

Institutional Effects on Community College Completion Rates:

An Analysis of Washington State's Community and Technical College System

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ABSTRACT

Institutional Effects on Community College Completion Rates:
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Today nearly half of all U.S. undergraduates at public institutions are community college students. Despite being the fastest growing sector of American higher education, the success rates of these colleges are extraordinarily low. Only one-third of community college students earn a certificate/award within six years of starting higher education, and less than 20% earn a Bachelor's degree in that period – despite the fact that nearly 80% of new community college students aspire to obtain at least a four-year degree or higher. Although prior research has investigated how individual characteristics play a part in community college students' success rates, there is less known about how institutional characteristics link with student outcomes. The present study helps fill this gap by 1) quantitatively investigating how, after accounting for individual-level effects, institutional variables contribute to community college students' likelihood of completing a college certificate or degree, or transferring to a baccalaureate institution, and 2) qualitatively investigating the practices and cultures of highly effective institutions relative to “typical” institutions.

Multilevel modeling results for two cohorts of first time, degree-seeking students ($N = 58,492$ combined) enrolled in Washington State community and technical colleges ($N = 33$) showed that college location (urban, rural, or suburban) and focal orientation of the college (workforce vs. transfer) were the only consistent predictors of student outcomes, once student characteristics were accounted for. In other words, students were more likely to complete their degree/certificate or transfer to a 4-year college when attending an institution with a focus that matched their own. Transfer students were more likely to complete at urban institutions whereas workforce students were more likely to complete in colleges situated in non-urban locations.

Case study results of highly effective institutions – those with higher than predicted completion rates – revealed wide variation in leadership, culture, reform initiatives, and use of data. Nevertheless, highly effective institutions appeared to be utilizing wrap-around, mentor-style student advising, and have cultures built around a strong “sub-mission” such as an institution-wide focus on equity or workforce education, unique to each institution that potentially helps to focus the broad community college mission. Finally, findings also show that highly effective institutions perceive participation in the national “Achieving the Dream” completion initiative as transformational for institutional practices, especially in terms of aiding them in focusing on their institutional data, student completion, and intermediate measures of completion. Potential implications for policy and future research are discussed.

Keywords: Community colleges, completion, institutional characteristics, institutional effectiveness, Achieving the Dream

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TABLE OF CONTENTS

Chapter 1: Introduction.....	1
1.1 Introduction and Problem Statement.....	1
1.2 Purpose and Overview of Dissertation.....	6
Chapter 2: Literature Review.....	9
2.1 Role of Two-Year Community Colleges in Post-Secondary Education.....	9
2.2 Student Characteristics and Post-Secondary Success.....	12
2.3 Two- vs. Four-Year Colleges: Diversion vs. Democratization & Issues of Selection Bias...	19
2.4 Institutional Effects and Post-Secondary Student Success.....	24
2.5 Limitations of Prior Research on Two-Year Institutions.....	36
2.6 Summary of Need for Present Study.....	44
Chapter 3: Research Design and Methodology.....	46
3.1 Research Questions.....	46
3.2 The Case of Washington State’s Community Colleges.....	48
3.3 Conceptual Framework for Study.....	50
3.4 Mixed-Methods Research Design Overview.....	56
3.5 Overview of Quantitative Methodology.....	58
3.6 Overview of Qualitative Methodology.....	75
Chapter 4: Institutional Variable Exploratory Results	84
4.1 The Washington State Community and Technical College System.....	84
4.2 Institutional Variable Selection Rationale.....	86
4.3 Institutional Variables: Testing for Change over Time.....	99
4.4 Institutional Variables: Correlations with Aggregate Student Outcomes.....	101
Chapter 5: Quantitative Analyses of Student Data (Multilevel Models).....	105
5.1 Sample Descriptive Statistics.....	105
5.2 Overview of Models.....	107
5.3 Approximate ICC and Pseudo-R ² Computation Method.....	108
5.4 Multilevel Prediction Model Results.....	108

5.5 Adjusted Measures of Institutional Effectiveness.....	134
5.6 Limitations in the Quantitative Analysis.....	135
Chapter 6: Qualitative Analyses of Institutions (Case Studies).....	140
6.1 Introduction and College Descriptions.....	140
6.2 Case Study: College M.....	141
6.3 Case Study: College L.....	149
6.4 Case Study: College D.....	158
6.5 Case Study: College X (Representing Average Institutional Effectiveness).....	163
6.6 Summarizing Policies, Practices, and Cultures across Case Studies.....	169
6.7 Common Practices and Themes from Highly Effective Institutions.....	173
Chapter 7: Conclusions and Implications.....	150
7.1 Introduction.....	150
7.2 Findings.....	181
7.3 Discussion.....	183
7.4 Policy Implications.....	192
7.5 Limitations and Future Research.....	195
Appendices.....	225
Appendix A. Semi-Structured Interview Protocol.....	225
Appendix B. Zero-Order Correlations for Student-Level Covariates	226-227

LIST OF TABLES

Chapter 3

Table 1. Student-Level Variables.....62-63

Table 2. Institution-Level Variables 68

Chapter 4

Table 3. Correlations among Enrollment Types (2010 Cohort)..... 95

Table 4. Correlations among Enrollment Types (2011 Cohort)..... 95

Table 5. Results for 2- and 3-Group *K*-Means Cluster Analyses (2011 Cohort)..... 97

Table 6. Zero-order Correlations among Institutional Variables (2010 Cohort)..... 102

Table 7. Zero-order Correlations among Institutional Variables (2011 Cohort)..... 104

Chapter 5

Table 8. Disaggregated Sample Descriptive Statistics across all Students..... 105

Table 9. Models Used by Type of Outcome and Student Intent..... 108

Table 10. Results for Model 2: Unique Student Characteristic Effects (2010 Cohort)..... 109

Table 11. Results for Model 2: Unique Student Characteristic Effects (2011 Cohort)..... 110

Table 12. Results for Model 3: Direct Institutional Characteristic Effects (2010 Cohort)..... 111

Table 13. Results for Model 3: Direct Institutional Characteristic Effects (2011 Cohort).....112

Table 14. Results for Model 4: Unique Institutional Characteristic Effects (2010 Cohort)..... 113

Table 15. Results for Model 4: Unique Institutional Characteristic Effects (2011 Cohort)..... 114

Table 16. Results for Models 5-6: Unique Combined Effects (2010 Cohort)..... 115

Table 17. Results for Models 5-6: Unique Combined Effects (2011 Cohort)..... 116

Chapter 6

Table 18. Common Practices and Themes from Highly Effective Institutions..... 179

LIST OF FIGURES

Chapter 3

Figure 1. Integrated Student-Institutional Effects Conceptual Model.....	55
Figure 2. Mixed-Methods Explanatory Sequential Design.....	56

Chapter 4

Figure 3. Map of Washington State Community and Technical College System.....	84
Figure 4. Hierarchical Cluster Analysis Dendrogram (2010 Cohort).....	98

Chapter 5

Figure 5. Predicted Probability of Any Award for Different Institution Orientations by Student Degree Intent (2010 Cohort)	125
Figure 6. Predicted Probability of Any Award for Different Institution Locations by Student Degree Intent (2010 Cohort)	126
Figure 7. Predicted Probability of Any Award for Levels of Over-enrollment by Student Degree Intent (2010 Cohort).....	128
Figure 8. Predicted Probability of Any Award for Different Institution Orientations by Student Degree Intent (2011 Cohort)	132

Chapter 1: Introduction

1.1 Problem Statement

Access to education,¹ especially higher education, has long been the policy tool of choice in the United States to ameliorate social inequities of class, income, and race, and allow for a meritocratic sorting of the population (Beach, 2011; Carnevale & Strohl, 2010; Courant, McPherson, & Resch, 2006). Today, most students, even those with minimum academic preparation and financial assistance, can attend (access) college (Adelman, 2007; Cabrera & La Nasa, 2001), and over 70% of high school graduates currently enroll in some form of post-secondary education within two years of graduation (Adelman, 2007; Symonds, Schwartz, & Ferguson, 2011). Unfortunately, in the last four decades there has been a dramatic shift in the success of students who enroll in college, including decreased postsecondary degree completion² and attainment³ rates overall, while lower completion and attainment rates for historically disadvantaged students have increased relative to more advantaged students.

Inequities in Enrollment (Access) and Completion (Success)

Although increasingly higher percentages of the U.S. population are enrolling in some form of post-secondary education, the overall post-secondary degree attainment rate has not risen for more than three and a half decades (OECD 2011; National Center for Education Statistics 2014). Today's students actually have lower completion rates than those who attended college in the 1970s (Belley & Lochner, 2007; Bailey & Dynarski, 2011). In addition, the percentage of students who begin higher education and fail to complete at least a certificate or degree has

¹ There are various ways to define "access" to higher education. This paper uses what Clifford Adelman (2007) calls "Threshold Access": anyone who has ever enrolled a postsecondary institution long enough to generate a transcript record is counted as having accessed higher education.

² Completion is often defined as the percentage of an entering cohort that earn a degree (or certificate) within a set amount of time. Graduation rate is a term that was traditionally used for completion rates (Hauptman, 2012).

