *for each recode*

			11 11 or more -3 Item legitimate skip/NA -4 Nonrespondent -8 Survey component legitimate skip/NA -9 Missing		
F1RAPIB	Total AP/IB courses	Continuous	0 Zero C continuous -4 Nonrespondent	F1RAPIB	Continuous
BYTXCSTD	Standardized test composite score-math/reading	Continuous	0 Zero C continuous -8 Survey component legitimate skip/NA	BYTXCSTD	Continuous
TXSATC	Most recent SAT composite score	Continuous	0 Zero C continuous -9 Missing	TXSATC	Continuous
F1RGPP	GPA for all courses taken in the 9th - 12th grades	Categorical	0 0.00 - 0.50 1 0.51 - 1.00 2 1.01 - 1.50 3 1.51 - 2.00 4 2.01 - 2.50 5 2.51 - 3.00 6 3.01 - 3.51 7 3.51 - 4.00 -4 Nonrespondent -9 Missing	GPA_LessThan2 (0, 1, 2, 3) GPA_2_3 (4, 5) GPA_3_4 (6, 7)*	0 Not 1 Yes *for each recode*
Admissions-Related Activities					
F2CPSTAT	CPS/FAFSA data availability status	Categorical	0 CPS data not available	FAFSA (1, 2, 3, 4, 5, 6, 7)	0 Not

			1 CPS 04/05 and 05/06 and 06/07 available 2 CPS 04/05 available 3 CPS 05/06 available 4 CPS 06/07 available 5 CPS 04/05 and 05/06 available 6 CPS 04/05 and 06/07 available 7 CPS 05/06 and 06/07 available		1 Yes *for each recode*
F1S48A	Has gone to counselor for college entrance information	Categorical	0 No 1 Yes -3 Item legitimate skip/NA -4 Nonrespondent -8 Survey component legitimate skip/NA -9 Missing	INFO_COUNSELOR (1)	0 Not 1 Yes *for each recode*
F1S48B	Has gone to teacher for college entrance information	Categorical	0 No 1 Yes -3 Item legitimate skip/NA -4 Nonrespondent -8 Survey component legitimate skip/NA -9 Missing	INFO_TEACHER (1)	0 Not 1 Yes *for each recode*
F1S48D	Has gone to parent for college entrance information	Categorical	0 No 1 Yes -3 Item legitimate skip/NA -4 Nonrespondent -8 Survey component legitimate skip/NA -9 Missing	INFO_PARENT (1)	0 Not 1 Yes *for each recode*
F1S48H		Categorical	0 No 1 Yes	INFO_COLLREP (1)	0 Not 1 Yes

	Has gone to college representatives for entrance information		-3 Item legitimate skip/NA -4 Nonrespondent -8 Survey component legitimate skip/NA -9 Missing		*for each recode*
F1S48I	Has gone to college publications/websites for entrance information	Categorical	0 No 1 Yes -3 Item legitimate skip/NA -4 Nonrespondent -8 Survey component legitimate skip/NA -9 Missing	INFO_WEBSITE (1)	0 Not 1 Yes *for each recode*
F1S48J	Has gone to college search guides for entrance information	Categorical	0 No 1 Yes -3 Item legitimate skip/NA -4 Nonrespondent -8 Survey component legitimate skip/NA -9 Missing	INFO_GUIDEBOOK (1)	0 Not 1 Yes *for each recode*

Table A-3. Variables in the degree completion model. * Reference group

Outcome Variable

F3PS1RETAIN	Status relative to first-attended postsecondary institution	Categorical	1 Earned credential from PS1; still attending PS1 as of F3	COMPLETE	categories include- *Completed (1, 2, 3) Not (4-5)*
			2 Earned credential from PS1; no longer attending PS1		
			3 No cred from PS1; still attending PS1		
			4 No cred from PS1; no longer attending PS1; did attend another		
			5 No cred from PS1; no longer attending PS1; did not attend another		
			-3 Item legitimate skip/NA		
			-4 Nonrespondent		
			-8 Survey component legitimate skip/NA		
			-9 Missing		

Demographic and Socioeconomic Characteristics

BYSEX	Student sex-composite	Categorical			
			1 Male	FEMALE (2)	0 Male
			2 Female		1 Female
			-4 Nonrespondent		
			-8 Survey component legitimate skip/NA		
BYRACE_R	Student's race/ethnicity-composite	Categorical	1 American Indian/Alaska Native	RACE_ASIAN (2, 7)	0 Not
			2 Asian, non-Hispanic	RACE_BLACK (3)	1 Group
			3 Black or African American, non-Hispanic	RACE_HISPANIC (4, 5)	
			4 Hispanic, no race specified	RACE_WHITE (8)*	
			5 Hispanic, race specified	RACE_OTHER (1, 6)	
			6 More than one race, non-Hispanic		
			7 Native Hawaiian/Pac. Islander, non-Hispanic		
			8 White, non-Hispanic		
			-4 Nonrespondent		
			-8 Survey component legitimate skip/NA		

