IMPROVING BACHELOR'S DEGREE COMPLETION RATES:

AN EXAMINATION OF FIRST YEAR EXPERIENCE AT SACRAMENTO STATE

A Thesis

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Jodi Lewis

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by

Jodi Lewis

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Abstract

of

IMPROVING BACHELOR'S DEGREE COMPLETION RATES:

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Too many students are not completing their Bachelor's degrees in California and

nationwide, threatening not only the global competitiveness of our workforce, but also the

economic and civic vitality produced by an educated society. At California State University

(CSU) campuses, about 50,000 freshmen enrolled in 2006, representing the top one-third of

California's graduating high school seniors (CSU, 2013a). However, system-wide, roughly half

of the students who enrolled as freshmen did not complete their degrees within six years (CSU,

2013a). This statistic, which has fluctuated only slightly for several years, warrants the

attention of taxpayers, policymakers, administrators, education practitioners, and parents,

because of the significant investments they have made in students by the time they matriculate

in CSU (CPEC, no date). In order for society to reap the significant returns promised by

Bachelor's degree graduates in the workforce, and in order for California to meet urgent

workforce needs, students must complete their degrees.

One way to improve graduation rates is through effective resources and programs that

increase the academic achievement and engagement of students. Research indicates that the

majority of students who drop out do so in the first year, making this a critical time to intervene

(CSU, 2013c; Tinto, 2012). To that end, this research quantifies the impact of participation in

First Year Experience (FYE) on the graduation rate of first-time freshmen at California State

University, Sacramento ("Sacramento State"). Using data from the cohort of first-time freshmen entering Sacramento State in 2006, this research employs logistic regression analysis to demonstrate that participation in FYE, either through a first year seminar or a learning community, is associated with a 38 percent greater likelihood of graduation than non-participation, holding constant all background characteristics and high school academic experiences. The research also indicates that other first-year achievements, including freshman GPA and first-year units, are statistically significantly associated with graduation, holding constant all background characteristics, high school academic experiences, and college experiences.

Based on these findings, I recommend that Sacramento State continue and enhance its efforts to increase engagement of freshman students through FYE – to help bridge their academic and social contexts, to help them advance college over competing priorities in life, to help them establish a critical psychological mindset through academic achievement in their freshman year. The CSU Chancellor's recent $50 million investment in student success provides potential resources to enhance the focus on freshmen. These efforts could help move the needle on graduation rates, promising significant economic returns to California stakeholders.

_____, Committee Chair
Su Jin Jez

_____
Date

DEDICATION

To my three wonderful children, and to college-bound students everywhere: throughout your educational journey, may you find personal strength, familial support, and institutional empowerment to follow your dreams.

ACKNOWLEDGEMENTS

Larry, for all that you have done to help us achieve this absolutely blessed life, and for the many years of adventure – my heart swells with love and appreciation.

Julia, Ellie and John: thank you for being such loving, caring, funny, encouraging, intelligent, determined young people, and for inspiring me to be a better person every single day. Words cannot express how proud I am of each of you.

I acknowledge the talent and expertise of the PPA faculty and staff for providing such a valuable degree program – I am indebted to each of you for the unique skills and perspectives that you taught me. I thank Nancy and Andrea for their excellent mentorship in higher education. Although I didn't appreciate it at the time, I am thankful that Mary made us write a policy analysis paper before the very first class of the program. I was thinking not-so-nice things about the assignment that summer three years ago, but now I know just how far I've come!

To my readers, Su Jin and Andrea: your guidance was invaluable to this research. Thank you.

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Too many students are not completing their degrees

While a more diverse population than ever is enrolling in four-year universities, too many students are not completing their Bachelor's degrees in California and nationwide. At California State University (CSU) campuses, more than half of students who enroll as first-time freshmen do not complete their degrees within six years (U.S. Dept. of Education, 2013f). This statistic, which has fluctuated only slightly for several years, warrants the attention of taxpayers, policymakers, administrators, education practitioners, and parents, because of the significant investments they have made in students by the time they matriculate in universities (California Postsecondary Education Commission, no date). As publicly funded institutions, CSU campuses have an obligation to remove structural barriers that impede student success, and taxpayers have a right to expect better than 50 percent success rates for graduating students. Increasing the number of students who complete their Bachelor's degrees offers significant benefits to stakeholders in the form of higher earnings and greater tax revenues, lower unemployment, and faster job growth, which is good for California and the country (The National Center for Public Policy and Higher Education, 2004).

America's ranking among the most educated nations is declining as the percentage of Americans with Bachelor's degree in the population drops (Organization for Economic Cooperation and Development, 2013). Based on strong evidence of the benefits of Bachelor's degrees as well as the need to enhance the country's global competitiveness, national efforts have intensified to increase the educational attainment

of our population. While researchers continue to analyze ways in which we can foster student success, one conclusion is clear: achievement of national goals will depend heavily on contributions from California, which enrolls nearly double the number of postsecondary students than the next closest state (U.S. Census Bureau, 2012).[1] California is a microcosm of the nation's higher education landscape with a declining proportion of Bachelor's degree graduates in the population. The Public Policy Institute of California predicts that by 2025, two of every five jobs will require a Bachelor's degree, but present trends indicate that there will be a gap of one million such workers if current trends continue (Reed, 2008; Johnson & Sengupta, 2009).

There have been many strategies posited to increase the percentage of Bachelor's degree graduates in California and therefore the nation at large. Increasing access and completion are two main options. While national data indicate that a larger and more diverse share of students than ever is enrolling in college, completion rates show room for improvement, especially for minority students who comprise an increasing proportion of the college population (Tinto, 2012; U.S. Department of Education, 2012b). Completion trends in California largely mirror the nation, with rates that vary among public four-year universities and vary for minority populations. Specifically at CSU campuses, about 50,000 freshmen enrolled in 2006, representing the top one-third of California's graduating high school seniors (CSU, 2013). However,

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[1] In 2008, California had the most students enrolled in public postsecondary institutions in the nation (2.2 million). Texas had the next highest number (1.2 million). As a share of total population, California's was the highest among the four most populous states (California, Texas, New York, and Florida) (U.S. Census Bureau, 2012).

system-wide, roughly half of the students who enrolled as freshmen did not complete their degrees within six years – a trend which has not changed significantly in the past decade (CSU, 2013; CPEC, no date).

This is not only a private trouble for each dropout, but also a public problem that warrants policy intervention for two reasons. First, in these publicly funded institutions, government is traditionally expected to act effectively for all populations (Bardach, 2009). Second, significant public investments have been made in students to get them to their first year in college and beyond. In order for society to reap the significant returns promised by Bachelor's degree graduates in the workforce, students must complete their degrees. To that end, my thesis focuses on institutional efforts to improve student success – in particular, one first-year intervention program at California State University, Sacramento. Research indicates that the majority of students who drop out do so in the first year, making this a critical time to intervene for student success (CSU, 2013; Tinto, 2012). In this introduction to my thesis, I suggest that improving completion rates is an important effort to help California increase the share of Bachelor's degree graduates in its population. I present national as well as state-specific evidence that Bachelor's degrees graduates honor stakeholder investments through their economic returns to society, and that improving completion of degrees is a problem that deserves policy intervention. Research that informs practices in California will be applicable far beyond the state's borders.

Improving rates of completion is an important policy priority

Nationwide, enrollment has increased in four-year postsecondary institutions over the past several decades. Enrollment increased by 11 percent between 1990 and 2000 in the nation, with a much larger 37 percent increase in enrollment from 2000 and 2010 (U.S. Department of Education, 2013c). A larger percentage of minorities are enrolling in four-year institutions, which reflects the growing diversity of our nation. From 1976 to 2010, the percentage of Hispanic students enrolled in four-year postsecondary institutions rose from 3 percent to 13 percent, the percentage of Asian/Pacific Islander students rose from 2 percent to 6 percent, and the percentage of Black students rose from 9 percent to 14 percent.[2] During the same period, the percentage of White students fell from 83 percent to 61 percent (U.S. Department of Education, 2013c). These data indicate that efforts to increase access are resulting in upward trends of enrollment. Notwithstanding the success achieved in expanding access, persistence and degree attainment data indicate that large shares of students are not completing their degrees. Table 1 shows that there is much room for improvement, particularly among minority populations. Only about half of Hispanic (51.7) and Black (50.9) students earned a Bachelor's degree in six years.[3] In contrast, about 75 percent of White and Asian students earned their Bachelor's degrees

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[2] In this thesis, the terms "Hispanic" and "Latino" are used interchangeably, as is commonly accepted in research literature.

[3] The de facto time to complete a Bachelor's degree, accepted in the academic and research communities, is six years. This is also the "Student Right-to-Know" rate that California statute requires all public postsecondary institutions to report. In this document, when I refer to "graduation rate" or "completion rate," it will refer to the rate in which it took first-time, full-time freshmen to complete their Bachelor's degrees within six years.

Table 1: Percentage distribution of persistence attainment status by June 2009 for first-time, full-time freshmen entering institutions nationwide in 2003, by sex and race/ethnicity

	No degree, not enrolled	No degree, still enrolled	Bachelor's degree by 2009
Male	21.9	8.1	64.3
Female	17.9	5.5	72.1
Race/ethnicity			
White	17	4.8	73.1
Black	31	12.5	50.9
Hispanic	30.2	12.6	51.7
Asian	12.8	9.1	75.8
Two or more races	20.9	8.1	65.6
Race/ethnicity by sex *Male*			
White	19.8	5.8	68.8
Black	33.9	14.2	47.7
Hispanic	31.8	16.1	45.6
Asian	16.2	13.6	65.7
Two or more races	18.1	9.6	62.8
Female			
White	14.8	4	76.6
Black	29.2	11.4	53
Hispanic	29.1	10.1	56.1
Asian	9.8	5.2	84.4
Two or more races	23	7	67.5

Reporting standards were not met for Native Hawaiian/Pacific Islander, and American Indian/Alaska Native populations. Either there were too few cases or the coefficient of variation (CV) was 50 percent or greater

Source: U.S. Department of Education, *Higher Education: gaps in access and persistence* (2012)

within six years (U.S. Department of Education, 2012b). The highest achieving group in that cohort was female Asians, with an 84 percent completion rate.

Within California, data indicates that the average rate of completion at all University of California (UC) campuses was 79 percent for cohorts beginning in 1996 through 2001. The comparable average rate of completion at all California State University campuses was 45 percent (California Postsecondary Education Commission, no date). Historical data in Table 2 shows that attainment rates at UC and CSU campuses have varied along racial/ethnic minority lines, as seen in nationwide rates. Most recently, in 2012, about 80 percent of students who entered the UC system as first-time freshmen graduated within six years. While graduation rates at UC are relatively high – they exceed the nationwide average for flagship public research universities -- lagging rates at CSU campuses require improvement (Freeling, 2013). In

Table 2: Percentage of first-time, full-time freshmen graduating with a Bachelor's degree within 6 years, by entering cohort and race/ethnicity at UC and CSU campuses

UC campuses					
cohort	Asian/Pacific Islander	Black	Latino	White	Total
1996	80	64	71	77	77
1997	81	68	72	79	79
1998	83	71	73	80	80
1999	82	70	74	81	80
2000	83	68	74	81	80
2001	84	70	69	81	80
CSU campuses					
cohort	Asian/Pacific Islander	Black	Latino	White	Total
1996	42	23	35	50	42
1997	45	26	38	51	44
1998	46	27	39	52	45
1999	47	27	40	52	46
2000	49	32	42	54	48
2001	49	31	40	53	47

Source: California Postsecondary Education Commission, Graduation Rates,
http://www.cpec.ca.gov/StudentData/GradRates.asp

2012, the average graduation rate among all 23 CSU campuses was 48 percent. The rates ranged from 28 percent to 72 percent (Table 3) (U.S. Department of Education, 2013f).[4]

The higher completion rates at UC campuses can be explained in part by the system's competitive admission standards. California's Master Plan for Higher Education stipulates that UC will enroll only the most academically prepared students -- the top 12.5 percent of California's graduating high school seniors (Geiser & Atkinson, 2013). Because many of them possess characteristics that are strong determinants of academic success, this leads to a greater likelihood of completion.

Likewise, according to the Master Plan, CSU campuses are broader access institutions, but they limit enrollment to the top one-third of California's graduating high school seniors. The

Table 3: Percentage of first-time, full-time freshmen earning their Bachelor's degree within 6 years at CSU campuses in 2012

Campus	Rate
Bakersfield	37%
Channel Islands	51%
Chico	57%
Dominguez Hills	28%
East Bay	41%
Fresno	48%
Fullerton	51%
Humboldt	41%
Long Beach	57%
Los Angeles	37%
Maritime Academy	58%
Monterey Bay	37%
Northridge	48%
Pomona	51%
Sacramento	41%
San Bernardino	44%
San Diego	66%
San Francisco	47%
San Jose	50%
San Luis Obispo	72%
San Marcos	45%
Sonoma	55%
Stanislaus	49%
Average	48%

Source: Integrated Postsecondary Data Education System (2013)
http://nces.ed.gov/ipeds/datacenter/

[4] Graduation rates are only for students who enter CSU campuses as first-time freshmen. CSU is also an important destination for nearly 50,000 students who transfer from one of California's 112 community colleges each year on average (CCCCO, 2013). For the 2006 cohort of students entering CSU campuses as transfers from a California community college, the average *six-year* graduation rate (from the time they entered CSU) was 70 percent, ranging from 62 to 79 percent at the 23 campuses (CSU, 2013c). Combined with the time the student spent in community college, this is a substantial amount of time for a student to pay tuition, exacerbated by a relatively low completion rate.

low completion rates on many campuses should therefore raise the question: why are more than half of newly enrolling freshmen – all of whom received "college preparatory" educations according to California standards -- not completing their degrees within six years? Research on predictors of student success is far-ranging; I review the literature in Chapter 2.