³ Degree attainment represents the percentage of the total population (not just those who accessed higher education) with a college certificate or degree (Cook & Pullaro 2010)

increased over that of thirty years ago (Bailey & Dynarski, 2011); although students *entering* post-secondary education are far more diverse today than they were forty years ago, the demographics of today's *completers* look much the same as they did four decades ago (Bound, Lovenheim, & Turner, 2007). Furthermore, socioeconomic status, especially family income, has become an increasingly powerful predictor of college success and has a large influence on whether or not a student will successfully complete college (Goldrick-Rab, 2010; Reardon, 2011). For example, over the last four decades, the percentage of students from the lowest income quartile earning a four-year college degree has barely increased, from 6% to 8%. In contrast, during that same time period, the share of students from the top income quartile earning a college degree increased from 42% to 82% (U.S. Department of Education, 2014). This mirrors a trend in the U.S. toward increasing income inequality and decreasing economic mobility (United Nations, 2011; Isaacs, Sawhill, & Haskins, 2008). Finally, the financial and social importance of earning a college degree has never been more pronounced for U.S. citizens: postsecondary degree holders experience higher wages, greater job security, and greater economic mobility in the United States than in any other country (Douglass 2006; OECD 2011).

National College Completion Agenda and its Link to Two-Year Institutions

In response to these trends, U.S. higher education policies have shifted from a long-standing focus on access to a priority on degree attainment (completion) (American Association of State Colleges and Universities, 2012; Kelly & Schneider, 2012; Shugart, 2013; Wang, 2017). The majority of the growth in higher education access can be explained by increased community college enrollments, and two-year post-secondary institutions are now the largest single undergraduate sector in higher education (Digest of Education Statistics, 2016). Furthermore,

low overall U.S. post-secondary degree attainment rates can be linked to the relatively low U.S. completion rate of sub-baccalaureate degrees and certificates (Hauptman, 2012).

Community colleges are increasingly viewed as the key to improving college completion rates, and thus increasing degree attainment levels in the U.S. population (Bailey, 2012; Hauptman, 2012; Wang, 2017). These institutions have been traditionally passed over by the media and are often looked down on as “lesser” than other institutions in the higher education community (Goldrick-Rab, 2010), but they are now receiving unprecedented attention from federal and state policymakers as well as private foundations leading initiatives on retention and completion. For example, although we do not yet know what the current administration will do, the Obama administration had made it national policy to regain a leadership position in college degree attainment for U.S. workers, and set a goal of educating an additional 8 million students through credential completion by 2020, including 5 million new *community* college graduates (Obama, 2009).

Non-governmental organizations have also made college completion a top agenda item. The Lumina Foundation for Education set a goal to increase the percentage of postsecondary certificate or degree attainment among U.S. workers from 40% to 60% by 2025 (Lumina, 2013); the Gates Foundation has a goal, focused mainly on community colleges, to double the number of low-income students with college degrees by 2025 (Gates Foundation); The College Board has a goal to increase the number of younger workers (ages 25-34) with a postsecondary degree to 55% or higher by 2025; and the National Governors’ Association has a goal to increase certificate and degree completion rates so that 8 million additional college students graduate by 2020 (Russell, 2011). Indeed, what current national completion initiatives share in common is their stated focus on improving completion rates for older, underrepresented minority, low-

income, part-time, and working-class students who are disproportionately concentrated in two-year colleges. Many initiatives, such as Achieving the Dream (Achieving the Dream & Public Agenda, 2012), are focused solely on community college students. Furthermore, all of these initiatives include two-year degrees (in addition to Bachelor's degrees) in their completion efforts (Russell, 2011).

Measuring Institutional Efficacy and Quality for Two-Year Institutions

The intense focus on increasing college completion rates has also led to a conversation about college effectiveness and quality. In 2006, the Spellings Commission raised the issue of measuring colleges and universities with a common metric, and argued for the need to “weigh and rank comparative institutional performance” (U.S. Department of Education, 2006, p. 20). In particular, graduation rates are widely used as a proxy measure for not only institutional completion rates (Hauptman, 2012)⁴, but also institutional effectiveness and quality (Horn & Lee, 2016; The National Center for Public Policy and Higher Education, 2008). Although it is unclear how the Trump administration will react, the previous Obama administration fought hard to implement a Federal Rating System for all colleges and universities that linked graduation rates and other success measures to future financial aid eligibility for an institution's enrollees (Field, 2013; Stratford, 2013). However, by the end of the Obama administration, the rating system agenda ended up as a far less controversial “College Scorecard Tool” on the U.S. Department of Education's website.

⁴ Traditionally, graduation rates are the number of students entering an institution who earn a degree at that same institution (Cook & Pullaro, 2010) while completion rates are the percentage of entering students who earn a degree, either at the same institution or at another (Hauptman, 2012). Using either statistic for community college students is problematic for multiple reasons, most importantly because these students can often “complete” without earning a degree, for example by transferring to a four-year institution before completing a (two-year) degree (Cook & Pullaro, 2010).

One seemingly obvious problem with using institutional completion rates as a measure of institutional efficacy is that students sort non-randomly (i.e., self-select) into colleges and universities (Black & Smith, 2004), and many social factors that are strongly linked with degree completion rates are beyond the control of any one institution, including socioeconomic status (SES), academic preparation and ability, and whether or not a student is able to attend college full-time (Adelman, 2006). Therefore, the most common objection to using unadjusted graduation rates as a measure of institutional success is that institutions that enroll students with stronger education backgrounds have an unfair advantage, seeming to be more successful than institutions enrolling lower achieving students (Clotfelter, Ladd, Muschkin, & Vigdor, 2013). In order to understand (and potentially evaluate) differential institutional effects on student success outcomes, one needs to be able to control for these differences in student characteristics.

Clotfelter (2012) summed this up as follows.

...some institutions enroll students with much stronger educational backgrounds than others, giving those institutions a built-in advantage in achieving high graduation rates that might have little to do with their own effectiveness in educating students. The difficulty is exactly analogous to that of determining the fastest runner on a track team. If runners start a race at different spots on the track, the runner who crosses the finish line first will not necessarily be the fastest. To determine who is fastest, it is necessary to correct for those starting positions. In the same way, if graduation rates are to be used to compare the educational effectiveness of postsecondary institutions, it is necessary to correct for differences in student preparedness, or differences in educational “inputs” (p. 3).

Education administrators and researchers, especially those who focus on open access institutions such as community colleges, have recently been advocating for “input-adjusted” institutional measures of success, that take into account the institution’s student characteristics (Adelman, 2006; Bailey & Xu, 2012; Horn & Lee, 2016). Because community colleges serve the majority of students who bring with them many indicators predictive of low educational success, research

on what institutions can do to positively affect student likelihood of completing certificates or degrees is of particular importance (Bailey & Xu, 2012; Crisp & Mina, 2012; Wang, 20107).

For researchers interested in understanding potential ways an institution might improve student retention and completion outcomes, identifying those institutions that appear to be more effective at promoting student success is a key first step. Although research on what influences community college student success has proliferated in the last decade (Bunch & Kibler, 2015; Calcagno, Crosta, Bailey, & Jenkins, 2007; Cho & Karp, 2013; Crisp & Mina, 2012; Goldrick-Rab, 2010), the field suffers from a lack of consistency and cohesion. In a recent piece on creating a theoretical framework for studying community college success, Xueli Wang notes:

...the wide range of disciplinary backgrounds of scholars with sustained or new interest in the community college sector inherently results in vastly different and often diverging theoretical, methodological, and analytical approaches to empirical efforts in this area. As a result, research on community college student success yields mixed, and sometimes even conflicted, results that are not particularly conducive to the sustained accumulation of evidence that informs policy and practice (Wang, 2017 p.260).

Moreover, much of what is “known” about institutional factors affecting success has been gained through studies of traditional students attending four-year institutions (Kurlaender, Carrell, & Jackson, 2016) whereas little research has been “devoted to understanding the unique issues in retaining community college students” (Crisp & Mina, 2012, p. 147-8). Researchers are now becoming aware of the limitations of applying four-year college student and institutional research to two-year students and institutions (Astin & Oseguera, 2102; Bailey & Xu, 2012).

1.2 Purpose and Overview of Dissertation

This dissertation project employs a mixed-methods approach to understanding the correlates of two-year institutions’ completion rates by: first, quantitatively analyzing two-year college student and institutional data from a single state, Washington, to identify whether there are meaningful institutional differences among public two-year colleges on measures of student

success within a single state system (i.e., governed by one state policy), after controlling for student characteristics; and second, by testing the effects of relatively fixed institution-level characteristics of these two-year colleges, such as college enrollment size, location (urban, suburban, rural), spending, and student-faculty ratios, on students' certificate and degree completion. Further, after controlling for institution- and student-level characteristics, I use the model-based residual error patterns to identify a sample of colleges that are average performing, as well as colleges that are performing better than would be expected, to qualitatively analyze whether any institutional practices, organizational structures, and cultural norms are occurring in the highest performing colleges but are not captured in the quantitative analyses.

Overall, the purpose of this study was to investigate the institutional factors (after controlling for incoming student characteristics) that potentially influence student completion in one of the larger community college systems in the nation: nearly 60% of full time undergraduates in public institutions in Washington are enrolled in one of the state's community and technical colleges (CTCs), and at least 40% of Bachelor's degree completers in the state began higher education in one of these community colleges (WSBCTC, 2016). Specifically, I set out to understand the role of individual institutions in student completion, and to identify whether differences among institutions in their students' completion rates are explained by institutional characteristics that might be subject to manipulation by policy improvement.