BYSTLANG	Whether English is student's native language- composite	Categorical	0 No 1 Yes -4 Nonrespondent -8 Survey component legitimate skip/NA	ENGLISH (1)	0 Not 1 Yes
BYSES1QU	Quartile coding of SES variable	Categorical	1 Lowest quartile 2 Second quartile 3 Third quartile 4 Highest quartile -4 Nonrespondent -8 Survey component legitimate skip/NA	SES_LOW (1) SES_MID (2, 3) SES_HIGH (4)*	0 Not 1 Yes *for each recode*
Aspirations					
F1STEXP	How far in school student thinks will get- composite	Categorical	1 Less than HS graduation 2 GED or other equivalency only 3 HS graduation only 4 Attend or complete 2-yr college/school 5 Attend college, 4-yr degree incomplete 6 Graduate from college 7 Obtain Master's degree or equivalent 8 Obtain PhD, MD, or other advanced degree 9 Don't know -4 Nonrespondent -8 Survey component legitimate skip/NA	ASPIR_4YR (1,2, 3, 4, 5, 6, 9) ASPIR_GRAD (7, 8)*	
Pre-College Achievement					
TXSATC	Most recent SAT composite score	Continuous	0 Zero C continuous -9 Missing	TXSATC	Continuous
Academic Match					
ACADMATCH04	_____	Categorical	1 Undermatch	UNDERMATCH04 (1)	0 Not

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	Derived academic match variable		2 Overmatch	OVERMATCH 04 (2)	1 Yes
			3 Match	MATCH04 (3)*	*for each recode*

Postsecondary Achievement

F3TZGPAALL	Transcript: GPA from postsecondary institution	Continuous	0 Zero C continuous -1 Don't know -2 Refused -3 Item legitimate skip/NA -4 Nonrespondent -7 Not administered; abbreviated interview -8 Survey component legitimate skip/NA -9 Missing	F3TZGPAALL	Continuous
F2MAJOR2	Major Code	Categorical	2-digit codes re-categorized	MAJOR_AS* MAJOR_BU MAJOR_CA MAJOR_ED MAJOR_STEM MAJOR_OTHER	0 Not 1 Yes

Postsecondary Engagement - Academic

F3HIIMPACT	Number of high-impact educational activities in which R participated	Continuous	0 Zero C Continuous -3 Item legitimate skip/NA -4 Nonrespondent -8 Survey component legitimate skip/NA -9 Missing	F3HIIMPACT	Continuous

F2B18A	Talk with faculty about academic matters outside of class	Categorical	1 Never 2 Sometimes 3 Often -3 Item legitimate skip/NA -4 Nonrespondent -8 Survey component legitimate skip/NA -9 Missing	ACENG_FACULTY (2, 3)	0 Not 1 Yes *for each recode*
F2B18B	Meet with advisor about academic plans	Categorical	1 Never 2 Sometimes 3 Often -3 Item legitimate skip/NA -4 Nonrespondent -8 Survey component legitimate skip/NA -9 Missing	ACENG_ADVISOR (2, 3)	0 Not 1 Yes *for each recode*
Postsecondary Engagement - Social					
F2B18G	Participate in other extracurricular activities	Categorical	1 Never 2 Sometimes 3 Often -3 Item legitimate skip/NA -4 Nonrespondent -8 Survey component legitimate skip/NA -9 Missing	SOENG_EXCURRIC (2, 3)	0 Not 1 Yes *for each recode*
F2B18F	Participate in varsity or	Categorical	1 Never 2 Sometimes	SOENG_SPORTS (2, 3)	0 Not 1 Yes

	intercollegiate sports		3 Often -3 Item legitimate skip/NA -4 Nonrespondent -8 Survey component legitimate skip/NA -9 Missing		*for each recode*

Financial Factors

F3PELLCUM	Cumulative Pell (as of F3)	Continuous	0 Zero C continuous -9 Missing	F3PELLCUM	Continuous
F2SPPCUM	Cumulative Stafford, Perkins, PLUS	Continuous	0 Zero C continuous -9 Missing	F2SPPCUM	Continuous
F3A23	Whether R received merit-based grants/scholarships during first term at first attended PS institution	Categorical	0 No 1 Yes -3 Item legitimate skip/NA -4 Nonrespondent -7 Not administered; abbreviated interview -8 Survey component legitimate skip/NA -9 Missing	GRANTS_FIRSTTERM (1)	0 Not 1 Yes
F3A25	Whether R received merit-based grants/scholarships during last term at	Categorical	0 No 1 Yes -3 Item legitimate skip/NA -4 Nonrespondent	GRANTS_LASTTERM (1)	0 Not 1 Yes

	last attended PS institution				
			-7 Not administered; abbreviated interview		
			-8 Survey component legitimate skip/NA		
			-9 Missing		

Institutional

F2PS1CTR	Control of postsecondary institution	Categorical	1 Public	CONTROL_PUBLIC (1)*	0 Not
			2 Private not-for-profit	CONTROL_PRIVATE (2, 3)	1 Yes
					for each recode
			3 Private for-profit		
			-3 Item legitimate skip/NA		
			-4 Nonrespondent		
			-8 Survey component legitimate skip/NA		
			-9 Missing		
BYURBAN	School urbanicity	Categorical	1 Urban	URBN_URBAN*	0 Not
			2 Suburban	URBN_SUBURBAN	1 Yes
					for each recode
			3 Rural	URBN_RURAL	