Workers with Bachelor's degrees pay substantial dividends to society

Policy intervention to improve completion is supported by evidence of numerous benefits to be reaped individually from a Bachelor's degree, but also equally valuable benefits that a graduate will contribute to the economy, workforce, and society. In this section, I present evidence that indicates that improving the share of Bachelor's degree graduates is an important policy priority to improve economic and social mobility in both the nation and California -- the leading provider of postsecondary education.

Bachelor's degree graduates pay substantial dividends to society. National statistics show that college graduates earn substantially higher incomes than those without degrees, which leads to increased tax revenue for states, and increases the share of disposable income that can be used for goods and services in local economies – all of which drive economic vitality in the United States (Johnson & Sengupta, 2009). The median weekly earnings of a full-time, Bachelor's degree holder in 2012 were 63 percent higher than those of a high school graduate ($1,066 compared to $652), and 36 percent higher than those of an Associate's degree graduate ($785) (U.S. Department of Labor, 2013b). As evidence in support of improving the percentage of

graduates who complete their degrees, the gap in lifetime earnings between those who complete a Bachelor's degree and those who start college but do not graduate is more than $750,000 (Tinto, 2012).

Americans with Bachelor's degrees not only earn better incomes, but also are less likely to be unemployed. In 2012, the unemployment rate for 25-34-year-olds with a Bachelor's degree or higher was 4 percent, compared to 10 percent for those with some college education, and 13 percent for high school graduates (U.S. Department of Education, 2013a).

Increased educational attainment also benefits communities through higher social and civic participation, and college graduates make better decisions regarding finance and healthcare that lead to decreased demand for social services (Johnson & Sengupta, 2009; Berliner 2013).

Bachelor's degree graduates also make significant contributions to America's workforce. Increased education can contribute to better innovation in the marketplace, as well as larger shares of qualified workers to fill jobs. The Georgetown Center on Education and the Workforce predicts that by 2018, there will be approximately 46.8 million job openings, about 33 percent of which will require a Bachelor's degree or better. The Center predicts that 13.8 million will be new jobs, and about 33 million will be positions vacated by workers who have retired or permanently left their occupations (Carnevale, 2010).

Evidence supports the notion that along with better job prospects and increased earnings, college graduates enjoy upward social mobility (Johnson, 2009). Improving

the percentage of Bachelor's degree graduates in the population can help narrow the gap between the highest and lowest incomes (Reardon, 2013). Statistics show that earning a college degree makes an individual born into the middle three income quintiles more than 75 percent more likely to advance to a higher income quintile than those who do not earn a college degree (Eberly & Martin, 2012).

America needs more people with Bachelor's degrees, and to achieve this goal, it must focus on improving the likelihood that minority students will graduate from four-year postsecondary institutions. Minorities are increasing as a percentage of the population, and their high school graduation rates are increasing, yet, as I demonstrated in the previous section, their completion rates at most four-year postsecondary institutions are low. The United States Census predicts that the percentage of Hispanics in the population will increase from approximately 15 percent today to about 30 percent by 2050. The percentage of Asians will increase from 5 to 9 percent of the population, and the percentage of African Americans will increase slightly from 13 to 15 percent. The percentage of White people will decrease from 66 percent to about 46 percent of the population in 2050 (U.S. Census, 2013). Improving completion rates especially for these populations is both a social equity argument and an increasing necessity for the nation's economic strength.

California could be one million workers short for jobs requiring a Bachelor's degree

With such strong evidence of the benefits of Bachelor's degrees in general, and accepting that we should achieve better graduation rates, I return the focus of this

analysis to California. Increasing the percentage of Bachelor's degrees in California is needed not only to help drive economic vitality in the state, but also to help lead the nation in the same effort. For the first time in the state's history, young adults in California are less likely than older adults to have graduated from college (Johnson, 2010). The Public Policy Institute of California projects that by 2025, about 41 percent of jobs in California will require a Bachelor's degree, but current trends predict that only 35 percent of Californians will have any college degree (including an Associate's degree). This represents a shortfall of approximately 1 million workers (Reed, 2008). Further, the number of workers with only a high school diploma is projected to far outnumber jobs available to people with that level of education (Johnson, 2009). These projections are based on growth trends in demand for college-educated workers in California along with projected declines in the percentage of college-educated workers in the state. California has the largest number of Baby Boomers in the nation -- approximately 3 million who will retire by 2025 (Johnson, 2009). They will be vacating largely technology-related jobs that increasingly demand college educations. As the predominantly White Baby Boomers leave the workforce, the state's available labor force will be increasingly diverse along racial/ethnic lines. The state estimates that in 2020, Hispanics will account for 40.7 percent of California's population while Whites will make up 36.6 percent. In 2030, the population is projected to be nearly 44 percent Hispanic and about 34 percent White (Williams, 2013).

With the Hispanic plurality in the population, educators, policymakers, and researchers need to focus on ways to affect not only enrollment but also completion

rates for this group. Hispanics represent an increasing percentage of potential Bachelor graduates in the population. Currently, about half of the K-12 student population in California is Hispanic (Excelencia, 2013). While more Hispanic students than ever are enrolling in college, the graduation rate for Hispanic students in California (35 percent) is lower than for White students (47 percent) (Santiago & Callan, 2010). There are many factors that are common among Hispanic populations that are negatively associated with degree attainment including English Language learning status, lack of college-educated parents, lack of academic preparedness, and lower socioeconomic status (Nunez & Kim, 2012; Hill et al., 2013; Rich, 2013). The share of Hispanics with a Bachelor's degree in California is projected to reach only 12 percent in 2020 (Hill et al., 2013).

In order for California to be a desirable place for businesses, to have enough skilled workers to fill workforce needs, to be a place where people enjoy decent earnings, and where minorities and low-income populations are given the opportunity for social mobility, we must confront college completion for all populations as a policy priority. Dennis Jones, president of the National Center for Higher Education Management Systems, spoke in reference to the nation as a whole, but his comment is entirely applicable to California alone: "Almost the entirety of the population growth that we'll look at over the next two decades will consist of students and individuals that we have not been particularly successful at serving. And if we don't serve them well, then the country will have no hope of reaching the goals for an educated workforce" (Pandolfo, 2012).

The first year of college is the biggest hurdle

Efforts to improve completion rates are informed by research about where policy interventions can have the greatest impact. A large body of evidence exists on factors that impact student success (see Chapter 2). This thesis narrows the focus to those efforts that are made by institutions to help students in their first year, because research shows that between one-quarter and one-third of students, on average, do not return for a second year (U.S. News & World Report, 2013). The majority of attrition tends to occur in the first year and decline thereafter, and first year attrition rates tend to be higher at institutions with less selective admissions policies (Tinto, 2012). Nationwide, among full-time, first-time students who enrolled in a postsecondary degree-granting institution in 2010, about 79 percent returned to 4-year institutions, with a range of 62 percent at the least selective institutions (those with open admissions) to 95 percent at the most selective institutions (those where less than 25 percent of students are accepted). (U.S. Department of Education, 2012a).[5] At CSU campuses in California, the largest percentage of students who drop out tend to do so after the first year. About 84 percent of first-time freshmen entering in 2010 matriculated the following fall, system-wide. About 75 percent of the cohort returned for a third year (CSU, 2013c). In the UC system, about 93 percent of first-time freshmen in 2010 matriculated the next fall, university-wide (UC, 2013). This high retention reflects in part the selective admissions policy of UC campuses. For the CSU,

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[5] An interesting line of research would be to explore the statistical correlation between breadth of access and retention rates. Research could quantify the effect of selectivity factors on graduation rates.

however, which are broader access institutions, the first year of college is a critical

retention point, and interventions for first-time freshmen can have the greatest impact

on completion rates.

Improving rates of completion among Bachelor's degree-seeking students

involves identifying how and why these students fall off track, and providing resources

and interventions to help them persist. In the early 2000s, CSU launched the

Graduation Initiative (GI) across all 23 campuses, dedicated to "systematically

discovering and dislodging the roadblocks to our students' success" (CSU Chancellor's

Office, 2010). The aim of the initiative is to increase the freshman six-year graduation

rate by eight percentage points by 2015, and cut in half the existing gap in degree

attainment by CSU's under-represented minority (URM) students. The initiative

encourages campuses to establish graduation targets comparable to the top quartile of

national averages of similar institutions. Although the GI focuses on only the

graduation rates of first-time freshman, increasing the graduation rates of these students

will result in reliable, quantifiable data that will ultimately help all students. One aspect

of the plan is the development of metrics for assessing the impact of interventions on

graduation rates. Noting that this is often a strategic challenge, the plan says:

> "Graduation rates fluctuate from year to year due to a wide array of variables. How
> can campuses measure whether a specific program is facilitating or hindering their
> students' path to graduation?   Although reliab
> lacking, campuses have been encouraged to develop their own metrics for assessing
> the impact of their programs on graduation rates. Admittedly, this process is often
> more art than science, but by putting a stake in the ground and consistently analyzing
> progress, campuses have a much greater likelihood of achieving their goals." (CSU
> Chancellor's Office, 2010)

First Year Experience is an important support program for freshmen

To complement these efforts, this thesis analyzes the effect of a program intended to help first-time freshmen succeed at California State University-Sacramento ("Sacramento State"). My research seeks to quantify the impact of participation in First Year Experience (FYE) on the graduation rate of first-time freshmen at Sacramento State.

FYE has been serving students at Sacramento State since the 1990s, aiming to ease their transition from high school to college. Unlike many outreach programs that seek to provide equity for underserved populations, FYE is an institutional effort that benefits all incoming freshmen who are equally subject to risk factors that cause students to drop out in the first year. The program offers an academic component, including major and/or General Education courses taken in Learning Communities, as well as a First Year Seminar course; a non-academic component, consisting of co-curricular events designed especially for first year students, helping them draw connections between their academic training and experiences of educated society; and peer mentors, who offer academic advising, workshops, study groups, and peer networking. The program addresses one of the key campus-identified reasons why students drop out – engagement. Students who do not feel a sense of belonging at the university and/or do not see enough value in a college degree fail to place it above competing priorities. The university dedicates considerable resources to this program, which is well-suited to helping students achieve first-year milestones including

retention after the first year, completion of the first 30 units of a student's courses, and completion of remedial coursework (if required) (Offenstein & Shulock, 2010). [6]

One important question is the extent to which participation in FYE is affecting student outcomes at Sacramento State. Determining causality of student outcomes is complex, as there are numerous confounding factors that impact student experiences. While researchers may never definitely conclude that any particular program causes students to graduate, we can create multiple data points that reveal how the program interacts with many of the factors that have been proven to determine student success. This analysis will help tailor efforts to meet the varying needs of many students. With limited resources for programs, and with such a distinct priority on improving persistence and completion, university administrators and educators can use data that demonstrate exactly what types of students can benefit the most from FYE.

My analysis isolates the effect of FYE on degree completion at Sacramento State for first-time freshmen entering the university in 2006. Data from my study will help Sacramento State ensure that it is using its limited resources on impactful programs, and will inform the university's effort to target resources in a way that most directly impacts the goal of improving completion rates at CSU. As one of the largest four-year university systems in the nation, and as the top destination for students from the largest community college system in the nation, CSU would serve its students well with rates that more closely match those achieved in the UC system.

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[6] In 2013, Sacramento State was awarded a grant of $250,000 to support First Year Experience

This thesis complements the on-going evaluation of programs being conducted by the university, many under the guise of the CSU Graduation Initiative. Chapter 2 of my thesis is a comprehensive review of the literature, through which I identify individual and institutional variables that research has shown affect student success, particularly variables that impact student persistence through the first year. I then identify gaps in the research that my thesis potentially fills. Chapter 3 outlines my research methodology: from data collection to regression analysis, identifying the dependent and independent variables that I control for in order to isolate the effect of FYE on outcomes. Chapter 4 summarizes the results of my econometric analysis, quantifying the effect of each independent variable on graduation rates at Sacramento State. Finally, in Chapter 5, I synthesize the information, drawing conclusions and making recommendations that will help stakeholders target best practice interventions in the most efficient way to improve completion rates at Sacramento State, in the CSU system, and nationwide.

Chapter 2 - Literature Review

Across the education continuum from preschool to college, there are a number of factors in students' home, social, and school environments that affect educational attainment (Adelman, 1999; Tinto, 2012). Many of these factors confound each other, making it difficult to isolate their independent influence on student outcomes (Kozol, 1991; Stull, 2013). However, in the interest of increasing the educational attainment of students in the U.S., researchers have attempted to get as close to parsing out causality as possible. A great deal of literature focuses on students' background and secondary school characteristics that influence college preparedness and college-going behaviors, and many studies have found that these same characteristics significantly influence students' persistence and completion in college. Historically, research has focused on students' behaviors in preparing for, applying for, choosing, and enrolling in college. Recently, more literature has focused on what impacts student progression in college. Other studies focus more on students' sociological experiences in college, demonstrating that institutional interventions influence student success. However, few studies seek to understand how student background and institutional interventions interact to impact educational attainment. My research fills this gap in the literature. In this chapter, I first review the literature on the numerous factors that have been shown to influence postsecondary persistence and completion. I group the factors into three broad themes: student background, high school factors, and college experiences and activities. Finally, I describe the conceptual framework, based on my review of the literature, that will support my study.