Prior research has shown that institutional characteristics have been fairly strongly associated with four-year college student success (Bailey & Xu, 2012); however, the literature examining two-year institutions indicates tenuous, inconsistent, and largely null associations between broad institutional characteristics and student success measures (Bailey & Xu, 2012; Crisp & Mina, 2012; Wang, 2017). The weak association found between institutional

characteristics and two-year student outcomes may be due to several factors, including relatively little variation in spending due to fixed spending policies, relatively lower overall spending in community colleges in general (floor effects) and/or lack of variation in spending levels between institutions (due to limited funding), and the reliance on national datasets that are potentially less informative about community college effects due to the relatively larger variation across states' community college systems versus four-year counterparts. Further, prior studies employed relatively old data from students enrolled more than two decades ago, which is why studies utilizing recent, state-level data employed in this study are important (Calcagno, Bailey, Jenkins, Kienzl, & Leinbach, 2008; Bailey, 2012).

The present study will thus fill the gaps in the previous research on community college institutional effects by utilizing a sequential, mixed method design to investigate recent two-year college variation in student completion and institution-level predictors of completion, both broadly (quantitatively) and narrowly (qualitatively) with two recent cohorts of community college students in Washington State.

Chapter 2: Literature Review

2.1 Role of Two-Year Community Colleges in Post-Secondary Education

U.S. community colleges are open-access institutions that have traditionally served students unable to access four-year colleges and universities for a variety of reasons (Beach, 2011; Brint & Karabel, 1989). Moreover, the majority of growth in post-secondary education over the last 40 years has been driven by increased enrollment in community colleges (McIntosh & Rouse, 2009). Attendance at two-year colleges has grown at three times the rate of that at four-year institutions, and currently 45% of all undergraduates attending public colleges and universities are enrolled in two-year institutions (U.S. Department of Education, 2014). Finally, economically disadvantaged, first-generation, older, part-time, underrepresented minority, and academically underprepared students are disproportionately enrolled in community colleges, and these non-traditional students (students who exhibit one or more of the following criteria: economically disadvantaged, financially independent, first-generation, older, part-time, underrepresented minority, students with children, or academically underprepared students) represent the vast majority of students at these two-year institutions (American Association of Community Colleges, 2016; Adelman, 2006; Calcagno, Crosta, Bailey, & Jenkins, 2007; Crisp & Mina 2012; Goldrick-Rab, 2010; McIntosh & Rouse, 2009; Radford, Berkner, Wheelless, & Shepherd, 2010; U.S. Department of Education, 2014).

For example, 62% of all Native American students, 52% of all African American students, and 57% of all Latino students are enrolled in community colleges, while white students, who make up the majority of students in four-year institutions, represent just under half of two-year college students (AACC, 2016; McIntosh & Rouse, 2009). Low-income students are far more likely to start higher education in two-year institutions, although community college

students receive less financial aid than do four-year students (Crisp & Mina 2012; McIntosh & Rouse, 2009), and are more likely to be the first in their family to attend college (AACC, 2016; Crisp & Mina, 2012; McIntosh and Rouse, 2009). Community college students are also far more likely to be academically underprepared than four-year students (Crisp & Mina, 2013; McIntosh & Rouse, 2009). In addition, married students, students with children, financially independent students, and older students (greater than 24 years of age) are far more likely to be enrolled in community college: 35% of four-year college students are older than 24 years compared to 65% of community college students (DES, 2014). Finally, students in community colleges are more than twice as likely to attend college part-time, compared with students in four-year institutions (61% versus 23%), which is a risk factor for non-completion (AACC, 2016; U.S. Department of Education, 2013).

Public community college is often the only higher education available to these students for a variety of reasons (Cohen, Brower, & Kisker, 2014). Stephan, Rosenbaum, and Person (2009) used data from the National Educational Longitudinal Study (NELS88) to analyze how student characteristics influenced institutional choice of attendance, as well as degree completion. The authors used matched cohorts (via propensity score matching) of students attending community college and non-selective four-year institutions. Their weighted regression results found that the student's academic preparation (defined as high school grade point average, or GPA), followed by the socio-economic background of the student's family, best predicted whether he or she would attend a two-year or a non-selective four-year institution. In other words, students with relatively poor high school performance and those from low-SES families were more likely to attend community college than peers with better academic preparedness or those from higher-SES backgrounds. Importantly, the authors concluded that

there is minimal overlap in the characteristics of students who attended two-year institutions compared to those attending four-year institutions: for the large majority of two-year community college students, the choice is not among competing college prospects; it is really between attending a community college or not attending college at all.

Despite the significant role community colleges play in providing higher education access, it is clear that two-year college student retention, transfer, and degree attainment rates remain significantly lower than those at four-year institutions (Crisp & Mina, 2012). Although students enroll in community college with a wide variety of goals (Bailey, Leinbach, & Jenkins, 2006), more than 80% of degree-seeking community college students initially indicate that a Bachelor's degree is their ultimate goal (Horn & Skomsvold, 2011). Despite this goal, nationally only 25% to 33% of four-year degree-seeking community college students successfully transfer to a four-year institution, irrespective of whether or not they initially completed an Associate's degree (Horn & Skomsvold, 2011; Jenkins & Fink, 2016). In recent studies, only 34% of students who initially enrolled in a two-year institution earn *any* certificate or degree (at any institution) within six years of enrollment: 8% earned a certificate, 14% earned an Associate's degree, and another 12% earned a Bachelor's as their highest degree (Radford et al., 2010; Snyder & Dillow, 2011). Comparatively, 65% of students who begin higher education at a four-year institution earn any certificate or degree (Bachelor's or Associate's) within six years of enrollment, although not necessarily at the same institution; 58% complete a Bachelor's degree in that time period (Radford, et al., 2010, Snyder & Dillow, 2011). Finally, approximately 62% of community college students who successfully transfer go on to complete a Bachelor's degree, and for the majority (72%) of students who transfer to a public four-year institution the completion rate is 65%, which is marginally better than comparable students who began higher

education in public four-year institutions (Jenkins & Fink, 2016; Shapiro et al., 2013). Thus, the (relatively select) group of community college students who transfer do quite well at baccalaureate institutions.

2.2 Student Characteristics and Post-Secondary Success

Four-Year Student Characteristics

It is well-established that student background characteristics are highly predictive of whether or not a student attains a four-year degree (Adelman, 2006; Astin & Oseguera, 2012; Astin, Tsui, & Alvaros, 1996; Bowen, Chingos, & McPherson, 2009; Carter 2001; Pascarella & Terenzini, 2005), and studies have repeatedly found that that most of the variation in graduation rates can be accounted for by student characteristics (Austin & Oseguera, 2012; Bailey Leinbach, & Jenkins, 2006). In general, research on four-year college student characteristics indicates that students who come from higher-income families with at least one parent who went to college, who are financially supported by their parents, who are White, Asian, and/or female, who have better academic preparation, and who enroll in college immediately after high school on a full-time basis are far more likely to persist and attain a degree at any post-secondary institution (i.e., two- or four-year college) compared to students from less advantaged backgrounds (Astin & Oseguera, 2005; 2012; Adelman, 2006; Attewell, Heil & Reisel, 2011; Bailey & Dynarski 2011; Calcagno, et al. 2006; Dougherty & Kienzl, 2006; Titus, 2006).

Academic preparation. A student's academic preparation is one of the strongest predictors of whether he or she will persist and earn a degree (Adelman, 2006; Astin & Oseguera, 2012; Attewell, et al., 201; Bailey & Dynarski, 2011; Bowen, et al., 2009; Cabrera, Burkum, La Nasa, & Bibno, 2012; Dougherty & Kienzl, 2006; Jenkins & Weiss, 2011; Porchea, Allen, Robbins, & Phelps, 2010; Roksa & Calcagno, 2010). In particular good grades in high

school remain one of the best predictors of whether or not a student will complete a four-year degree (Adelman, 2006; Astin & Oseguera, 2005; 2012, Atteweel, Heil, & Reisel, 2011). Astin and Oseguera (2012) used data from the Cooperative Institutional Research Program to analyze entering first-time students at 262 four-year institutions in the fall of 1994 and tracked students for six years to analyze degree attainment. The dichotomous outcome variable was degree completion (at either four or six years) at the same institution in which a student initially enrolled. Results indicated that higher academic preparation (in terms of high school grades) was the strongest unique predictor of degree completion, after controlling for other student, institutional, and environmental characteristics. Additionally, students from well-educated, higher income families, students who enrolled in college within one year of high school graduation, lived on campus, and were involved in college life had increased chances of degree completion. Study limitations included model structure (nesting of student data within institutions was not taken into account), the older vintage of the data, and the lack of data on students in two-year colleges.

Socioeconomic status. Even when controlling for all other factors, SES is often a significant predictor of whether or not a will complete a four-year college degree (Adelman, 2005; 2006; Astin & Oseguera, 2012; Bowen, Chingos, & McPherson, 2009; Cabrera, Burkum, & La Nasa, 2005; Crisp & Mina, 2012; Dougherty & Kienzl, 2006; McIntosh & Rouse, 2009; Melguizo & Dowd, 2009). Overall, students with at least one parent who has earned a bachelor's degree are 46% more likely to earn a degree than those whose parents lack such a degree, and college students from families with incomes in the top 25% are currently 62% more likely to earn a degree than are students from the lowest income quartile (Radford et al., 2010). The strong positive relationship between parental education and student degree attainment has

remained constant over the last three decades, but the influence of family income on educational attainment has grown by approximately 40% over that same time period (Reardon, 2011), and is now a stronger predictor of whether or not a student will complete college than parental educational attainment.

Race, ethnicity, and gender. Female students are more likely to enroll in higher education and earn a degree (Bowen et al., 2009; Astin & Oseguera, 2012; Bailey & Dynarski, 2011) and in general underrepresented minorities have lower degree completion and transfer rates (McIntosh and Rouse, 2009; Radford et al., 2010) than white or Asian students. However, several studies examining the effects of race and gender have failed to find either race or gender uniquely predictive of four-year student retention (Titus, 2004) or completion (Attewell et al., 2011) once other covariates are taken into account.

Other student characteristics. Overall, older students are less likely to persist and complete a certificate or degree (Adelman, 2006; McIntosh & Rouse, 2009; Moore, Shulock, & Offenstein 2009; Radford et al., 2010) and age is a significant unique factor in predicting four-year degree completion, with older students at a significant disadvantage (Adelman, 2006; Attewell et al., 2011; Dougherty & Kienzl, 2006). Similarly, research has shown a consistent negative association of enrolling part-time on degree completion (Adelman, 2006; Attewell et al., 2011; Doyle, 2009a) with studies indicating that students who enroll full-time during their first year in college are at least thirty percent more likely to complete a degree than those who enroll part-time (Adelman, 2006)

Two-Year Student Characteristics

Unsurprisingly, research focusing specifically on community college students indicates that the same demographic and pre-college characteristics that are predictive for four-year

students are strong predictors of degree completion for community college students: in general, first generation students, older, part-time, underrepresented minority, academically underprepared and/or otherwise nontraditional students, and students from lower SES backgrounds are all less likely to persist and complete a degree, regardless of whether they attend a two- or four-year institution (Bailey et al., 2006; Crisp & Mina, 2012; Goldrick-Rab, 2010; McIntosh & Rouse, 2009). As Astin and Oseguera (2012) wrote, “researchers have repeatedly found that students’ chances of degree attainment are to a substantial degree a function of their own individual backgrounds” (p. 120). Furthermore, it is reasonable to suspect that much of the disparity in completion rates found between community college and four-year students might be explained by the greater disadvantages that two-year students bring with them to college.

Academic preparation. Inadequate or poor academic preparation remains a significant barrier to community college student success (Adelman, 2006; Goldrick-Rab, 2010) and community college students are far more likely to be academically underprepared than students attending four-year institutions (Crisp & Mina, 2012; MacIntosh & Rouse, 2009). Roksa and Calcagno (2010) found that, after controlling for variables such as age, ethnicity, financial aid, and whether a student attended college full- or part-time, “academic preparedness”⁵ accounted for 52% of the variance in predicting whether or not Florida community colleges students would successfully transfer to a baccalaureate institution. Several researchers have argued that lack of academic preparation of community college students can explain most of the completion disparities between two- and four-year college students in higher education. For example, using data from the National Longitudinal Study of the High School Class of 1972 and NELS88. Bound, Lovenheim, and Turner (2010) found that decreases in academic preparation of students

⁵ Academically prepared was defined in this study as students who scored below a pre-determined score on the S.A.T, following the definition of “college level” set out in the guidelines of the Florida State Board of Education.

(as measured by standardized math test scores) could account for approximately 88% of a decrease in completion rates found over a twenty year period (roughly 1972-1992) for students attending two-year colleges, (and did not account for any of the corresponding drop in completion rates for students attending four-year institutions).

However, other research indicates that community colleges students' lack of academic preparedness is only one of many (potentially overlapping) characteristics that predict decreased likelihood of retention and completion, and therefore is less uniquely predictive than it is for four-year students. For example, Attewell et al. (2011) used longitudinal data from the Beginning Postsecondary Students Longitudinal Study (BPS) data to compare several theoretical explanations of college non-completion, examining all first-time college students enrolled in two- and four-year institutions in 1995 with an intent to earn a degree. The dichotomous dependent variable was "degree completion" (either Associate's or Bachelor's, respectively) within six years of initial enrollment. In the study's model, "academic preparation"⁶ again was the strongest unique predictor of completion among students who began higher education at four-year institutions, but was not a significant *unique* predictor for students who began at a community college (Attewell et al., 2011). Similarly, Roksa and Calcagno (2010) found that enrollment in remedial math or English courses was not significantly predictive of completion for community college students, although it was for students who initially enrolled in non-selective four-year institutions.

Socioeconomic status. As previously discussed, a student's SES is a strong predictor of whether or not they are likely to succeed in college, with students from higher SES families faring significantly better than those from lower-SES families (Bailey, Leinbach, & Jenkins,

⁶ In this study a composite score determined by 1) cumulative high school GPA, 2) score on ACT/SAT math exam, and 3) highest level of math taken in high school.

2006; Crisp & Mina, 2012; Goldrick-Rab, 2010; McIntosh & Rouse, 2009). For example, Dougherty and Kienzl (2006) examined data from the NELS88 as well as data from the Beginning Postsecondary Students Longitudinal Study (BPS), and found that a student's SES was the strongest unique predictor of whether or not she or he would transfer to a four-year institution, with students from higher SES background being more likely to transfer. Titus (2006) found that, after controlling for other student covariates, students in the highest SES quartile had significantly higher predicted completion rates of a Bachelor's degree in six years, compared to students in the first or second SES quartiles. Titus employed a standardized measure of SES based on the student's family income and parental education level. More recently, Melguizo and Dowd (2009) also found that a student's SES was a strong overall predictor of both transfer and four-year degree completion. However, Melguizo and Dowd also found a significant interaction between a student's SES and type of institution attended: coming from a higher SES conferred a more pronounced completion advantage for students who began at a four-year institution compared with those beginning at a community college. In fact, for students coming from the lowest SES bracket, beginning at a community college actually predicted a *greater* chance of obtaining a Bachelor's degree than beginning at a four-year institution. Finally, Attewell et al. (2011) found that the amount of financial aid received was the strongest unique predictor of degree completion for community college students, (with a stronger effect for poorer students), while for students attending four-year institutions it was much less predictive of completion, all other factors being held constant in the model.

Race, ethnicity, and gender. As is true with four-year college students, female community college students are more likely to enroll in higher education and earn a degree (Bowen et al., 2009; Crisp & Mina, 2012; Radford et al., 2010), whereas underrepresented

minorities have lower degree completion and transfer rates (Attewell et al., 2011; Clotfelter et al., 2013; Crisp & Mina, 2012; McIntosh and Rouse, 2009; Radford et al., 2010) than White or Asian students. In a recent study of California community colleges, Clotfelter et al. (2013) found that being a female was uniquely positively predictive of completion, while being African American was uniquely negatively predictive of both retention and completion. Other studies have indicated that much of the effects of race on student retention and completion may be explained by low SES and low academic preparation (Attewell et al., 2011).

Non-traditional students. “Non-traditional” students, which include those who attend college part-time, are older (i.e., delay entry into college more than two years post-high school graduation), are financially independent, and who have children/dependents, are all more likely to be enrolled in community colleges compared to four-year institutions (American Association of Community Colleges, 2016; McIntosh & Rouse, 2009). Moreover, these students have a decreased likelihood of completion at two-year, as well as four-year, institutions (Crisp & Mina, 2012). For example, Attewell et al. (2011) found a strong negative effect for non-traditional status (students who were older, financially independent, part-time, or with children), which was uniquely predictive of decreased completion for community college students. In fact, after the amount of financial aid students received, non-traditional status was the most significant (negative) predictor of completion, even after controlling for variables such as SES, academic preparation, race and gender.

Several studies show large negative effects of increased age and of part-time attendance on completion for community college students (e.g., Adelman, 2006). However, the degree to which age is a unique disadvantage versus a proxy for other variables that are predictive of failure (e.g., lack of academic preparation, part-time attendance status) remains uncertain.

Calcagno, Crosta, Bailey, and Jenkins (2006) analyzed longitudinal unit record transcript data from first-time community college students in Florida and found that older students (25+ years) were less likely to complete a certificate or degree within five years than were traditional aged students. However, the authors found that, after controlling for academic ability and attendance patterns, older students actually had a *higher* probability of completing a degree. In addition, Calcagno et al. (2006) found that having to enroll in a remedial math course was not a negative predictor of completion for older students, in contrast to younger students.

As noted earlier, community college students are far more likely to enroll part-time than students in four-year institutions (McIntosh & Rouse, 2009; Horn & Skomsvold, 2011), and research shows a consistent and strong negative association of enrolling part-time (versus full-time) for community college students (Adelman, 2006; Attewell et al., 2011; Doyle, 2009a; Goldrick-Rab, 2010). Adelman (2006) notes that students who enroll full-time during their first year in college are a third more likely to complete a degree within eight years than those who enroll part-time. Finally, Doyle (2009a) analyzed students enrolled in Tennessee community colleges and found that, after controlling for other characteristics, enrolling for more than 12 credits during a student's first year (i.e., full-time) had a significant and positive relationship with the likelihood of transferring to a four-year institution.

2.3 Two- vs. Four-Year Colleges: Diversion vs. Democratization & Issues of Selection Bias

Two strands of research have examined the systemic and individual institutional effects of attending a community college on student outcomes. The first, representing several decades of research, focuses on differential outcomes for similar students pursuing a Bachelor's degree who begin college at a two-year institution versus those starting college at a four-year institution. This literature has examined and attempted to quantify the *overall* effect of attending a community

college on educational outcomes, specifically on the completion of a Bachelor's degree. A second, more recent strand of literature has examined the differential outcomes *between* two-year institutions; this research includes a handful of national- and state-level studies investigating variation in educational outcomes (i.e., persistence, certificate/degree completion, and transfer) among two-year colleges and institutional characteristics associated with this variation.