Student Background

A general consensus in the literature is that family background characteristics are important influences on college persistence and completion (Bowen and Bok, 1998; Adelman, 2004; Roderick et al., 2008), though researchers disagree about the relative importance of specific attributes (i.e. socioeconomic status, race/ethnicity) (Niu & Tienda, 2013), and sometimes the impact of these factors can change over time. For example, in recent decades, the effect of gender on completion rates has reversed from favoring men to favoring women (Adelman, 2004; Buchmann & DiPrete, 2006; U.S. Department of Education, 2012). Researchers have time and again shown correlation between family background and college completion, but the complexity of the interaction makes it difficult to determine causality.

Race/ethnicity. While educational attainment does vary significantly according to race/ethnicity in many studies that control for other factors such as parental involvement, parent education, socioeconomic status, secondary school quality, and peer influences, the magnitude of influence of race/ethnicity becomes much less important (Steinberg et al., 1992; Fletcher & Tienda, 2009). Perna and Titus (2005) studied a random sample of more than 9,000 Hispanic, African American and White students from the third follow-up (1994) in the National Educational Longitudinal Study (NELS:94). After controlling for student and school-level variables, the authors' regression analysis concluded that the odds of Hispanics and African Americans enrolling in a four-year college are *higher* (odds-ratios 1.598 and 1.187, respectively), compared to Whites. The authors posited that the generally lower observed college

enrollment rates for minorities are largely due to the fact that 49% of Hispanics and 37% of African Americans attended schools in the lowest quartile of parent education, compared with 17% of Whites, leading to lower levels of college-enrollment resources through their schools' social networks. Steinberg et al. (1992) found that parenting practices that are the most effective in supporting student achievement vary by racial/ethnic differences and that the parenting practices that result in high achievement among White middle-class students are different from those that are successful among African American students. These findings echo many others to suggest that race/ethnicity is usually confounded by other background factors.

Parent education. One of the most important background factors identified in the literature is parental education. Many researchers contend that parental education directly affects student outcomes on both an individual and an aggregate school level (Nunez & Kim, 2012; Perna, 2000; Perna & Titus, 2005). When parents are college-educated, they tend to raise their children with enriched experiences and academic rigor, with the expectation that their children will go to college. Grodsky and Riegle-Crumb (2010) defined this lifelong expectation about college as a *habitus*, and they found that – after controlling for socioeconomic origins, race/ethnicity, nativity, citizenship, and preparatory commitment – students who hold this habitus are 6 percentage points more likely to apply to a four-year college than students who make a conscious decision to attend college. This lifelong habitus is influenced by several factors, of which parental education is one of the most influential. Students whose parents completed a Bachelor's degree or higher are about 20 percentage points more

likely to have a college-going habitus. Latino students are seven percentage points less likely to hold a college-going habitus.

Parental education is highly correlated with socioeconomic status (SES), as college graduates tend to earn higher incomes and have better job prospects. The literature identifies both parent education and SES as strong determinants of student achievement (Roderick et al., 2008; Stull, 2013). Because of the strong correlation of these factors, as well as their interaction with other mediating factors such as school quality and peer influence, it is difficult to discern their isolated and/or direct effect on student outcomes (Studenmund, 2006).

Family socioeconomic status. Coleman et al.'s (1966) research established the importance of an individual's family SES as an influence on academic achievement, and researchers have demonstrated its enduring effect, even after controlling for other influences on student achievement (Caldas, 1993; Caldas & Bankston, 1997; Stull, 2013). In a study of NELS:88, Cabrera & La Nasa (2001) identify a significant achievement gap between students with low and high SES. The authors identify a negative correlation of -0.065 between upper SES and presence of risk factors (such as poor academic performance in middle school, or being raised by a single parent) that endanger a student's ability to complete the following three tasks critical to college enrollment: obtain college qualifications, graduate from high school, and apply to a postsecondary institution. This results in disproportionate access by wealthier students to college. At the wealthiest 50 institutions, students from American families in the bottom quartile of income represent only seven percent of the institutions' collective

student body. By contrast, students from families in the top quartile account for more than half of total enrollment (Marx, 2011). Jez (2008) also found that students from wealthier families are very likely to continue on to four-year institutions, although the influence of wealth was negated when controlling for academic achievement, habitus, and educationally-purposeful social and cultural capital. Social and cultural capital that is valuable to education measures such abilities as a student's access to information about college (Perna & Titus, 2005). A recent study (Giudici & Pallas, 2014) suggests that while socioeconomic status is an influential factor, it does not predetermine student outcomes, but rather interacts with institutional actions to influence outcomes.

High School Factors

      Economic composition of the high school. Many study findings suggest that SES of individual students aggregate at the high school level, producing an even greater effect on student outcomes than the effect of individual family SES (Caldas & Bankston, 1997; Engberg & Wolniak, 2010). Niu & Tienda (2013) sought to test the theory that the aggregate SES of a high school influences college persistence and completion. The authors studied 2,752 Texas high school seniors of 2002 who enrolled in college within the calendar year of high school graduation. They hypothesized that postsecondary outcomes differ among students who attend schools that largely serve more affluent students compared to those that mainly serve poor students. The economic composition of an affluent high school is based on the collectively high socioeconomic status of families at the school, which is largely a product of parents' education levels. At these schools, other factors generally correlated with high SES that

contribute to student success are usually present: rigorous academic coursework including college preparatory English and math, high parent involvement in student academic life, student involvement in enrichment activities, student access to resources about college, and student access to guidance from parents, faculty and counselors. The study found that graduates from affluent high schools are over twice as likely to graduate on time (in four years) and 1.65 times as likely to remain enrolled relative to withdrawing compared with graduates from average high schools. The researchers concluded that economic composition of high school is an important determinant of persistence and completion.

A secondary finding of Niu and Tienda (2013) is that a good match between a student's academic achievement and the selectivity of the college s/he attends is an important determinant of persistence and completion. They found that a student whose SAT score is at or above their institution's 75th percentile are less than half as likely to graduate on-time or remain enrolled relative to withdrawing compared with their statistical counterparts whose SAT score is between their institution's 25th and 75th percentiles.

Academic Factors. Some researchers look at measures of academic preparation to discern influences on persistence and completion. Clifford Adelman's seminal works *Answers in the Tool Box* (1999) and *The Tool Box Revisited* (2006), along with *Principal Indicators of Student Academic Histories in Postsecondary Education, 1972-2000* (2004) examined factors that influenced students' pathways from high school through college. His first *Tool Box* study (1999) used data from a study designed and

executed by the National Center for Education Statistics (NCES) of the U.S.

Department of Education, called High School & Beyond/Sophomore (HS&B-

So:80/92). This study uses high school and college transcript information and student

surveys to follow the history of the scheduled high school graduating class of 1982

from the time they were in 10th grade in 1980 until roughly age 30 in 1993. The study

also uses data from NCES' first longitudinal study (National Longitudinal Study

(NLS): 72/86, that of the high school graduating class of 1972) and the third study,

known as National Education Longitudinal Survey (NELS): 88/2000, which begins

with 8th graders in 1988 and concludes with a survey of the cohort (aged 26-27) in

2000. Adelman's *Principal Indicators* (2004) work derives data from the

postsecondary transcript files of those same three overlapping grade-cohort

longitudinal studies: NLS:72/86, HS&B-So:80/92, and NELS: 88/2000. The study

populations consist of nationally representative samples of students. While Adelman's

findings from these studies are extensive (I cite many of his findings in my review of

the literature), perhaps the most influential finding was that academic resources in

secondary school outweigh social background variables in determining college

completion. Adelman (1999) found that a powerful predictor of persistence and

completion was high school math. His study outlined a five-rung ladder consisting of

calculus, pre-calculus, trigonometry, Algebra 2, and less-than-Algebra 2. After

controlling for SES, he found that for each rung of math climbed, the odds of

completing a Bachelor's degree increased by a factor of 2.59 to 1. Each rung up the

SES quintile ladder (which matches the 5-step math ladder), in contrast, increased the

odds by 1.68 to 1. Similarly, Bound et al. (2010) found that academic preparation (measured by math test percentiles) is associated with the likelihood of college completion for 1972 and 1992 cohorts of high school classes, after controlling for race/ethnicity, parental education, and income as well as institutional type and resources. Niu and Tienda's (2013) study found that their measure of academic preparation (class rank, first thought about college, grades A, courses taken, and SAT score) was only weakly associated with completion and persistence, after controlling for student and school variables.

Researchers have also studied the effect of SAT scores and high school GPA on college completion, although researchers disagree about the importance of their effect (Roderick et al., 2008). Rothstein (2004) contends that much of the SAT's predictive power is found to derive from its correlation with high school demographic characteristics. The researcher found that, in predicting college GPA (CGPA), student-level HSGPA was a much better predictor than average HSGPA, while the opposite was true for SAT -- the high school average on SAT was actually a better predictor than individual level SAT score. Betts and Morrell (1999) found that students' SAT scores and HSGPA are significant predictors of CGPA, but that a one-point increase in HSGPA is associated with an increase of only 0.053 points in CGPA. My conclusion from the research is that researchers look to HSGPA and SAT scores as a proxy for academic preparation, but that, at best, HSGPA and SAT scores are predictors of first year CGPA, which is then confounded by other factors to influence persistence and completion.

To conclude my sections on student background and high school factors, I acknowledge the abundance of research that identifies common factors in students' pre-college lives known to affect student success, such as gender, race/ethnicity, student and high school socioeconomic factors, academic preparation, and social and cultural capital. While the research shows that these factors impact likelihood of college completion, the complexity of student influences makes it nearly impossible to discern whether they *cause* college completion. The next section explores factors within the college experience that affect the likelihood of college completion. Kuh et al.'s (2008) study provides an interesting take on how the effects of student background factors on college completion might change when accounting for college experiences. In a study of 6,193 students across 18 four-year institutions, the researchers hypothesized that increased student engagement in the first year of college – measured by students' participation in educationally purposeful activities – could at least partially compensate for disadvantages of students' demographic characteristics, pre-college experiences, and prior academic achievement. After entering measures of student engagement into the regression model, the effects of those background characteristics remained statistically significant, but decreased in magnitude. The influence of parents' education virtually disappeared.

College Experiences and Activities

Academic and financial factors. Once students enter college, they are exposed to new academic and social experiences that affect their success. Influences of persistence and completion include academic and financial factors, along with

institutional interventions intended to integrate a student's academic and social life. First, I review the literature on individual academic and financial factors. Then I review the literature on institutional interventions.

Researchers have concluded that passing college-level math early in the first year influences the likelihood of completion, though it is undetermined whether it causes completion or is simply another measure of academic preparedness. Herzog (2005) studied 14,230 students at a public research university, finding that better grades and passing a first-year math course are the two most important factors during the first semester in lowering a student's dropout risk. Succeeding in a first-year math course and selecting math-intensive majors lowers the dropout and transfer risk during both the first and second semester. In a study of 30,497 students enrolling in the State University System of Florida in 1999, Offenstein et al. (2010) found that, holding demographic and academic preparation variables constant, students who completed college-level math in the first year persisted through the second year at a rate of 91.9 percent, compared to a rate of 71.3 for those who did not. For those who completed college-level English, the rate of retention to the second year was 88.1 percent, compared to 59.6 percent for those who did not. These conclusions about the overall importance of college-level math supplement Adelman's (1999, 2004) position that completion of higher levels of math in high school dramatically improves the likelihood of persistence in college.

A higher number of credits in the first year of college is positively correlated with completion (Offenstein et al., 2010). Adelman (1999), after controlling for various

background characteristics, identified 20 credits as an important influence on likelihood of completion, with completion of fewer than 20 credits negatively correlated with completion. The number of credits attempted compared to credits earned is another indicator of student engagement. The higher the number of grades of W (withdrawal) and NCR (no credit) on a student's record, the less likely the student will achieve a Bachelor's degree (Adelman, 2004). Withdrawals and no-credit grades in classes also increase time to degree. Among Bachelor's degree recipients in Adelman's (2004) high school class of 1992, those with no W or NCR grades completed their degrees in an average of 4.14 calendar years. With one or two grades of W and/or NCR, the average time-to-degree jumped to 4.45 calendar years, and with 7 or more Ws and NCRs, to 5.97 calendar years. Incomplete classes indicate that the student was either not academically prepared for the class or did not feel engaged in the class – both of which reflect a failure on the part of the institution to intervene with curricular assistance and/or another effort to enhance student engagement.

Stopping out – or non-continuous enrollment – is also negatively correlated with achievement of a Bachelor's degree (Choy, 2002). Not every departure from higher education is permanent (Horn 1998), but continuous enrollment – even for minimal amounts of earned credit – is strongly associated with degree completion (Adelman, 1999). Specific to the first year of college, if a student's year-1 to year-2 retention includes non-continuous enrollment, momentum toward degree completion is weakened (Adelman, 2004).