Selection bias. Perhaps the largest methodological difficulty when investigating the potential differential effects of attending a community college on educational attainment outcomes (either between sectors or between individual institutions) is that students do not randomly sort into institutions. As discussed previously, academically prepared and economically and socially advantaged students are far more likely to attend four-year institutions compared to two-year colleges, and these traits all strongly predict degree completion. Additionally, many four-year institutions have a competitive entry process, thus further selecting for those students who are more likely to succeed. Researchers have made statistical adjustments to address the potential selection bias that exists when examining these questions, although these adjustments cannot replace experimental or quasi-experimental designs that allow the researcher to draw causal conclusions (Shadish, Cook, & Campbell, 2002).

Diversion vs democratization. Beginning with Clark's (1960) "cooling out" hypothesis, the effort to understand the effect of attending a community college (versus a four-year institution) has generated "one of the most robust streams of literature...on the question of whether community colleges provide a democratizing or diversionary influence on students" (Goldrick-Rab, 2010, pp. 441-442). To oversimplify a complex issue, proponents of community college attendance have historically argued that, overall, community colleges increase access to higher education for those who would not otherwise be able to attend college, due to financial,

academic, or logistic (i.e., place-bound) limitations, thus increasing the potential for degree attainment and therefore social mobility (Cohen, Brawer, & Kisker, 2014). These are also known as “democratization effects” (Rouse, 1995). However, critics of community colleges have historically argued that increased access to higher education through poorly funded institutions with low degree attainment and transfer rates potentially pulls economically or otherwise disadvantaged students away from attending four-year institutions, where they would be better able to earn a Bachelor’s degree. These critics have argued that the conflicting missions of community colleges (i.e., transfer education, vocational education, continuing education) function to “divert” these students toward vocational jobs, thus thwarting their aspirations to join professional or managerial careers and maintaining or accelerating socioeconomic stratification and stifling social mobility (Brint & Karabel, 1989; Beach 2011; Clark, 1960). These are the so-called diversion effects (Rouse, 1995).

Two decades of research have clearly established that students who aspire to earn a Bachelor’s degree and begin college at a two-year institution are less likely to complete a four-year degree than similar students who begin at a four-year institution (Alfonso, 2006; Doyle, 2009; Long & Kurlaender, 2009; Reynolds, 2012; Stephan, Rosenbaum, & Person, 2009). However, Rouse (1995) used an instrumental variables (IV) approach to conclude that community colleges were not altering the overall Bachelor’s degree attainment rate (p. 217) of U.S. students⁷. Specifically, her results indicated that students who *could have* attended a four-year institution but instead chose to attend a two-year community college completed fewer years of education (relative to similar students who chose to attend a four-year institution), but that this effect was offset by the increased access (and resulting degree attainment) of students attending

⁷ Rouse used a sample of 6,786 high school seniors in 1980 from the High School and Beyond Longitudinal Study.

community college who would *not* have been able to begin higher education in a four-year institution.

In contrast to Rouse's (1995) conclusion, all subsequent studies to date show a handicap in (Bachelor's) degree completion, after controlling for incoming student characteristics, for students who initially enroll in community college. Using an IV approach to analyze NELS88 data, Reynolds (2012) and Alfonso (2006) found community college students were less likely to complete a Bachelor's degree when compared with similar students who began at a four-year institution. Reynolds (2012) estimated a 24.5 percentage point disadvantage in Bachelor's degree completion for females and a 31.5 percentage point disadvantage for males for community college students over four-year students whose educational goal was to attain a Bachelor's degree. Alfonso (2006) found a similar 30 percentage point disadvantage for students. In addition to the findings by Reynolds (2012) and Alfonso (2006), Stephan, Rosenbaum, and Person (2009) used propensity score matching with NELS88 data and found a 23-percentage point handicap in Bachelor's degree completion for students who began at a two-year institution, versus students with similar degree aspirations who began at a four-year institution. Interestingly, the Stephan et al. (2009) findings were specific *only* to students earning a Bachelor's degree: for matched students, there was no advantage to initial enrollment in a four-year institution when the outcome was earning an associate's degree. Doyle (2009b) analyzed BPS data (1996 entry cohort) and concluded that attending a community college lowers the hazard rate of completing a Bachelor's degree. Monaghan and Attewell (2015) used more recent BPS (2004 cohort) data and found a 17-percentage point disadvantage for students who began at a community college versus similar students who initially enrolled in a non-selective four-year institution. Finally, Long and Kurlaender (2009) examined data from a single state (Ohio) and found a 14.5 percentage point

disadvantage in Bachelor's degree attainment for students who began higher education in a community college, versus similar students who initially enrolled in a non-selective public institution in the state.

In contrast, researchers who have found evidence in support of the democratization argument have tended to focus on non-degree measures of educational attainment, such as increased years of education (Leigh & Gill 2003), expanded educational aspirations (Alexander, Bozick, & Entwisle, 2008; Leigh & Gill 2004), or the evidence indicating that community colleges allow some “academically underprepared” students to “catch up” and successfully complete a four-year degree when they would not otherwise have been able to do so (Melguizo & Dowd, 2009; Roksa & Calcagno, 2010). For example, Alexander, Bozick, and Entwisle (2008) found that, in contrast to the “cooling out” hypothesis put forward by Clark (1960) and others (e.g., Brint and Karabel, 1989), attending a community college (versus not attending college at all) increased students’ educational goals and degree expectations, a process the authors termed “heating up”. And Leigh and Gill (2003) found that community college students who might otherwise be qualified to attend a four-year institution are less likely to be diverted from seeking a Bachelor's degree than previous estimates show⁸. Furthermore, they find that for students who are academically underprepared, and especially for students from economically disadvantaged backgrounds, attendance at a community college increases educational aspirations. A serious limitation of these studies is that increased aspirations, or even increased years in college (retention), do not necessarily translate into increased degree attainment. Indeed the major difference in this approach is that so called “democratization” research focuses mainly

⁸ This conclusion was based on conditioning a student's choice of institution on their desired “years of schooling.” That is, many students seem to have already decided on a desired level of schooling (e.g., Associates versus Bachelor's) *before* attending college.

on comparisons among students who would otherwise not have attended college at all were it not for community colleges, whereas the diversion literature focuses primarily on college bound, four-year degree seeking students.

2.4 Institutional Effects and Post-Secondary Student Success

As discussed previously, it has been fairly well established that students seeking a Bachelor's degree and who begin at a community college are disadvantaged relative to similar students who begin at four-year institutions. However, very little is currently known about how two-year institutions might *vary* amongst themselves in their ability to produce completers or transfers to baccalaureate institutions, about the institutional characteristics associated with this potential variation, or the underlying mechanisms that facilitate successful two-year student completion or transfer to a four-year institution (Bailey & Xu, 2012, Crisp & Mina, 2012; Stange, 2012).

Four-year Institutional Effects

Although student characteristics tend to account for the majority of differences in institutional variation in success measures,⁹ research has established that post-secondary institutions vary in their ability to retain students and produce completers (graduates), even after controlling for a wide range of incoming student characteristics (Bowen, Chingos, & McPherson, 2009). In general, after accounting for students' pre-college characteristics and other environmental factors, researchers have demonstrated that four-year private nonprofit institutions, institutions that spend more on students and instruction, and more selective institutions have a positive link with degree completion rates among four-year institutions (Astin

⁹ Student characteristics accounted for as much as 60% of the variance in completion according to one recent national study of community college students and institutions (Calcagno, Bailey, Jenkins, Kienzl, & Leinbach, 2008).

& Oseguera, 2012; Bailey & Xu, 2012; Bowen, et al., 2009; Pascarella & Terezini, 1991; Scott et al., 2006). In contrast, institutions with higher percentages of male students, public institutions, and institutions with larger percentages of non-traditional students have decreased student success rates (Astin & Oseguera, 2012; Ryan, 2004). Studies have also shown that four-year institutions with lower percentages of students who live on (or near) campus, so-called commuter campuses, have lower degree completion rates, even after controlling for student demographics, while those with higher percentages living on campus have better rates (Astin & Oseguera, 2005; 2012; Pascarella & Terenzini, 1991; Porter 2000). However, many institutional characteristics of four-year institutions show mixed results as to effects on student outcomes. Goenner and Snaith (2004) used IPEDS measures of graduation and found that campuses located in urban areas had decreased overall student completion rates, holding all else constant. Conversely, Hamrick, Schuh, and Shelley (2004) used IPEDS measures of graduation and found the opposite. Goenner and Snaith (2004) limited their sample to only Research 1 Universities, and used the 6 year (150%) graduation rate, while Hamrick, Schuh, and Shelley (2004) included all public bachelor's granting institutions and did not specify whether they used the 4 year or 6 year IPEDS graduation measure. Finally, some studies have found positive effects of larger campus enrollments on retention and completion (e.g., Scott, Bailey, Kienzl, 2006; Ryan, 2004; Titus, 2004), while others have found positive effects of smaller enrollments (e.g., Porter, 2000; Astin & Oseguera, 2005).

Institutional spending. Overall, relatively larger expenditures on student support, academic support, and/or instruction are predictive of increased four-year student retention and completion rates (Archibald & Feldman, 2008; Astin & Oseguera, 2012; Bailey & Xu, 2012; Hamrick, et al., 2004; Porter, 2000; Ryan, 2004). Bound, Lovenheim, and Turner (2010)

examined the relationship between declining degree completion rates and institutional expenditures over a twenty year period (roughly 1972-1992) and found that, for four-year institutions, more than 80% of the completion decrease could be associated with decreases in overall measures of per-student institutional spending. However, the literature shows mixed results regarding the effects of specific types of institutional spending (e.g., academic support, instruction, and student services). Greater institutional expenditures have been found to positively predict student learning outcomes (Pike, Smart, Kuh, & Hyack, 2006) and graduation rates (Zhang, 2009), and Titus (2006) found that six-year institutional completion rates were positively associated with increased overall institutional expenditures per FTE. Other measures of institutional spending, (e.g., on instruction, administration, and student services) and total state and grant appropriations were not significant, however these measures were calculated as a percent of total expenditures, and not on a per-FTE (or full-time student equivalent) basis. Importantly, lower SES students benefited more from higher overall per FTE expenditures than did higher SES students.

In general, researchers agree that increased spending at four-year institutions positively predicts increased student success, but there is little agreement as to which type of spending to measures or potentially increases this effect (Bailey & Xu, 2012; Pike, Huh, McCormick, Ethington, & Smart, 2011). Bailey & Xu (2012) argue that it is important for researchers to examine variables that are the most meaningful to student completion, either through theory or logic, and suggest a focus on expenditure variables that take into account average amounts per student (or FTE) spent on instruction, academic support, student services, and financial aid. For example, Webber and Ehrenberg (2010) found that higher per FTE student service expenditures at four-year institutions positively influenced six year graduation and retention rates, especially

for academically underprepared and economically disadvantaged students; Titus (2006) found that lower SES students¹⁰ benefited more, as measured by six year completion rates, from higher overall institutional per FTE expenditures in four-year institutions; and Ryan (2004) found that four-year instructional and academic support expenditures per FTE positively predicted six-year degree completion rates, but found no evidence showing that student service support expenditures per FTE positively predicted graduation. Similarly, Hamrick, et al., (2004) found that increased student service expenditures per student did not positively predict four-year degree completion at four-year public institutions, and Gansemer-Topf and Schuh (2006) found that first year persistence at four-year institutions was positively predicted by academic support expenditures per FTE, while spending on student services per FTE negatively predicted persistence (which may be due to insufficient controls for student needs in the study), and instructional expenditures per FTE had no relationship with persistence. In their review of the literature examining various types of institutional spending in relation to student persistence and success, Pike, Huh, McCormick, Ethington, and Smart (2011) suggest that inconsistent findings between institutional spending and student success outcomes (i.e., persistence and graduation) may occur because 1) the effect is weak when compared with student-level influences on the outcome, (i.e., most of the variation in student outcomes is due to student characteristics, rather than differences in institutions), 2) researchers have inconsistently defined institutional expenditures and operationalized institutional expenditures in a diverse range of variables, and 3) the effect of institutional spending has indirect (rather than direct) relationships with student outcomes (p. 82-83).

Two-Year Institutional Effects

¹⁰ Based on a standardized calculation of a student's family income and parental education (Titus, 2006).

The majority of research examining institutional characteristics associated with individual variation in student success measures has focused on four-year institutions (Astin & Oseguera, 2102; Bailey & Xu, 2012) and “relatively little attention has been devoted to understanding the unique issues in retaining community college students” (Crisp & Mina, 2012, pp. 147-8). Recent research on the characteristics of two-year institutions associated with variation in student success builds on prior studies of four-year institutions, yet two-year institutional characteristics in general appear to have a more attenuated relationship with student outcomes.

In a rather wide-ranging study, Bailey, Calcagno, Jenkins, Kienzl, and Leinbach (2005) examined two-year institutional characteristics associated with student completion rates. This study contained several models and samples, including an analysis of institutional completion rates based solely on IPEDS data, as well as an analysis that included NELS88 data for both all first time community college students and a subsample of degree seeking community college students. I will focus on the most relevant portion for my purposes that 1) includes data for individual student characteristics linked with their institution of record when they first enrolled, and 2) is restricted to only associate degree-seeking, first time community college students. In this section of their paper, the authors linked student-level completion data from NELS88 and with IPEDS institutional variables in order to simultaneously examine institutional characteristics and individual student characteristics on individual and institutional completion rates. Completion was defined as successful transfer to a four-year institution and/or completion of an Associate’s or Bachelor’s degree within eight years of initial enrollment. Results showed that, net of their student characteristics, institutions with larger enrollments and larger proportions of part-time (adjunct) faculty had lower completion rates, as did institutions with

greater percentages of part-time students and minority students. Institutions being located in urban environments and being certificate-oriented (rather than degree-oriented) institutions were also marginally negatively predictive of completion, after accounting for student differences.

In a related study, Bailey, Calcagno, Jenkins, Leinbach, and Kienzl (2006) examined the effects of institutional characteristics on aggregate levels of student success using aggregate IPEDS data on institutions' degree completion rates. Successful completion was defined as the completion of a certificate or degree within 150% of expected time to graduation.¹¹ Their results mirrored those of Bailey et al. (2005), indicating that increased student success was associated with institutions located in non-urban areas, as well as those that were smaller, those that focused on certificate production, those with relatively more female students, and those with lower percentages of minority and part-time students.

In a study focused on two-year college quality, Stange (2012) utilized a more restricted sample of students to examine several institutional characteristics, including instructional expenditures, average faculty salary, and percentage of full-time faculty, that are potentially representative of institutional quality and therefore (potentially) predictive of two-year student degree attainment. The study used similar national data sources to the other studies already cited (IPEDS for institutional characteristics linked with NELS88 student characteristics), although this author limited the sample to students who enrolled in a public two-year college within one year of high school graduation with intent to complete at least a four-year degree. Because Stange (2012) also found community college students largely sort into colleges based on location (i.e., locations nearest to a respective student's high school), he included variables that examined average income and educational attainment in households surrounding each two-year institution

¹¹ 150% of expected time to degree is three years for an associate's degree, and less for any given certificate.

included in the study. Results indicated no significant association between these two-year institutional characteristics and likelihood of student completion. Limitations include the age of the NELS data in the study, the limitation to students who indicated a Bachelor's degree was their final goal, and that the OLS analysis employed did not account for potential nesting of the data.

Although each of these studies examines the relationship between various institutional characteristics and community college student completion, they have several limitations, acknowledged by the authors, which I will briefly describe here and explore at length in a subsequent section. These studies don't adequately control for the nesting effect of students in individual institutions, except that the Bailey et al., (2005) study simultaneously examines both student and institutional characteristics. The NELS88 data used in these studies contained only traditional aged students, thus missing many of the older students disproportionately found in community colleges, and the data is now more than two decades old. The Bailey et al. (2006) study represents only an institutional level examination of institutional completion rates, without any individual student data, as IPEDS data did not allow the authors to account for individual student characteristics (they are only included in institutional aggregates). Furthermore, IPEDS data did not allow the authors to disaggregate completion data between certificate and degree completers, which is important as most community colleges with the highest (unadjusted) completion rates tend to be those who have disproportionately higher percentages of certificate students (Bailey, 2012b). Additionally, as will be explored in more detail shortly, IPEDS data do not account for students who successfully transfer to a four-year institution prior to earning a credential, represent a very small percentage of students actually enrolled in community colleges (i.e., less than 35% of all students), and lack many student predictor measures of completion,

including socioeconomic status, part-time attendance, academic preparation, and student age. Finally, it should be noted that both Bailey et al. studies included state-level dummy variables that indicated that the state in which a college is located is a significant (unique) predictor of student completion rates.

Calcagno, Bailey, Jenkins, Kienzl, and Leinbach (2008) employed multilevel modeling in which both student-level data (from NELS88) and institution-level data (from IPEDS) were modeled together to jointly predict student success at two-year institutions. This study modeled two populations: 1) all students who entered higher education (at any point in the study) via a two-year institution, and 2) a more restricted subset of degree-seeking students who indicated their goal was (at least) the completion of an associate's degree (in any area – workforce or transfer). Completion was measured via a binary variable that included earning any certificate or degree (Associate's or Bachelor's) and/or transfer to a four-year institution within eight years of enrolling at the two-year institution. Similar to earlier studies (Bailey et al., 2005; 2006), results showed that larger institutions and institutions with higher percentages of minority students were predictive of decreased likelihood of degree completion. In addition, increased institutional spending on academic support (as defined by \$1000s per full time student enrollment, or FTE) was associated with a *decrease* in completion likelihood. Finally, a higher percentage of part-time faculty was weakly predictive of decreased completion likelihood, although this finding was only marginally significant ($p < .10$). Overall, results showed that approximately 13% of the variation in student completion likelihood could be attributed to institutional characteristics.

Finally, two recent state-level studies examined (two-year) institutional differential ability to produce completers after controlling for student-level characteristics in two large states with extensive and well-known community college systems. Clotfelter et al. (2013) examined

differential completion rates in the North Carolina community college system, and Kurlaender, Carrell, and Jackson (2016) examined differential institutional completion rates in California's two-year higher education system (the nation's largest) and both found that some institutions were better at producing completion than others, even after controlling for a wide range of student characteristics. However, both studies were only able to statistically differentiate between the most and least effective institutions.

Both studies took advantage of rich student unit record data and employed multilevel modeling to control for student-level characteristics that contribute to institutional completion rates. Furthermore, both studies utilized residuals from the models to calculate "input-adjusted" (Bailey & Xu, 2012) completion rates. In other words they utilized the difference between model-predicted (based on an institution's student characteristics) and actual completion rates to identify better and worse performing institutions. However, neither model included fixed institutional characteristics in their models predicting adjusted completion. In addition to controlling for the usual range of student background characteristics, Kurlaender, Carrel, and Jackson (2016) utilized a measure of peer effects, what they describe as "college-level means of individual student characteristics," to control for unobservable selection effects (Altonji & Mansfield, 2014). The authors examined four cohorts (beginning in 2005-2009) of first time, traditional age (17-19) community college students using student unit record data from California high school and public two-year college records. The study had four outcome variables for "success": transfer units completed during the first year of attendance, persistence into second year of attendance, transfer to a four-year institution, and certificate/degree completion. By controlling for incoming student characteristics and institutional covariates meant to account for selection, 39% to 71% of the variance in outcome measures was

explained.¹² However, significant differences in adjusted student completion measures remained, an indicator of what the authors called institutional quality (which might be better conceived of as institutional effectiveness). Lower-bound model estimates indicated that going from the 10th to the 90th percentile in campus quality (effectiveness) was associated with a 37% increase in the number of transfer units completed, a 21% increase in the probability of persisting to the second year, a 42% increase in the probability of transferring to a four-year institution, and a 27% gain in the probability of certificate/degree completion.