Remediation can act as a gatekeeper and a quality control in higher education, especially at institutions with non-selective admission. It has been a regular part of the curriculum at Ivy League and other colleges from the Colonial period to the present (Merisotis & Phipps, 2000). Bettinger and Long (2009) found that students in remediation are more likely to persist in college in comparison to students with similar backgrounds who were not required to take the courses. In a study of 6,879 students from the National Education Longitudinal Survey (NELS:88), Attewell et al. (2006) found that, after controlling for high school preparation and family background, students who take one or two remedial courses in four-year colleges have a six percent lower probability of graduating with a Bachelor's degree. For students who took two or three remedial courses, graduation rates were between 12 and 15 percent lower than those with comparable skills and backgrounds who took fewer or no remedial courses. Also, taking remedial coursework increases time to degree by about two to three months compared to those who do not take remedial courses. Taking remedial coursework in reading had a clear negative effect on graduation, even after controlling for academic skills and background. Herzog (2005) found that enrollment in remedial math raises the odds to both drop out and transfer out, while remedial English only reduces the odds to transfer out.

Receiving financial aid is also correlated with student outcomes. Low-income students tend to have substantial "unmet need"—the balance remaining after all financial aid and their family/student contribution towards the cost of education is taken into account—at all types of higher education institutions (Tinto, 2004). Herzog

(2005) found that middle-income students with greater levels of unmet need are more likely to drop out than those with less unmet need (odds ratio=1.83). To help compensate for unmet need, students reduce their attendance from full-time to part-time, live off campus rather than on campus, and work longer hours. All of these behaviors significantly reduce the probability that they will persist to completion of a four-year degree (Advisory Committee on Student Financial Assistance, 2001).

Institutional Factors. The more a student's experiences serve to integrate the student socially and intellectually into the life of the institution, the more likely the student is to persist until degree completion (Leppel, 2001). Special seminars designed to assist students in the academic and/or social transitions of institutional life have existed for many years. The earliest senior seminars/capstone courses date back to the 18th century, and first-year (freshman) seminars first appeared in the late 1800s (Barefoot et al., 2012). Vincent Tinto's (1975) research study "Dropout from Higher Education: A Theoretical Synthesis of Recent Research," is considered the seminal work establishing a sociological framework for postsecondary student success. His theory suggests that student attrition is not only a reflection of the characteristics of the student who drops out, but also of the academic and social environment of an institution. Tinto's (1975) "interactionist" theory posits that postsecondary institutional practices that help integrate the academic and social contexts of students positively influence persistence and completion.

A 2002 study revealed that 94 percent of accredited four-year colleges and universities in America offer a first year seminar to at least some students and over half

offer a first year seminar to 90 percent or more of their first-year students (Porter &

Swing, 2006). A widely studied intervention program, first year seminars are designed

to improve student engagement in educationally purposeful activities that

simultaneously foster social integration (Barefoot et al., 1998). Although their content

may vary – from study skills to extracurricular outings – first year seminars do appear

to have a positive impact on persistence (Cuseo, 1991; Pascarella & Terenzini, 1991;

Jamelske, 2009). Based on a survey of almost 20,000 first-year students who

participated in first year seminars at 45 four-year institutions, Porter and Swing (2006)

determined that students at schools who participate in first year seminars that include

study skills and health matters have higher mean probabilities of intent to persist.

Therefore, choice of content in first year seminars may make a difference on student

persistence, especially when they are effective in specific content areas. There is some

indication, however, that the impact of participation in first year seminars on

graduation rates and persistence is still unclear. In a survey of more than 500 chief

academic officers at a nationally representative sample of four-year postsecondary

institutions, Barefoot et al. (2012) found that fewer than half of respondents felt that

first year seminars yielded desired outcomes in retention and graduation rates.

However, a number of "other" responses indicated that research is just beginning and

findings are unclear or "not ready to be reported."

 Another program often associated with first year seminars is the learning

community (Barefoot et al., 2012). For new students in particular, engagement in the

community of the classroom becomes a gateway for subsequent student involvement in

the academic and social communities of the college generally (Tinto & Goodsell, 1994). Zhao and Kuh (2004) found that participating in learning communities is uniformly and positively linked with student success, broadly defined to include enhanced academic performance, integration of academic and social experiences, positive perceptions of the college environment, and self-reported gains since starting college. In their study of 80,479 students from 365 four-year institutions in 2002, Zhao and Kuh (2004) found that the relative magnitudes of impact ranged from .23 for quality of academic advising, to .60 for interactions with faculty. The relative magnitudes were smaller for senior students, but still statistically significant, indicating that the effects of learning communities are greater for first-year students, but that the effects persist well into the senior year. Introducing students early in their college years to the kinds of educationally purposeful activities often associated with learning communities, such as interacting with faculty members and cooperating with peers on learning tasks, may encourage them to continue these activities throughout college. The authors also identified which students are more or less likely to self-select into learning communities. Students more likely to participate are female (Odds ratio=1.077), full time (OR=1.389), living on-campus (OR=1.218), and Latino (OR=1.176). Students less likely to participate are White (OR=0.531), transfer students (OR=0.795), and American Indian (OR=0.713).

In an examination of a Coordinated Studies Program (CSP) at Seattle Central Community College, Tinto (1997) found that, after controlling for background characteristics of 121 students in CSP and 166 students in similar but unlinked courses,

five variables positively influenced persistence: participation in the CSP, college GPA, hours studied per week, perceptions of faculty, and the factor score on involvement with other students. The researcher posits that learning communities help students to make new friends who are in the same courses, helping bridge the academic-social divide that typically plagues student life. Tinto's (1997) theory is that classrooms, especially at commuter institutions, are the optimal places to help students integrate their academic and social experiences in college. Thus, collaborative learning opportunities in the classroom and/or linked classrooms in learning communities are important influences on the likelihood of persistence and completion.

Cabrera et al. (2002) studied the effects of learning communities on 2,050 second-year college students who participated in the National Study of Student Learning as incoming freshmen to 23 varying institutions in 1992. The researchers found that collaborative learning practices exerted the greatest effect on four learning outcomes across all students: personal development, understanding science and technology, appreciation for art, and analytical skills. Women were as predisposed towards collaborative learning as men. There was no significant difference between White females and White males, and minorities were more predisposed towards collaborative learning than were Whites.

Based on my review of the literature related to college experiences and activities, I conclude that researchers have identified some common factors that increase the likelihood of college completion, such as college GPA, units attempted versus completed, units in the first year, participation in activities that are intended to

increase student engagement, financial aid, commuter status, remedial coursework, and continuous enrollment. Researchers are divided about the relative importance of these factors versus the student's family and high school characteristics and pre-college academic factors, however. In other words, it is very difficult to generalize why students do not complete because of the complex interactions between determinants. Is it a result of low social and cultural capital due to low family SES? Did the high school curriculum not prepare the student for college work? Did the student not see a benefit to a college degree? Did the institution not appropriately engage or assist the student? The answers to these questions are likely very different for every study, due to differences in study subjects and their environments. Therefore, it is important for institutions to study patterns of completion in their own student populations to try to identify common influences on likelihood of completion.

An unexplored line of research

Evidence is strong that participation in first year seminars and learning communities positively influences the likelihood of persistence and completion (Cuseo, 1991; Pascarella & Terenzini, 1991; Tinto, 1997; Cabrera et al., 2002; Zhao & Kuh, 2004). An unexplored line of research is examining whether participation in freshman seminars and/or learning communities has different effects on students from less affluent high schools. Can a first year seminar impart enough study skills to students who come from economically disadvantaged high schools to compensate for inadequate academic preparation? Can learning communities help integrate these students' academic and social contexts enough to overcome tension between these two

fields that might cause disadvantaged students to drop out? My thesis seeks to fill this unexplored connection between the economic composition of students' high school, and the compensatory effect of first year seminars and learning communities.

Conceptual Framework

To analyze the impact of FYE on graduation at Sacramento State, I propose a theoretical framework based largely on Adelman and Tinto's theories about determinants of college completion. I propose that students' background characteristics influence their college preparedness, college-going behavior, and performance in at least the first semester of college. I identify these individual background characteristics as race, gender, family's socioeconomic status, and parents' education level. In addition, the student's success at the beginning of college is heavily influenced by the
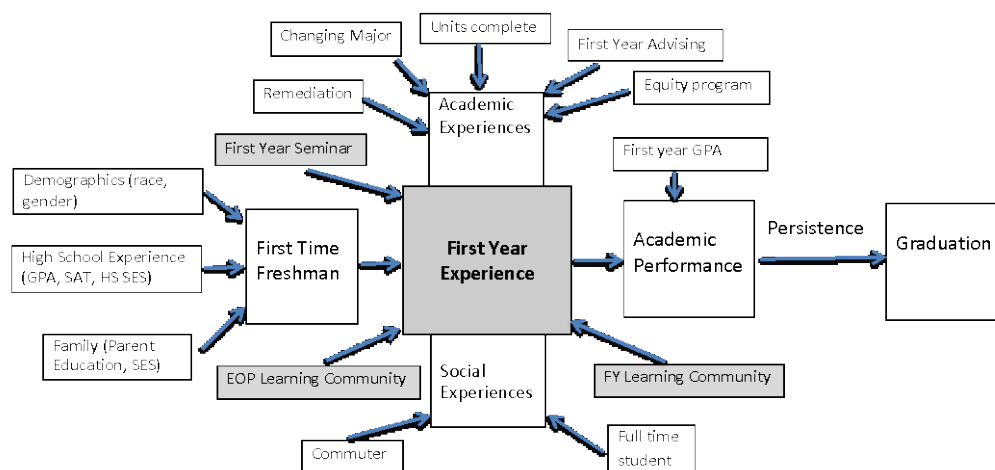
Figure 1: Conceptual framework that indicates how background characteristics interact with college experiences to influence persistence and completion

quality of high school experiences, including rigor of academic preparedness, and student's social and cultural capital, which research shows can be represented in the economic composition of the high school (Perna and Titus, 2005). Social capital is a general measure of a student's ability to capitalize on social networks, and cultural capital is generally ways of talking, dressing, interacting and socializing that are influenced by values passed down in the family (Bourdieu, 1986). Research shows that generally the higher the economic composition of the high school, the higher the social and cultural capital of students at the school (Niu & Tienda, 2013). My review of the literature suggests that these background characteristics are important influences in the student's first year of college.

Next, I draw on Tinto's model to hypothesize that, once students enter college, their engagement in academic and social experiences overtake background characteristics in magnitude of influence. As indicated in the literature, student engagement during the first year can be measured by a number of academic experiences, as well as participation in institutional programs meant to bridge students' academic and social experiences. Academic experiences include the number of units attempted versus units completed over the course of study; completing remedial coursework; declaring a major; changing major; and first-year GPA. Institutional efforts include participation in freshman orientation, first-year advising, freshman seminars, learning communities, and social equity outreach programs. A factor that impacts students' social context includes living on campus. I hypothesize that these

factors can influence the likelihood of completion, and possibly could change the significance of background characteristics.

In the next chapter, I outline the methodology of my study, in which I operationalize my conceptual framework through multivariate regression analysis.

Chapter 3 – Methodology

Based on the significant social and economic benefits of increasing the percentage of Bachelor's degree graduates in the U.S., and based on the significant opportunities for improvement in the rate of Bachelor's degree graduates in California - - especially at California State Universities – this analysis is centered around a theoretical framework which suggests that student success is the result of an interaction of background factors and institutional factors. The key institutional factor under examination is First Year Experience.

In this chapter, I outline the methodology used in my study. First, I specify the dependent and independent variables in the equation – based on evidence in research literature – along with the positive or negative influence I expect them to have on completion. Next, I present the regression models that I structured to best isolate the effect of participation in First Year Experience on degree completion. Finally, I describe my data collection methods and my method used to deal with missing data: estimating the missing data through multiple imputation.

My theoretical framework hypothesizes that a student's background characteristics strongly influence a student's success up to and through his/her first year of college, at which time college experiences and activities start to overtake background characteristics in their magnitude of influence on degree completion. My study aims to quantify the influence of FYE programs (freshman seminar, learning community) on degree completion. I also wish to examine whether freshmen-level

interventions have a compensatory effect for students who come from socioeconomically disadvantaged high schools. Thus, two questions guide my study:

1) Does participation in FYE have a significant impact on degree completion, net of the effects of student background characteristics (demographic and family factors) and high school experience?

2) Are the effects of FYE greater in magnitude for students from less economically advantaged high schools than from more economically advantaged high schools?

Regression Equation

Graduation= f **(institutional factors, college experiences, student background)**

The dependent variable of my study is a dichotomous measure of completion of a Bachelor's degree within six years. This timeframe is the de facto time to degree accepted in the research community and accepted as a standard measurement for federal "Student Right-to-Know" reporting requirements (Cook & Pullaro, 2010). The unit of analysis of my study is students who entered Sacramento State as first-time freshmen in 2006. Students who began their study in Fall 2006 and completed their degree before or in Fall 2012 were considered to have graduated.

A key independent variable in my study is participation in First Year Experience either through a freshman seminar or a learning community. My research aims to quantify the effect of these programs on graduation within six years at Sacramento State. Another key independent variable is the economic composition of the student's high school (HSSES). My thesis explores whether the effect of FYE participation on graduation is different depending on the economic composition of the

student's high school. I group the independent variables as institutional efforts, college experiences, and student background characteristics. Taken together, these variables provide a longitudinal look at students from before college entry to their last semester at Sacramento State.

Institutional efforts=f (first-year seminar, learning community, equity program, first-year academic advising)

There are a number of interventions that institutions use to engage students, spanning from the summer before freshman year to the senior capstone course. These efforts are meant to engage students in educationally purposeful activities that bridge their academic and social experiences, and to provide extra assistance to disadvantaged students. I include four institutional efforts as independent variables.

The key independent variable of my study is participation in First Year Experience, which includes both a freshman seminar and learning community. At Sacramento State in 2006, all students were given the opportunity to self-select into FYE through participation in a freshman seminar, a learning community, or both. Low-income, minority students were also given the opportunity to enroll in a freshman seminar and learning community through the Educational Opportunity Program (EOP). Any student can enroll in FYE, whereas EOP is a selective admission equity program to which low-income minority students must apply. For the purpose of my study, all first-time freshmen who participated in a freshman seminar – regardless of the program

of origin – are coded 1 as a participant in the variable FYESEM.[7] In 2006, the

freshman seminar course was nearly identical for FYE and EOP participants. The

courses used the same readers, had the same learning outcomes, and were taught by the

same trained faculty (e-mail communication with Lynn Tashiro, Marcellene Watson,

and Deidre Sessoms, January 14, 2014) . The courses provided all students with

individual advising, career advising and assessments, and co-curricular events. The

differences were that FYE participants had peer mentors, while EOP participants had

instructional student assistants and a one-unit group tutorial course. With respect to the

learning community, however, I measure students separately by program of origin in

two variables (FYELC and EOPLC). For each variable, participants are coded as 1 and

non-participants are coded as 0.

Another institutional effort that could be associated with completion is

academic advising. At Sacramento State in 2006, First Year Advising included

providing general education and graduation requirements to freshmen. Participants in

my data are coded 1, and non-participants are coded 0. I also control for students

participating in an educational equity program. At Sacramento State, equity programs

include: Business Educational Equity Program (BEEP), College Assistance Migrant

Program (CAMP), Cooper Woodson College Enhancement Program (CWC),

Educational Opportunity Program (EOP), MESA Engineering & Computer Science

Program (MEP), Science Educational Equity (SEE), and Summer Bridge Program

(SMB). A student who participated in any of these equity programs is coded 1, others

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[7] This was the way the data was coded and provided to me through OIR. About 25 percent of the participants were EOP, with the balance participating through FYE.

0. Because this variable includes various programs, the odds ratio outcome of this variable cannot be interpreted as an evaluation of equity programs' effect on student outcomes. Rather, this variable is used to control for the effect of any equity program participation in order to better isolate the statistical association between participation in FYE and graduation.

College experiences= f (first-year GPA, remediation, units in first year, units attempted vs. complete, commuter, changed major)

It would be nearly impossible for a researcher to quantify every academic experience of a student once h/she enters college. However, there are several important experiences that have been identified as "milestones" on a student's path to degree completion that research shows have a relationship with the intended outcome (Adelman, 1999; Offenstein et al., 2010).

The influence of remediation upon student success is mixed. Some studies say that needing any remediation is negatively correlated with completion (Attewell et al., 2006), but other studies report that if a student needs remediation and completes it, the student is more likely to graduate (Bettinger & Long, 2009). Needing remediation in math also has a more negative influence than needed remediation in English (Herzog, 2005), as discussed in the literature review of chapter 2. My study includes a categorical variable for remediation. The categories are coded (1) for needing English only, (2) for math only, and (3) for both needed. The reference category (0) is none needed.

Credits completed in the first year is another milestone (Offenstein et al., 2010). Adelman (1999) identified 20 units as a boundary that is positively correlated with completion. I include number of units completed in the first year as a continuous variable in my study. Adelman (1999) also discussed the negative influence of a higher number of withdrawals or no-credit grades in classes. My study includes a continuous

Table 4: Variable Definitions

Variable	Definition	Source
Dependent		
Graduation	Graduation by or in Fall 2012	OIR - Sac State
Independent		
Gender	Gender	OIR - Sac State
Race	Race/ethnicity	OIR - Sac State
HS GPA	Cumulative final high school GPA	OIR - Sac State
HS SES	Percentage of students on free and reduced price lunch program (proxy for high school economic composition)	California Department of Education, API 2006 Base
Student SES	Low income indicator, based on income that qualifies student for Pell grant	OIR - Sac State
SAT verbal	SAT Verbal score	OIR - Sac State
SAT math	SAT Math score	OIR - Sac State
FYE seminar	First Year Experience freshman seminar*	OIR - Sac State
FYE LC	First Year Experience learning community	OIR - Sac State
First-year advising	Received advisement on class and graduation requirements freshman year	OIR - Sac State
EOP LC	Educational Opportunity Program learning community	OIR - Sac State
Full time	Full time student	OIR - Sac State
Equity	Equity program participant	OIR - Sac State
Change Major	Number of times student changed major after first declaration	OIR - Sac State
Remediation	Type of remediation required, if necessary	OIR - Sac State
UNAUNC	Percent of units attempted that were completed over 6 years	OIR - Sac State
First year units	Number of units completed in first year	OIR - Sac State
Commuter	On or off-campus resident in first semester	OIR - Sac State
College GPA	Cumulative GPA at the end of freshman year	OIR - Sac State
Parent education	Highest parent education level	OIR - Sac State
Reference categories		
Race	White	
Remediation	None needed	
Parent education	High school graduate	

OIR - Office of Institutional Research, CSU-Sacramento

* approximately 25 percent of students counted in this variable were EOP participants

variable that indicates the percentage of units completed that were attempted.

One variable that might affect a student's ability to complete their courses is whether they live on/close to campus, or whether they commute to school. Students who commute to campus are more likely to have jobs and family that occupy their time and attention outside of their college experiences (Advisory Committee on Student Financial Assistance, 2001). My study includes commuter status as a variable measuring whether the student commuted to campus during the first semester of college (the only semester for which this data is available). Commuters are coded as 1, and all others (living on or near campus) are coded as 0. Sacramento State's Department of Student Housing identifies certain housing complexes besides dorms that are considered "on-campus" housing. Students living in those residences are included here. However, some students live similarly near campus but not in campus housing, and they are coded as commuters. Some students might actually live on campus but report their parent's home address on registration, leading to a false status as commuter. Therefore, although this variable is included as a control, there are some data limitations that could affect the validity of the effect of this variable.

My study includes college GPA, measured after the second semester of the first year, as a continuous variable. Since the first year of college is critical in terms of retention, student engagement, and remedial coursework completion (Tinto, 2012), I want to also explore whether GPA at the end of the first year is similarly an important influence on likelihood of completion.

Another continuous variable indicates the number of times a student changed his/her major in six years. The comparison group is the group of students that declared a major once in six years and never changed it, even if they declared it late in their college career. I hypothesize that students who change their major more often are unlikely to complete in six years, as additional coursework may be required for different majors, and changing major could reflect overall lack of direction in the student.

Background characteristics=f(female, race/ethnicity, family socioeconomic status, parent education level, high school GPA, SAT Verbal score, SAT Math score, high school socioeconomic status)

A student is influenced by characteristics in his/her background from preschool through college. Important factors include demographic characteristics of the student, characteristics of the student's family, and the student's academic preparation. This section outlines the variables I use to measure these conditions.

A key independent variable from the student's background is the economic composition of the high school. In my study, this is a continuous variable that measures the percentage of students on the Free and Reduced Price Lunch program at each high school of origin. This is a commonly used proxy to indicate the aggregate SES of students at a high school.[8] The higher the percentage of students on free/reduced price lunch plans, the lower the socioeconomic status of the school.

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[8] Free and Reduced Price Lunch is part of the Child Nutrition Program of the California Department of Education. Based on income guidelines that change each year, a student from a lower income family is eligible to receive either free or reduced-price lunches at school. In

My gender variable codes females as 1, males as 0. As revealed in my review of the literature, more women attend and complete college than men (Adelman, 2004). Race/ethnicity is included as an independent variable in order to identify potential populations at risk of non-completion, and to explore patterns of participation and effect of FYE on minority groups. Observations of race/ethnicity are coded as a categorical independent variable, with White students as the comparison group. Based on self-reports of ethnicity by students at registration, students are grouped as White, Hispanic, Asian/Pacific Islander, African American, Filipino, American Indian, and other. The data does not indicate the immigration status of the student, nor their language proficiency; rather, the observations are simply aggregated by race/ethnicity.

The literature indicates that socioeconomic status (SES) of a student's family is correlated with college completion (Caldas, 1993; Caldas and Bankston, 1997; Stull, 2013). My study uses Pell Grant-eligibility as a proxy to indicate low SES. The Federal Pell Grant Program provides need-based grants to low-income undergraduate and certain postbaccalaureate students to promote access to postsecondary education. Grant amounts are dependent on the student's expected family contribution, the cost of attendance, the student's enrollment status (full-time or part-time), and whether the student attends for a full academic year or less. My observations are coded as 1 for Pell Grant-eligible students, and 0 for those ineligible.

Research shows that students with college-educated parents are more likely to have a college-going habitus and access to information and training that influences

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research on schools and student success, the percentage of students on Free and Reduced Price Lunch is a commonly used proxy to represent the aggregate socioeconomic status of a school.

postsecondary success (Perna & Titus, 2005). Parents' education levels are included as a categorical independent variable in my study: *No high school, some high school, high school graduate, some college, two-year college graduate, four-year college graduate, and postgraduate*. The coding reflects the highest education attainment level of either parent. Observations coded as *high school graduate* are the comparison group.

Students' academic preparation is measured by their high school GPA and SAT scores. High school GPA is measured as a continuous variable. Since achievement in high school math is an influential predictor of college completion (Adelman, 1999), I posit that SAT Math scores can be used as a proxy to measure high school math achievement. Therefore, I include SAT Verbal and SAT Math scores as separate, continuous variables.

Interaction terms

An interaction term is an independent variable in an estimation model that is the multiple of two or more other independent variables. An interaction term is used when the effect on the dependent variable with respect to one independent variable is expected to change when some qualitative condition of another independent variable is met (Studenmund, 2006). I hypothesize that the impact of freshman seminar and learning community on graduation will change depending on the economic composition of the student's high school. Therefore, my model includes interaction terms to test for those changes. One term is a product of the dummy variable that indicates participation in freshman seminar and high school SES variable. Another interaction term is the product of the dummy variable that indicates participation in a

learning community and the HSSES variable. A third interaction terms uses a

dichotomous FYE variable – which indicates those students who participated in a

freshman seminar, FYE learning community, or both – multiplied by the continuous

HSSES variable.

Model specification

With a binomial dependent variable, I chose to use logistic regression ("logit")

rather than a linear probability model, as it is the most frequently used estimation

technique for equations with dummy dependent variables (Studenmund, 2006). In a

logit model, the estimated outcomes will move non-linearly from 0 to 1. Logit

regressions estimate the model using maximum likelihood instead of ordinary least

squares, with the difference being that it chooses coefficient estimates that maximize

the likelihood of the sample data set being observed (Studenmund, 2006). I report my

logit results using odds ratios, which indicates how each independent variable impacts

the likelihood of the dependent variable outcome. To interpret the odds ratios results in

my study, one should take the reported odds ratio and subtract 1, which indicates either

a positive or negative percentage association with likelihood of graduation within six

years.

I structure my study into three regression models in order to isolate the impact

of certain sets of variables on likelihood of graduation, and to see how the impact of

variables changes with the addition of other variables. **Model 1** estimates the effects of

student background characteristics (demographic and family), prior academic

performance (SAT, high school GPA), and high school economic composition, on

completion of degree within six years. In **Model 2**, participation in freshman seminar and learning community is added to the variables in the first model to examine the impact of these institutional efforts on degree completion. Since participation in freshman seminar and learning communities takes place the first semester of college, this model seeks to control for those variables that have impacted the student up to that point. In this model, I include interaction term variables to examine whether the effect of FYE freshman seminar and learning community is different depending on the economic composition of the student's high school. I also examine the interaction between freshman seminar, learning community, and race to see if the effect of these programs is significant for certain populations. Finally, all other college experience variables are added to the previous variables to examine their impact on degree completion in **Model 3**. With the addition of these variables, I examine whether the magnitude of effects of background characteristics, freshman seminar and learning community participation changes. Effects are considered statistically significant at the 90 percent confidence level (i.e., $p<0.10$).

Data Collection

Based on my model specification, I worked with the Office of Academic Affairs and the Office of Institutional Research (OIR) at Sacramento State to obtain information on all students who entered Sacramento State in 2006 as first-time freshmen. This file comprised 2,658 records ("2006FTF"). These records contained family and individual background characteristics, including high school GPA and SAT scores collected by OIR from student transcripts. In addition, the records included

information on their activities at Sacramento State semester by semester until Fall
2012.

Next, I accessed the California Department of Education website to obtain the
2006 Base API profile of all California schools. My 2006FTF database listed the high
school of origin for California students. By cross-walking the origin high school
records with the API database, I obtained the percentage of students at each high
school who participated in the Free or Reduced Price Lunch program. This is my high
school economic composition variable for each student observation.