Although the Kurlaender, Carrel, and Jackson (2016) study did not include an analysis of institutional characteristics themselves, Clotfelter et al. (2013) did regress a number of completion (adjusted and unadjusted) rates on a range of institutional characteristics. The study analyzed a single cohort of recent high school graduates who enrolled into one of North Carolina's community colleges within a year of graduation. The sample was further restricted to students enrolled in degree or college-level diploma (i.e., certificate) programs. The study utilized two outcome measures of completion within four years of initial enrollment: "applied success" (p. 812) was the outcome variable for vocation/technical students and was measured as the completion of either a college-level diploma (certificate) or workforce degree within four years of initial enrollment; and "transfer success" (p. 812) was the outcome variable for transfer intent students and was measured by the completion of a transfer degree or completion of 10 transferable courses (equivalent of 30 semester credits) also within four years of initial enrollment. Institutional completion rates (for both outcome variables), controlling for student-level covariates, were significantly associated with only two institutional characteristics, namely:

¹² 39% of the variance in transfer units, 36% of the variance in persistence to 2nd year, 71% of the variance in successful transfer, and 64% of the variance in certificate/degree completion was explained by controlling for student-level characteristics.

1) the presence of a UNC campus in the same county as the institution was associated with significantly lowered transfer (but not applied) outcomes, and 2) the number of trainees served by customized (but unspecified) training projects per FTE was associated with lowered applied (but not transfer) completion outcomes. The study found no statistical association between adjusted completion measures (applied or transfer) and institutional size,¹³ institutional expenditures,¹⁴ or institutional focus.¹⁵

Institutional spending. In contrast to research on four-year institutions, research to date on the effects of institutional spending at two-year institutions has found little relationship between expenditures and two-year student outcomes. As mentioned earlier, Bound, Lovenheim, and Turner (2010) examined the relationship between declining degree completion rates and institutional expenditures over a twenty year period (roughly 1972-1992) and found that decreases in expenditures per-student explained less than 10% of the decline in degree completion for two-year institutions, whereas at four-year institutions the declines in expenditures explained more than 80% of the declines in outcomes. Stange (2010) examined the effect of instructional expenditures per student on the likelihood of bachelor's degree attainment for students beginning at both two- and four-year institutions (separately). Although Stange examined adjusted faculty salary, percentage of full-time faculty, and tuition levels in addition to per student instructional expenditures, the overall likelihood of earning a bachelor's degree for students beginning higher education in two-year institutions was not associated with any measure of institutional spending.¹⁶ In contrast, Stange found that institutional expenditures, as measured

¹³ Measured as the natural log of total FTE.

¹⁴ Degree/diploma granting program expenditures per FTE.

¹⁵ Measured by the percentage of students (FTE) enrolled in degree granting (transfer or vocational) program at the institution.

¹⁶ Stange found small and marginally significant evidence to suggest that levels of spending had differential effects: male and Asian students appeared to benefit from increased spending while female, white, black and Latino students did not.

by per-student instructional expenditures, were strongly associated with increased likelihood of earning a bachelor's degree for students who initially enrolled in non-selective four-year institutions. Bailey et al. (2006), however, found a very small and positive relationship between overall instructional spending and two-year college graduation rates, although an earlier study that included controls for individual student characteristics (Bailey et al., 2005) found no such association. Calcagno et al. (2008) found a small *negative* relationship between academic support expenditures per FTE and completion rates for degree seeking community college students, which is similar to some four-year sector findings showing increased student support services spending (Gansemmer-Topf & Schuh, 2006¹⁷) was associated with decreased retention. This finding could be the result of increased spending on needier students, who might still have a lower (predicted) outcomes than more prepared students. Finally, Clotfelter et al. (2013) failed to detect an effect of overall institutional expenditures per FTE on student retention or completion outcomes in a recent analysis of the North Carolina community college system.

Community colleges spend far less per student than do their four-year peers on direct instructional costs as well as on other related education costs (Desrochers & Hurlburt, 2016), and lower expenditures, coupled with the greater disadvantages of the typical community college student population, could well mean that spending at current levels are inadequate to produce a detectable effect. Moreover, in states such as Washington where the legislature tightly controls tuition and the SBCTC allocates funding on a formula, there is probably less variation in expenditures than at four-year institutions. For example Stange (2012) found that there was considerably less variation in two-year colleges' per-student expenditures than in expenditures at four-year institutions (pp. 86-87). Moreover, current measures of institutional spending (and

¹⁷ Although Gansemmer-Topf and Schuh (2006) found that *academic support* expenditures per FTE positively predicted first year persistence at four-year institutions.

other institutional characteristics) are potentially too broad or imprecise (Calcagno et al., 2008) and/or inconsistent to show effects. For example, I have observed several two-year institutions in Washington coding the same position (e.g., Instructional Dean) into several different categories (e.g., instructional support, administrative services, and academic support). Finally, overall levels of spending in two-year colleges are potentially simply too low to detect an effect (also known as floor effects) (Goldrick-Rab, 2010).

2.5 Limitations of Prior Research on Two-Year Institutions

Lack of Precision in Nationally Representative Datasets

Previous national studies examining institutional effects on measures of community college student success link student-level characteristics and outcomes, usually from a nationally representative longitudinal dataset such as the NELS88 (that are then either aggregated to the institution level or not), with institution-level predictors and outcomes from a dataset such as IPEDS, in an effort to test cross-level effects (e.g., Calcagno et al., 2008; Stange, 2012). While the NELS88 data used in the majority of the previously described studies provides a rich set of student-level measures to control for student-level characteristics, it has several limitations. Most importantly, the data are old: students in the study graduated from high school more than twenty years ago and many changes in community college systems and related state and institutional policies have taken place since these students first entered college, most importantly in response to the current policy focus on completion. Moreover, as was discussed in the introduction, a post-secondary credential has never been more important in securing a living-wage job. Further, the NELS88 is focused on traditional-age, college-bound students (Adelman, 2006; Bailey et al., 2005) which excludes a significant percentage of the community college student population

whose average age tends to be substantially older than in four-year institutions (Horn & Skomsvold, 2011; McIntosh & Rouse, 2009).

More recent studies (e.g., LaSota, 2013) have sought to overcome the age limitation of the NELS88 data by employing newer data such as the Beginning Postsecondary Students Longitudinal Study (BPS) 2003-09, which represents the most recent nationally representative weighted sample, covering students enrolling in post-secondary education beginning in 2003. The cohort was followed for six years (i.e., 300% of expected time to graduate if full-time for AA degrees, 150% for Bachelor's degrees), and included both part- and full-time students at both two- and four-year institutions. Similar to the NELS88, the BPS includes a rich set of student-level variables, including race, gender, age, attendance status, academic preparation, socio-economic status, and relationship status. However, studies like LaSota's (2013) investigating institutional effects on student transfer rates using the BPS dataset have not found much in the way of significant institution-level effects, which is consistent with Stange's (2012) findings. On the one hand, perhaps the lack of connection between two-year institutional characteristics and two-year student outcomes is due to the fact that national datasets such as NELS and BPS do not survey large enough student samples to accurately investigate completion rates *at the institution level* (Bailey et al., 2005; Bailey & Xu, 2012; Calcagno et al., 2008). On the other hand, perhaps key two-year institution-level characteristics that are connected with two-year college student success have yet to be identified, measured, or tested at the student or institution levels. In addition, national datasets do not have the capacity to take an in-depth look at variation among two-year colleges within a given state.

Problems with IPEDS Measurement of Student Completion

Two-year community college graduation rates, which have traditionally been used as a measure of student “completion” for two-year institutions, are a deceptively complex when compared to four-year institution rates, and the lure to use them is great for policy makers and politicians wishing to compare or rank two-year institutions in terms of efficacy and/or quality (Kreighbaum, 2017). Graduation rates are specific to institutions, and are a measure of the number of students in a given entry cohort who complete a degree within a set amount of time at the institution in which they originally enrolled (Cook & Pullaro, 2010; Hauptman, 2012). Although graduation rates may be an excellent proxy for “completion” for four-year college students, they are a poor measure of “completion” for community college students. Degree seeking undergraduates enrolled in four-year institutions are, with rare exceptions, seeking to complete a Bachelor’s degree, and thus the graduation rate of the institution may be used as a fair measure of student completion for the institution. Comparatively, community college students enroll for a wide range of reasons, only some of which are to earn a degree. Furthermore, community colleges offer a much wider range of degree programs than do four-year institutions. Degree seeking community college students can pursue two-year transfer degrees, two-year workforce degrees (traditionally designed as terminal degrees), or shorter length certificates of less than two years duration. In many states community college students can transfer to a four-year institution *before* earning an Associate’s degree, and several (traditionally terminal) vocational degrees (such as nursing or engineering technology) currently are “transferrable” to specific four-year degrees in the same field, allowing for completion of a two-year vocational degree as well as the potential to transfer to a four-year degree program¹⁸

¹⁸ <http://www.wsac.wa.gov/sites/default/files/2016.06.15.NursingDTAMRP.pdf>.