Table 5: Descriptive statistics, observed data

Variable	N	Mean	Standard Deviation	Min	Max
Graduation	2658	0.44	0.50	0	1
Gender	2658	0.60	0.49	0	1
Race	2658	1.89	1.93	0	6
HS GPA	2652	3.19	0.46	1.53	4.91
HS SES	2285	32.79	20.95	0	100
Student SES	2658	0.59	0.49	0	1
SAT verbal	2119	469.91	88.53	200	780
SAT math	2119	487.84	87.88	200	800
FYE seminar	2658	0.49	0.50	0	1
FYE LC	2658	0.21	0.41	0	1
First-year advising	2658	0.68	0.47	0	1
EOP LC	2658	0.13	0.33	0	1
Full time	2658	0.97	0.16	0	1
Equity	2658	0.19	0.39	0	1
Change Major	2658	0.41	0.60	0	3
Remediation	2658	1.53	1.27	0	3
UNA/UNC	2658	81.61	24.57	0	105.33
First year units	2658	23.21	8.23	0	42
Commuter	2658	0.28	0.45	0	1
College GPA	2658	2.46	1.06	0	4
Parent education	2373	4.43	1.82	1	7

Omitted variable bias and data limitations

I acknowledge that although I tried to include as many independent variables as possible, my model could suffer from omitted variable bias. Financial aid is an important factor that could impact students' persistence that I do not control for in my study. This information was not aggregated with the rest of the student data I received from OIR; to include it, I would have had to access an additional database at Sacramento State. Since I did have an indicator of Pell-grant eligibility, I decided not to pursue the other database. However, I acknowledge the limitation caused by not measuring students' financial aid packages, nor considering tuition rates in 2006. I also do not account for immigrant generation status or English learner status, though I suspect that some of the effects of these factors would be controlled for in the independent variable that measures equity program participation. Parent education level is based on information reported by students at registration, which may not be accurate (Adelman, 1999). Finally, the variable measuring commuter status only reflects the student's living arrangements the first semester of college, which likely would have changed over the course of six years.

There were 398 student records in 2006FTF that did not have origin high school listed. Of those, 78 were students who came from outside California; Sacramento State does not save high school information for these students. A large number of the remaining 320 students were from parochial high schools in California that did not report this information. In total, my dataset was missing data for a small percentage of observations in each of five independent variables: high school SES, high school GPA,

parent education, SAT verbal scores, and SAT math scores. While listwise deletion

was one option to handle the missing data, this would result in nearly half of the

observations being deleted, which I believe would have been an unacceptable loss of

power. In most cases, the observations were only missing data for one out of 20

variables; discarding the entire observation would have been a significant loss, since

the reliability of a regression model increases with sample size. Therefore, I turned to

research literature to see how other researchers dealt with missing data.

Multiple Imputation

My study of the literature indicated that multiple imputation (MI) is a common

Table 6: Descriptive statistics, Multiple Imputation Data

Variable	N	Mean	Standard Deviation	Min	Max
Graduation	69108	0.44	0.50	0.00	1.00
Gender	69108	0.60	0.49	0.00	1.00
Race	69108	1.89	1.93	0.00	6.00
HS GPA	69102	3.19	0.46	1.53	4.91
HS SES	68735	32.19	20.93	-41.64	112.81
Student SES	69108	0.59	0.49	0.00	1.00
SAT verbal	68569	467.44	88.79	112.31	780.00
SAT math	68569	485.15	87.63	191.20	800.00
FYE seminar	69108	0.49	0.50	0.00	1.00
FYE LC	69108	0.21	0.41	0.00	1.00
First-year advising	69108	0.68	0.47	0.00	1.00
EOP LC	69108	0.13	0.33	0.00	1.00
Full time	69108	0.97	0.16	0.00	1.00
Equity	69108	0.19	0.39	0.00	1.00
Equity	69108	0.94	0.24	0.00	1.00
Change major	69108	0.41	0.60	0.00	3.00
Remediation	69108	1.53	1.27	0.00	3.00
UNAUNC	69108	81.61	24.56	0.00	105.33
First year units	69108	23.21	8.23	0.00	42.00
Commuter	69108	0.28	0.45	0.00	1.00
College GPA	69108	2.46	1.05	0.00	4.00
Parent education	68823	4.43	1.82	1.00	7.00

and widely accepted method of estimating missing data (Rubin, 1987; Little & Rubin, 1987; Rubin, 1996; Schafer, 1997). MI uses linear regression to predict the missing score on the basis of other variables that are present. This calculation involves a Monte Carlo technique in which the missing values are replaced by $m>1$ simulated versions. MI assumes that the missing data carry no information about probabilities of missingness. It is therefore important to understand the missing-data mechanism and the resulting inferences.

Studying the patterns and theoretical underpinnings of the missing observations, I concluded that the data was missing completely at random (MCAR) – that is, the probability that an observation (X_i) is missing is unrelated to the *value* of X_i or to the *value* of any other variables (Howell, no date). I concluded that the value of these missing observations – and not their "missingness" in general – was unrelated to any other variables, allowing me to conclude that the missing data mechanism was MCAR.

While the value of the high school SES data was unrelated to its missingness, there was a systematic pattern to the missingness. As I discussed earlier, my proxy for this variable was the percentage of students at each high school on free and reduced price lunch. This data was not reported for any students attending parochial, private high schools in California, and any students entering Sacramento State from outside California. Therefore, although I use MI to produce an estimate for missing fields for the high school SES variable, I generalize my findings with the most confidence for students who attended public and non-parochial private high schools in California.

Based on the literature, I used STATA to implement a fully conditional specification approach in which a set of chained equations estimated univariate conditional distributions of each variable. This approach is also known as ICE (van Buuren, Boshuizen, and Knook, 1999) or sequential regression multivariate imputation (Raghunathan et al., 2001). This remains one of the popular imputation methods in practice (STATA, no date). The literature suggests that the number of imputations required to estimate the data with confidence is related to the proportion of missing data. While five imputations could be sufficient with a low percentage of data, upwards of 50 imputations might be needed with a high percentage of data. Following guidelines for STATA, I chose to compute 25 (M=25) imputations using the ICE method. As suggested in the literature, this computation included all study variables, including the dependent variable, to inform the predicted values.

Using MI, I successfully imputed values for 285 observations of parent education, 6 observations of high school GPA, 373 observations of high school SES, and 539 observations of SAT verbal and math scores. This produced a total sample (N) of 2,658. For comparison, I ran descriptive statistics on the original dataset and on the multiply imputed data (see Tables 5 and 6). The means are nearly identical in both datasets.

Multiple Imputation estimate

Once the multiply imputed dataset was complete, I used the MI logit estimate command in STATA, reporting odds ratios. The MI logit command estimates model parameters from multiply imputed data and adjusts coefficients and standard errors for

the variability between imputations. It runs the estimation command on each of the *m*

imputed datasets to obtain the M completed-data estimates of coefficients. It then

computes MI estimates of odds ratios and standard errors by applying combination

rules (Rubin 1987, 77) to the M completed-data estimates.

Unlike non-MI linear regression analysis and logistic regression analysis, which

report measures of model fit such as R^2 and pseudo R^2, MI estimates report different

measures of fit. One measure is average RVI, which reports the average relative

increase (averaged over all coefficients) in variance of the estimates because of the

missing values. A relative variance increase is an increase in the variance of the

estimate because of the loss of information about the parameter due to missing data

relative to the variance of the estimate with no information lost (STATA, no date). The

closer this number is to zero, the less effect missing data have on the variance of the

estimate. The RVI on model 3 is 0.046.

Fraction of missing information (FMI) reports the largest of all the FMI about

coefficient estimates due to nonresponse. This number can be used to get an idea of

whether the specified number of imputations is sufficient for the analysis. A rule of

thumb is that $M \geq 100 \times FMI$ provides an adequate level of reproducibility of MI

analysis (STATA, no date). In my case, the largest FMI on my full model (model 3) is

0.2175. The number of imputations, 25, exceeds the required number of imputations,

22 (=100 x 0.22) according to this rule.

Multicollinearity

Frequently in studies such as this, where the outcome is a product of myriad interrelated factors, the effects of one variable will be reflected in another variable. Imperfect multicollinearity occurs when two or more explanatory variables are imperfectly linearly related, making it harder to distinguish the effect of one variable from the effect of another in regression analysis (Studenmund, 2006). I sought to determine the extent of multicollinearity between continuous variables in my equation by first creating a Pairwise Correlation table to see the simple correlation coefficients (Appendix A). If the absolute value of a simple correlation coefficient between two continuous variables is one, it means that they are perfectly correlated. An absolute value approaching one would mean they are highly correlated and possibly multicollinear (some researchers choose the absolute value of 0.80 as the indicator of multicollinearity). The pairwise correlation table did indicate multicollinearity between the variables first year units and percent units attempted vs. complete (significant at 0.805), as well as between first year units and college GPA (significant at 0.80).

Studenmund (2006) instructs that looking at pairwise correlation coefficients is a necessary but not sufficient test for multicollinearity. Based on this, I calculated Variance Inflation Factors (VIF) for my variables. A general rule of thumb is that a VIF greater than five indicates that multicollinearity is severe (although there can still be multicollinearity even with small VIFs). The largest VIF value was 4.41 for first year units, followed by 3.15 for percent units attempted vs. complete. With

multicollinearity indicated on both checks for these variables, I ran two additional logit regressions on models that individually omitted each variable.

By excluding percent units attempted versus complete, the first adapted model maintained the significance and changed the effect of variables that were already significant in my original model 3, and it resulted in the addition of three significant effects. The model that excluded first year units did not change the significance or effects of the variables from the original model 3 (with the exception of college GPA, whose odds ratio slightly decreased from 2.25 to 2.05). Based on these results, I conclude that the specification is improved by the exclusion of the variable percent units attempted vs. complete – it essentially measures the same influence as first year units, and the model results in a better fit without it. Appendix B shows the comparison.

Robust standard errors

Heteroskedasticity can be caused when there is wide disparity between the smallest and largest observations in the dependent variable, or by an error in specification. This amounts to non-constant error variance. Because my dependent variable is a dichotomous variable bounded by 0 and 1, the likelihood of heteroskedasticity is low. However, to account for a possible error in specification caused by omitted variables, I report robust standard errors, which can compensate for an unknown pattern of non-constant error variance.

Chapter 4 – Results

The 2006 cohort of first-time freshman entering Sacramento State is a relatively

diverse population of 2,658 students. Of them, 35 percent categorized themselves as

White, 17 percent Latino, 12 percent Black, 18 percent Asian/Pacific Islanders, with

the balance of students categorizing themselves as other minority or foreign ethnicities.

Nearly the entire cohort went to high school in California (all but 78 students, or 3

percent). The majority of the cohort (53 percent) has a parent with at least some college

education, and 63 percent have a parent with at least a two-year college degree. Six

years after they matriculated as first-time freshman (by or in Fall 2012), 43 percent of

the cohort had graduated.

FYE has small but significant impact on graduation

Using binomial logistic regression, I estimated the effects of 20 independent

variables on the outcome variable: graduation within six years. As I stated in chapter 3,

my analysis seeks to answer the following questions:

1) Does participation in FYE have a significant impact on degree completion, net of the

effects of student background characteristics (demographic and family factors) and

high school experience?

2) Are the effects of FYE greater in magnitude for students from less economically

advantaged high schools than those from more economically advantaged high schools?

To answer these questions, I first turn to the key independent variables in my

study: FYE learning community and freshman seminar. I find that participation in FYE

statistically significantly increases the likelihood of graduation compared to those who

opt out, holding student background characteristics and pre-college academic experiences constant. Participation in FYE, either through a freshman seminar or a learning community, is associated with a 38 percent greater likelihood of graduation over non-participants, controlling for student background characteristics and pre-college academic experiences (see Table 7).

To get a more nuanced understanding of what about FYE matters, I separated the two main components of FYE: freshman seminar and learning community. My analysis of these two components as separate independent variables, still holding background variables constant, shows that the impact of freshman seminar is statistically significant, with those who took a first year seminar being 29 percent more likely to graduate than those who did not. Data limitations did not allow me to separate freshman seminar participants who enrolled through FYE from those who enrolled through EOP. Therefore, a portion of those coded as participants in freshman seminar (25 percent) were enrolled through the EOP program, which shows a positive association of EOP freshman seminar with graduation as well. I was able to separate the learning community participants in those two programs. The impact of learning communities is not statistically significant for FYE participants, EOP participants, or all learning community participants combined. This analysis shows that regardless of the student's background, participation in a freshman seminar is associated with an increased likelihood of graduation. While this influence could be biased by self-selection – that is, that students who proactively enrolled were more likely to succeed

Table 7: Binary Logistic Odds Ratios of FYE variables

	Model 1: FYE combined variable (participation in either a freshman seminar or learning community)	Model 2: Separate freshman seminar and FYE learning community variables
Gender	1.41***	1.407***
	(0.128)	(0.128)
FYE	1.379***	
	(0.116)	
Freshman seminar		1.294***
		(0.114)
FYE learning community		1.161
		(0.128)
Race		
Latino	1.263*	1.261*
	(0.166)	(0.165)
Black	0.69**	0.689**
	(0.11)	(0.108)
American Indian	0.485*	0.481*
	(0.180)	(0.182)
HS GPA	2.70***	2.684***
	(0.285)	(0.284)
HS SES	0.99***	0.989***
	(0.003)	(0.003)
Student SES	1.152	1.164
	(0.108)	(0.11)
SAT verbal	1	1
	(0.001)	(0.001)
SAT math	1.001	1
	(0.001)	(0.001)
Parent education: 2-year college graduate	1.414*	1.429*
	(0.261)	(0.264)
4-year college graduate	1.44**	1.439**
	(0.226)	(0.225)
Postgraduate	1.763***	1.762***
	(0.32)	(0.319)

*p<.10, **p<.05, ***p<.01

FYE includes students who participated in either a freshman seminar or FYE learning community. Reference category for Race is White; reference category for parent education is High School Graduate. For brevity, insignificant race and parent education results are omitted from table. Robust standard errors in parentheses.

anyway than those who did not – the variables that I have controlled for place students

on a relatively even playing field, making it less

likely that the result is biased through participation of only the most academically

qualified students.

The effect of FYE loses its significance when I hold background characteristics,

pre-college experiences *and* college experiences constant. This is a positive finding, in

that it shows that learning the study skills to earn good grades, and learning to engage

in college life with like-minded peers (in other words, participating in FYE), is

associated with a greater likelihood of graduation, holding constant those background

and high school characteristics that influence students their first semester (see Table 8).

Once I compare students at the end of six years, considering all their background, high

school, and college experiences, I determine that participation in FYE loses its

significance, but that freshman GPA and first-year units (which FYE is intended to

influence) do matter. In other words, while participation in FYE is influential, its more

important influence is ultimately in helping students to achieve academically while

handling a course load that allows them to graduate within six years. This is especially

true for freshman seminars, whether through FYE or EOP.

With respect to my second research question, I did not find any evidence to

conclude that effects of FYE are greater in magnitude for students from less

economically advantaged high schools. The interaction terms that I created between

FYE and high school economic composition did not have an effect that was

significantly different from zero. Further, adding freshman seminar and learning

community as independent variables in the model that held constant student background and pre-college experiences did not largely change the magnitude of those effects. I conclude that while FYE is positively associated with graduation among participants, its mitigation of (or compensation for disadvantages in) family background or pre-college academic experiences is negligible in my study and deserving of further analysis.

Further considering the impact of socioeconomic status (student and school) on graduation, two variables did have significant effects in the first model. Holding student background and pre-college academic experiences constant, the likelihood of graduation decreases slightly with every point increase in the percentage of students in a high school on free and reduced price lunch (odds ratio 0.99). In other words, every slight decrease in economic advantage at the high school shows a corresponding slight decrease in likelihood of college graduation within six years. However, Pell grant eligibility *increases* the likelihood of graduation by 17 percent over those who are not eligible. In my study, Pell-grant eligibility is being used as a proxy for family SES. Since it is actually a financial aid indicator, though, my finding could reflect the importance of financial aid on student persistence – that is, students who receive aid through the Federal Pell Grant program are more likely to complete. These effects of SES did not hold their significance once college experience variables were included in the third model. Therefore, taking into account all background characteristics and pre-college and college academic experiences, my study shows that factors such as college GPA and first-year units are more influential than SES on graduation.

Table 8: Binary Logistic Odds Ratios: Graduation within six years

	Model 1: Background characteristics and pre-college academic experiences	Model 2: Add FYE variables -- learning community and freshman seminar	Model 3: Add College experiences
Gender	1.432***	1.407***	1.366***
	(0.130)	(0.128)	(0.144)
Race			
Latino	1.257*	1.261*	1.465**
	(0.164)	(0.165)	(0.223)
Black	0.681***	0.689**	0.894
	(0.106)	(0.108)	(0.161)
Asian/PI/SE Asian	0.97	0.972	0.948
	(0.133)	(0.134)	(0.151)
Filipino	1.036	1.045	1.086
	(0.180)	(0.183)	(0.221)
American Indian	0.482**	0.481**	0.48*
	(0.180)	(0.182)	(0.205)
Other	0.972	0.992	1.050
	(0.146)	(0.149)	(0.185)
HS GPA	2.625***	2.684***	1.333**
	(0.275)	(0.284)	(0.169)
HS SES	0.989***	0.989***	0.995
	(0.003)	(0.003)	(0.003)
Student SES	1.166*	1.164	1.030
	(0.108)	(0.109)	(0.114)
SAT verbal	1	1	0.999
	(0.001)	(0.001)	(0.001)
SAT math	1.001	1.001	1.000
	(0.001)	(0.001)	(0.001)
Parent education			
No high school	1.369	1.33	1.405
	(0.266)	(0.259)	(0.308)
Some high school	1.016	1	1.195
	(0.252)	(0.251)	(0.349)
Some College	1.209	1.216	1.281
	(0.184)	(0.186)	(0.228)
2-year college graduate	1.411*	1.429*	1.598**
	(0.26)	(0.264)	(0.341)
4-year college graduate	1.430**	1.439**	1.48**
	(0.222)	(0.225)	(0.272)
Postgraduate	1.756***	1.762***	1.554**
	(0.316)	(0.319)	(0.316)

*p<.10, **p<.05, ***p<.01
Reference category for Race is *White;* reference category for parent education is *High School Graduate*
Robust standard errors in parentheses

Table 8 (cont'd): Binary Logistic Odds Ratios: Graduation within six years

	Model 1: Background characteristics and pre-college academic experiences	Model 2: Add FYE variables -- learning community and freshman seminar	Model 3: Add College experiences
FYE Freshman seminar		1.294*** (0.114)	1.081 (0.114)
Learning community		1.161 (0.128)	1.108 (0.142)
First year advising			0.682*** (0.099)
EOP learning community			0.899 (0.227)
Full time			0.759 (0.309)
Equity program			0.533*** (0.123)
Change major			1.681*** (0.129)
Remediation English only			1.182 (0.189)
Math only			0.920 (0.172)
Both required			0.766 (0.149)
First year units			1.093*** (0.012)
Commuter			0.975 (0.109)
College GPA			2.46*** (0.231)
Constant	0.017	0.013	3.97E-07
Average RVI			0.049
Largest FMI			0.2423

*p<.10, **p<.05, ***p<.01
Reference category for remediation is *Not required*
Robust standard errors in parentheses

First-year units, GPA, parent education, being female, and being Hispanic are importantly associated with graduation

Outside of the scope of my primary research questions, the results of my study tell other interesting stories about factors that influence graduation. Across three regression models, four variables maintain their significant, positive effect on graduation: gender (female), parent education, high school GPA, and being Hispanic. Females are clearly finding success at Sacramento State with a 24 percent greater likelihood of graduation than males, holding background and college experiences constant.

Confirming the results of numerous studies, my results show that having a parent with any degree (two-year, four-year or postgraduate) compared to having a parent whose highest level of education is a high school diploma is associated with a greater likelihood of graduation, holding background and college experiences constant. The story this tells is that although increasing the number of graduates with Bachelor's degrees is desirable for the social and economic benefits it confers, increasing the number of graduates with *any* degree (two-year, four-year or postgraduate) could create a ripple effect with each college-educated generation of parents positively influencing the next.

Holding background characteristics and college academic experiences constant, every one-point increase in high school GPA is associated with a 33 percent greater likelihood of graduation. Similarly, a student's GPA at the end of the freshman year of college is positively associated with completion. Every one-point increase in a

student's freshman year GPA makes a student one and one-half times more likely to graduate, all else constant. Based on this, academic achievement before and during the freshman year is an important predictor.

Echoing findings from other studies, my analysis shows that first-year units have a significant influence on graduation. Every additional unit completed in freshman year produces a slightly higher likelihood of graduation (odds ratio 1.09), holding all background and college experiences constant. This confirms evidence in the literature about the importance of keeping freshman enrolled with as full a schedule as possible that would allow them to also achieve a strong GPA.

Interestingly, changing major is another factor positively associated with graduation. My study shows that with every additional change of major, a student is 68 percent more likely to graduate. I suspect that this variable is positive and significant because it is simultaneously measuring students' persistence – that is, those students who stay enrolled long enough to change their major once or twice are more likely to graduate.

Background is important and lasting influence

Analyzing these results within the context of my conceptual framework, I had proposed that students' background characteristics influence their college preparedness, college-going behavior, and performance in at least the first semester of college. I hypothesized that the addition of variables that measure student engagement to the model could change the significance of background characteristics.

I conclude that certain background characteristics have lasting statistically significant influences on achievement, although the magnitude of their effect changes (sometimes positively) with the addition of college experience variables to the model. This shows that influence of these characteristics is sometimes mitigated and sometimes magnified by factors in the institutional environment.

Gender. When holding only background characteristics constant, being female is associated with a 43 percent greater likelihood of graduation than males. When college variables are added, this reduces to a 37 percent greater likelihood of graduation than males. Therefore, institutional factors reduce the magnitude of effect of gender.

Hispanic. Being Hispanic is associated with 26 percent greater likelihood of graduation compared to White students holding only background characteristics constant. With the addition of college variables, this coefficient increases to 47 percent greater likelihood of graduation than White students. Therefore, student engagement positively influences Hispanic students.

Student SES. When holding only background characteristics constant, low-income students (as measured by Pell eligibility) are 17 percent more likely to graduate than non-Pell-eligible students. This variable loses its statistical significance once FYE variables are added to the model. Therefore, college experiences are diluting the statistical influence of SES. However, it is possible that the effects of SES are being absorbed by other influential factors such as freshman year GPA or first year units.

Parent education. The likelihood of graduation for students with a parent who holds a two-year or four-year degree increases with the addition of college experience variables (compared to students with a parent who is a high school graduate); the likelihood of graduation decreases for students with a parent who holds a postgraduate degree with the addition of college experience variables. This shows that while parent education is a lasting influence on student outcomes, the magnitude of effect changes as a result of college experiences.

High school GPA. The magnitude of effect of high school GPA reduces measurably with the addition of college experience variables to the model. Holding only background characteristics constant, every one-point increase in HS GPA is associated with a 163 percent greater likelihood of graduation. With the addition of college experience variables, the effect reduces to 33 percent greater likelihood of graduation with every one-point increase in HS GPA. Therefore, high school academic achievement is an important influence when students enter college, but its influence is mitigated by collegiate efforts.

High school SES. Holding only background characteristics constant, every slight decrease in economic composition of the high school is associated with a slight decrease in likelihood of graduation. This variable loses its statistical significance with the addition of college experiences variables, showing that student engagement can dilute the effects of HS SES on graduation.

Conclusion

In conclusion, the results of this study illustrate that FYE – particularly freshman seminar – is an important influence on graduation at Sacramento State. The results also identify other college experience factors that are importantly associated with graduation, namely freshman year GPA, freshman year units, and changing major. Finally, the results demonstrate the relative importance of background characteristics as factors of student success. These background factors are statistically significant in their influence on student outcomes, but their effects can be both mitigated and magnified by college experiences. In the next chapter, I consider the policy implications of these findings in an attempt to inform efforts to improve the graduation rate at Sacramento State and beyond.

Chapter 5 - Conclusion

The economic vitality of the state and nation relies in part on the research community's enduring efforts to identify the most influential determinants of student success. Contributing to a large and growing body of research, this study has identified important variables in a student's college experience, and important background characteristics, that influence graduation. In conclusion of this study, I synthesize the results to suggest that graduation rates can be positively influenced through two critical areas of focus.

Student success factor: Academic achievement and engagement in freshman year are critical to success

The overarching conclusion to be drawn from this study's findings is that academic achievement and engagement in the first year of college are strong and important influences on graduation. The results show that freshman year GPA, higher units in the first year, and participation in First Year Experience contribute meaningfully to graduation of first-time freshmen at Sacramento State (as shown in Table 9). The positive relationship between these variables supports the theory that student success in the first year initiates a confident and motivated psychological mindset in students that is more likely to carry them to graduation (Tinto, 2012). The results have important implications regarding how Sacramento State can deploy limited resources to improve student success, such as:

1. Invest in programs that target freshmen, such as FYE. Many researchers have concluded that interventions targeted to help freshmen – especially those that bridge

the social and academic contexts of students – can improve student success (Tinto, 1975; Pascarella & Terenzini, 1991; Leppel, 2001; Zhao & Kuh, 2004; Tinto, 2012). My evaluation of FYE at Sacramento State confirms these conclusions, showing a positive association of graduation especially with freshman seminar. Freshman seminar could be an early influence on GPA, as it aims to improve students' academic performance through peer and mentor support, and increase awareness of helpful university resources. Freshman seminar may also affect students' social interactions in positive ways that were not measured in my study. Presumably, interacting with peers in a freshman seminar is one of students' first social encounters at the university and is an important milestone in getting students involved and committed to university life. The seminar provides a network of similarly determined peers who might collectively practice the habits of success taught in the seminar. This is an important way to bridge the social and academic experiences of students, essentially helping to provide and shape a supportive peer network for the student. I recommend that Sacramento State consider scaling up freshman seminar to accommodate a larger percentage of first-time freshman students, ideally making it mandatory for all incoming freshman. In 2006, only about 44 percent of freshmen enrolled in a First Year Seminar or Learning Community, but recent efforts have been made to increase capacity in the programs (personal communication with Deidre Sessoms, March 2014). Research shows that the most effective first year programs:

a. Impart study habits and other habits of mind like critical thinking and problem solving (Pascarella & Terenzini, 2005);

b. Teach students to access academic support services and instructional resources, including making services more accessible, and integrating them into core academics (Tinto, 2012);

c. Allow students to collaborate and participate in project-based learning in order to improve critical thinking skills and also help build social relationships with other students (Pascarella & Terenzini, 2005);

d. Provide opportunities for students to build social connections with peers through co-curricular activities (Tinto, 2012).

Table 9: Student success factor

Academic achievement and engagement in freshman year	
Independent variable	*Impact on graduation within 6 years*
FYE (participation in either first year seminar or learning community)	38 percent greater likelihood of graduation than non-participants
First year seminar	29 percent greater likelihood of graduation than non-participants
Freshman year GPA	One point increase is associated with a 146 percent greater likelihood of graduation
Freshman year units	One unit increase is associated with a 9 percent greater likelihood of graduation

While there are many different types of postsecondary institutional efforts that impact freshman achievement, I recommend that – for the sake of cost-efficiency – Sacramento State scale up FYE since it is already deployed and is quantitatively associated with desired outcomes.

2. Invest in faculty who work with freshmen. Research consistently shows that effective ways to improve freshmen outcomes through the classroom are to:

a. Improve the pedagogical and assessment skills that faculty bring to first-year classrooms;

b. Avoid placing inexperienced or part-time faculty in first-year classrooms (Jaeger & Hinz, 2008; Eagan & Jaeger, 2008);

c. Give faculty the data capabilities to do formative assessments of students;

d. Formally implement "early warning" requirements so that faculty must refer struggling students to intervention services at certain points in the semester (Tinto, 2012).

CSU Chancellor Tim White recently announced a $50 million investment to improve student success, which would include efforts to hire more tenure-track faculty, appoint more advisors to help students graduate, and increase programs such as internships and service learning that keep students in school (Rivera, 2014). I recommend that these efforts be accompanied by plans for on-going formal evaluation. This will ensure that efforts are having the desired effect on student outcomes, and that resources are being deployed efficiently and effectively.

Student success factor: Institutional actions can help redirect pathways initiated by socioeconomic origins

Results in my study relating to the effect on graduation of student and school socioeconomic status (SES), as well as the effect of being Hispanic, show that graduation is the result of a dynamic interplay between student background characteristics, high school academic experiences, and postsecondary experiences. The results suggest that student pathways are not determined by social origins, but that

Sacramento State and all institutions have an opportunity to influence and potentially redirect student pathways through supportive policies and interventions.

A great deal of research suggests that a student's socioeconomic status (SES) is an important predictor of academic achievement – that students with more advantaged backgrounds are more likely to attend four-year institutions, more likely to a attain postsecondary degrees, and therefore more likely to attain economic advantages associated with a lucrative job (Coleman et al., 1966; Bourdieu, 1973; Deil-Amen & Turley, 2007; Borman & Dowling, 2010; Jez, 2014). This is consistent with social reproduction theory -- that the pathways for rich and poor students are determined by social origin and are relatively divergent, with advantaged students attending advantaged high schools, which in turn leads to advantaged institutional pathways, in a form of cumulative advantage over the life course (Bourdieu, 1973). Adding nuance to the research on the effects of social origins, Giudici and Pallas (2014) propose the Cumulative Dis/Advantage theory to explain varying paths of individuals in the life course as the result of dynamic interplay between individuals' resources *and* social structures (educational system, welfare state, labor market). Their study framework uses the National Longitudinal Survey of Youth 1979, which collected data through interviews of more than 12,000 students from 1979 to 2008. This study categorized subjects' post-high school pathways for five years. After examining the pathways of 5,336 high school graduates from this group, Giudici and Pallas (2014) find that both ascribed characteristics and students' high school characteristics and resources are predictors of post-high school pathways. Whereas social reproduction theory asserts

that social origins determine pathways, Giudici and Pallas (2014) suggest that outcomes can be influenced by institutional structures and policies.

The theoretical framework of this study similarly seeks to suggest that graduation is the result of an interplay between background characteristics and institutional factors. My framework hypothesizes that a student's background characteristics (including high school socioeconomic status and academic experience) influence graduation, but that college experiences would either reduce the magnitude of effect or overtake the influence of background on college completion.

There are three outcomes of my study that support this hypothesis; first are the effects of high school socioeconomic status (HS SES) and student SES. Both factors are statistically significant in my analysis when holding only background characteristics and pre-college academic experiences constant. The HSSES variable shows that every slight decrease in economic advantage at the student's high school is associated with a corresponding slight decrease in the likelihood of graduation. However, once the model adds all college experience variables, high school SES loses its statistical significance. Factors of achievement in college (freshman GPA and freshman units) are found to be more important influences on student success. It is possible that the negative effects of high school SES are being diluted and absorbed by those more important factors. Similarly, student SES (as measured by Pell grant eligibility) has a statistically significant positive effect on graduation *until* the model accounts for FYE variables and college experiences, when student SES loses its significance. It is possible that the positive effects of Pell grant eligibility are being

diluted and absorbed by factors of academic achievement. Student SES and high school SES matter when accounting only for background characteristics. However, once students are engaged at Sacramento State, the influence of SES is outweighed (perhaps absorbed) by the effect of more important factors such as freshman year GPA and units. These results show that a student's socioeconomic status does not predetermine his/her success. This supports the theory that graduation is the result of an interplay between background characteristics and institutional factors. Therefore, through institutional actions that support student achievement in the freshman year – especially actions that target disadvantaged socioeconomic groups – Sacramento State has an opportunity to help divert pathways that might have been predetermined by SES.

Another outcome supporting the study's hypothesis is the influence of race/ethnicity on graduation. The results show that being Hispanic is associated with a 47 percent greater likelihood of graduation than White students after controlling for background, pre-college academic experiences, and college experiences. Hispanic students in California have lower high school graduation rates than White students (California Department of Education, 2012), and Hispanics have lower educational attainment in general than Whites (PPIC, 2012). However, the reason that being Hispanic shows a strong positive association with graduation in this study is because this analysis holds constant those other risk factors often associated with Hispanic students, such as being low-income or not having a parent with a college degree. This indicates that, in general, Hispanic students are less likely to graduate due to disparities in income and parental education. Institutional and policy practice can help level the

playing field for Hispanic, low-income and first generation college students, helping to divert the pathways initiated by social origins.

One example of a policy that could help level the playing field is California's new Local Control Funding Formula and its Local Control Accountability Plan, which intend to provide enhanced curricular focus for low-income students, English Language Learners and foster youth in the K-12 system. The new formula provides additional funding for these students beginning this year, allowing K-12 schools to tailor practices and programs to improve student achievement. The accountability plan ensures that funds are being spent on high-needs students, and that new programs have been informed by public input. Extra funding and enhanced programs could help contribute to higher academic achievement in high school (as measured by GPA), which my study shows is a statistically significant influence on graduation, holding constant all background and college experiences. If the enhanced funding works as intended, students will arrive at universities more prepared for college. This could reduce the need for remediation and enable students to excel as freshman with a full schedule of credit-earning courses (which my study shows is positively associated with graduation). Institutional actions such as FYE, peer tutoring, EOP and the like, can support students' academic achievement in freshman year (which my study shows is positively associated with graduation). With this type of extra support, California could soon report much more favorable educational outcomes for the majority of Hispanic students entering higher education.

My results related to SES and Hispanic students show that the effect of social origin characteristics can be diluted by more influential factors of success, which demonstrates that institutions can help students break the cycle of cumulative advantage. As Giudici and Pallas' (2014) Cumulative Dis/Advantage theory asserts, institutions – particularly broad access institutions such as Sacramento State that enroll students from a variety of backgrounds – have an important opportunity to redirect students to educational success and, ideally, social, civic, and economic prosperity. Policy structures can help students from economically disadvantaged homes and schools apply to and enroll in college, and support programs in the college can give students resources to persist and achieve. When educational policy and practice provide these opportunities, students' collegiate efforts can overtake the influence of social origins on their likelihood of graduation and could steer their life courses to more advantageous paths.

Recommendations for further study

I recommend that further study focus on determining if causal relationships exist between FYE and freshman year GPA, units, and any other measure of student engagement. In other words, can we prove that participating in FYE positively impacts those factors? If there is such a relationship(s), that would strengthen the evidence in favor of FYE as a worthwhile program that helps students graduate and helps the university contribute to California's economic prosperity.

I also recommend that further study attempt to identify particular populations of students who could most benefit from FYE. I was unable to determine whether the

effects of FYE are different for students who come from disadvantaged families or high schools, and my study was not designed to determine whether its effects are different for males than females or for other ethnicities compared to White students. This information could help the university target intervention to students who stand to benefit from it the most.

Research is an art that helps sculpt policies to support student success

Of all first-time freshmen students who entered Sacramento State in Fall 2006, only 43 percent had graduated by or in Fall 2012. Low graduation rates like this have persisted for too long; CSU must make greater strides to honor the economic and personal time investments made by students, their families, taxpayers, and educators, and to improve the expected return on investment by contributing more Bachelor's degree graduates to California's workforce. Improving rates of completion among Bachelor's degree-seeking students involves identifying how and why these students fall off track, and providing resources and interventions to help them persist. This study complemented analyses under CSU's Graduation Initiative to discover and dislodge roadblocks to students' success, revealing factors that have statistically relevant associations with graduation for this group of 2,658 students – one of the most recent cohorts to have completed the six-year graduation window. The data points from this thesis contribute to stakeholders' efforts to expend limited higher education resources in ways that are likely to impact success of present and future students. I echo the CSU Chancellor's Office's assertion that research and evaluation is "an art." As such, I have crafted this examination with the highest ethical intent and the greatest effort at

understanding the landscape for a valid specification of study. My hope is that the

results will complement the good efforts already underway at Sacramento State, and

that collectively – with every additional data point – these research activities will help

the community of stakeholders sculpt policies and practices that positively impact

completion at the university.

	HS GPA	HS SES	SAT Verbal	SAT Math	Change Major	UNA/UNC	First year units	College GPA
HS GPA	1							
HS SES	0.0158*	1						
SAT Verbal	0.2163*	-0.3356*	1					
SAT Math	0.2723*	-0.2933*	0.6053*	1				
Change Major	0.0479*	-0.0212*	0.0127*	-0.0424*	1			
UNA/UNC	0.2796*	-0.1432*	0.1397*	0.1500*	0.2066*	1		
First year units	0.2398*	-0.0990*	0.0858*	0.0927*	0.1690*	0.8047*	1	
College GPA	0.3316*	-0.1400*	0.1870*	0.1794*	0.1788*	0.6880*	0.8001*	1

Appendix A
Pairwise Correlation Table

Appendix B

Binary Logistic Regression, Multicollinearity correction

	MC Model 1: All Variables	MC Model 2: Excluding UNAUNC (percent units attempted vs. complete)
Gender	1.237*	1.366***
	(0.144)	(0.144)
Race		
Latino	1.283	1.465**
	(0.214)	(0.223)
Black	0.941	0.894
	(0.195)	(0.161)
Asian/PI/SE Asian	0.885	0.948
	(0.157)	(0.151)
Filipino	1.254	1.086
	(0.293)	(0.221)
American Indian	0.462	0.480
	(0.229)	(0.205)
Other	0.807	1.050
	(0.161)	(0.185)
HS GPA	0.870	1.333**
	(0.121)	(0.169)
HS SES	0.996	0.995
	(0.003)	(0.003)
Student SES	1.150	1.030
	(0.141)	(0.114)
SAT verbal	0.999	0.999
	(0.001)	(0.001)
SAT math	1.000	1.000
	(0.001)	(0.001)
FYE freshman seminar	1.203	1.081
	(0.144)	(0.114)
FYE LC	1.008	1.108
	(0.143)	(0.142)

*p<.10, **p<.5, ***p<.01
Robust standard errors in parentheses
Reference categories: Race - White

Appendix B – continued

Binary Logistic Regression, Multicollinearity correction (continued)

	MC Model 1: All Variables	MC Model 2: Excluding UNAUNC (percent units attempted vs. complete)
Parent Education		
No high school	1.458	1.405
	(0.354)	(0.308)
Some high school	1.275	1.195
	(0.428)	(0.349)
Some College	1.282	1.281
	(0.255)	(0.228)
2-year college graduate	1.714**	1.598**
	(0.407)	(0.341)
4-year college graduate	1.403*	1.48**
	(0.283)	(0.272)
Postgraduate	1.548*	1.554**
	(0.360)	(0.316)
First year advising	0.744*	0.682***
	(0.116)	(0.099)
EOP LC	0.908	0.899
	(0.247)	(0.227)
Full time	1.231	0.759
	(0.592)	(0.309)
Equity	0.834	0.533***
	(0.203)	(0.123)
Change major	1.742***	1.681***
	(0.151)	(0.129)
Remediation		
English only	1.251	1.182
	(0.230)	(0.189)
Math only	0.973	0.920
	(0.201)	(0.172)
Both required	1.064	0.766
	(0.228)	(0.149)
First year units	0.974*	1.093***
	(0.014)	(0.012)
Commuter	0.922	0.975
	(0.119)	(0.109)
UNAUNC	1.154***	
	(0.009)	
College GPA	2.256***	2.46***
	(0.203)	(0.231)
Average RVI	0.046	0.049
Largest FMI	0.2175	0.2423

*p<.10, **p<.5, ***p<.01

Robust standard errors in parentheses

Reference categories: Parent Education - High School Graduate, Remediation - Not required

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