The Student Right to Know and Campus Security Act of 1990 (SRK), is a federal mandate that requires all post-secondary institutions to report graduation rates, and was originally intended to track post-secondary students on athletic scholarships to ensure that their graduation rates were not below those of their peers, and is currently the only federally mandated reporting of post-secondary graduation rates in the United States (Cook & Pullaro, 2010). Under the SRK Act, data from the Graduation Rate Survey (GRS) have been collected annually by the U.S. Department of Education’s National Center for Education Statistics, and are then reported in the IPEDS; data includes colleges’ student demographics, financial aid, enrollments, spending/finances, tuition rates, and other institutional data (Cook & Pullaro, 2010). Because the GRS was originally intended to compare students on athletic scholarships with those who are not, the methodology for calculating an institution’s “graduation rate” favors traditional (full-time) college students, especially those attending four-year institutions. Student cohorts tracked in IPEDS include first-time, full-time, degree-seeking students enrolled in fall (or summer) term; an institution’s graduation rate is then calculated at 100%, 150%, and (recently) 200% of the time normatively expected to complete a degree. For two-year colleges, the graduation rate is the percentage of students who enrolled as full-time and intending to pursue an Associate’s degree or certificate¹⁹ who completed within two, three, or four years, respectively. For two-year or four-year college students pursuing a Bachelor’s degree, this translates to four, six, or eight years to complete, respectively. Any community college student who transfers to a different institution before completing their two-year degree (or equivalent) is counted as a “non-completer” (as are

¹⁹ Although the GRS does require institutions to report the number of students who did not complete a degree or certificate but did transfer, the data collected are considered unreliable for a variety of reasons, most importantly because institutions have no capacity to track these transfers, and the stated way to measure them in the absence of actual tracking is to count students who have completed the equivalent of two years of transfer coursework (Bailey, 2011).

students who initially enroll in a four-year institution and transfer before completing a Bachelor's degree), which is especially problematic for understanding community college student completion, as I will discuss subsequently.

Although IPEDS graduation rates are the only nationally standardized rates with which to compare institutions' performance against each other, there are serious limitations to using IPEDS data when examining community college completion rates: IPEDS graduation rates exclude part-time students and students who enroll any time after fall quarter during an academic year, both of which are major populations at community colleges²⁰ (e.g., Horn & Skomsvold, 2012; McIntosh & Rouse 2009). Moreover, until fairly recently,²¹ IPEDS data on completion limited time to degree to three years for an Associate's degree and six years for a Bachelor's, which also potentially excludes a major percentage of community college completers (Medwick, 2009; Radford et al., 2010). Last but not least, IPEDS has never required two-year institutions to differentiate their "completion" counts between those completing a two-year degree and those completing a certificate/diploma involving fewer credits and less time than a degree. In sum, although institutions are asked to track completions for the standard expected time to *degree* completion, there is evidence that two-year college institutions simply group all sub-Associate's *certificates* into the two-year Associate's degree category and use the total across both categories to report their rate for expected time to completion (Bailey, 2012). Not surprisingly, completion of a shorter and potentially less rigorous certificate as a stand-in for a "degree" is easier to achieve than completion of a two-year degree. Thus, two-year schools that focus on producing

²⁰ For critiques see Bailey et al., 2006; Bailey & Xu, 2012; Cook & Pullaro, 2010; Hauptman, 2012; Medwick, 2009.

²¹ In 2008, The Higher Education Opportunity Act (HEOA) required IPEDS to begin tracking completions up to 200% of expected time, which would extend students seeking an associate's degree up to 4 years for normative completion time (Bailey, 2012b).

certificate completions tend to have higher “completion” rates than those focusing on degree completions (Bailey, 2011; 2012).

To compound matters, degree-seeking students who transfer out of a two-year institution into a four-year school before earning their Associate’s degree are counted as non-completers in the two-year institutions’ IPEDS data report, despite the fact that large numbers of community college students transfer one or more times between two- and four-year institutions (Goldrick-Rab, 2006). Similarly, community college students often transfer to a four-year institution *before* successfully completing a degree (Bailey, 2012b; Medwick, 2009) and this can be affected by state and system-level policies beyond the control of institutions. In sum, all of these inconsistencies in IPEDS data potentially exclude up to 80% of any given community college’s enrollment – and researchers have speculated that IPEDS institutional cohort data only represents approximately one-third of even the two-year college degree-seeking students (Cook & Pullaro, 2010; Bailey, Crosta, & Jenkins, 2006; Klor de Alva, Schneider, & Klagge, 2010; Medwick, 2009).

Finally, one more caveat regarding IPEDS data: student data at the institution level can only be disaggregated by gender or race categories; the data reported does not provide any sub-counts by student age, prior academic preparation, family status (e.g., married, children), socio-economic status, or degree intent (e.g., transfer-oriented, Associate’s degree-oriented, workforce degree-oriented, or certificate-oriented) (Cook & Pullaro, 2010).

State-Level Effects within National Datasets

Analyzing community college institutional effects using national datasets is problematic for community colleges for several reasons. National datasets may be problematic when examining two-year institutional effects without taking into account the state where the

institution is located, due to substantial differences in how states utilize their community colleges (Bailey, 2012; Long & Kurlaender, 2009). Also, research on two-year institutional characteristics associated with student completion has consistently found systematic differences in student outcomes based on the (state) location of the institution (Bailey et al., 2005; Bailey et al., 2006; Bailey & Xu, 2012; Stange, 2012), as have studies examining national community college student completion rates (Jenkins & Fink, 2016; Melguizo & Dowd, 2009).

There are significant differences in how states utilize community colleges (Beach, 2011; Brower et al., 2014; Kurlaender & Long, 2009). For example, Massachusetts uses community colleges mainly to educate older students and those in need of workforce retraining, while in California community colleges are the main point of access to higher education. In Florida all remediation takes place in community colleges (Long & Kurlaender, 2009) and, in states such as Tennessee and Wisconsin, technical colleges and community colleges have completely separate missions (i.e., community colleges only focus on transfer students and technical colleges only focus on workforce certificates and degrees²²) whereas in states like Washington community and technical colleges both offer a full range of two-year workforce and transfer degrees, as well as certificates. Researchers have therefore highlighted the need for state-level studies utilizing student record data (i.e., Bailey et al., 2005; Bailey et al., 2006; Bailey & Xu, 2012; Calcagno et al., 2008; Crisp & Mina, 2012).

Controlling for Student Characteristics

Controlling for incoming student characteristics and using the residuals from a regression score (of institutional completion measures on their student characteristics) can provide a “value-added” model between actual and predicted graduation rates. This approach is increasingly

²² In Tennessee, technical colleges only offer workforce oriented certificates, and not two-year degrees.

becoming standard in higher education research and policy interested in examining institutional efficacy and quality (Bailey, 2012; Bailey & Xu, 2012; Calcagno et al., 2008; Clotfelter et al., 2013; Cunha & Miller, 2009; Horn & Lee, 2016; Kelchen & Harris, 2011; Kurlaender, Carrell, & Jackson, 2016; Scott-Clayton & Weiss, 2011). This same methodology, with appropriate institutional variables added, can also help the researcher interested in understanding how best to alter institutional practices to positively influence student retention and completion rates. Horn and Lee (2016) used hierarchical longitudinal modeling of national data from four-year institutions and found that measures of institutional effectiveness had high levels of reliability and validity. In the study, Horn and Lee (2016) adapted the conceptual framework of Berger and Milem's (2000) model and identified four categories of relatively *fixed* institutional variables (structural, demographic, financial, and contextual) in addition to student-level variables. After accounting for the effects of both student-level and *fixed* institutional characteristics, Horn and Lee (2016) attributed the remaining institutional variation in student success measures to "amenable practices" (p. 472), or what Bailey and Xu (2012) call malleable characteristics (p. 12). Horn and Lee speculated that these differences are achieved via an indirect pathway, through individual institutional practices that positively influence "student engagement," which in turn can positively affect completion measures. Similar to Attewell et al. (2011), Horn and Lee included all theoretical constructs of student engagement in their model (e.g., Astin, 1993; Kuh, Cruce, Shoup, Kinzie, 2008; Tinto, 1993).

Similarly Bailey & Xu (2012) suggest that the best method to examine unique institutional contributions to student outcomes is through a residual that can control for all student and desired institutional characteristics. However, which institutional characteristics to leave in the model depend on the goals of the research (Bailey, 2012a). Generally, when the

researcher is interested in identifying or examining institutional practices that are associated with *individual* institutional variation, it is preferable to leave only “fixed” institutional characteristics in the model such as measures of size, location, and spending, and rely on potential variation in the residuals to identify variations in each individual institution’s practices that may be associated with increased measures of success (Bailey, 2012a). Of course, the decision to model an institutional characteristic as fixed or malleable is open to interpretation. As Bailey (2012a) correctly notes, many apparently fixed institutional characteristics, such as size, program mix, per student spending, and even location, can be changed over time. However, for community colleges in a state system such as Washington’s, factors such as tuition level, location, and enrollment are all outside of an individual institution’s control. Even spending patterns, it can be argued, are constrained if colleges are all operating on a slim margin of financial stability.

2.6 Summary of Need for Present Study

Researchers agree that a greater understanding of how two-year colleges can more effectively contribute to a student’s likelihood of completion, and a better understanding of which institutional factors are associated with student completion, continues to be an important area of research (Bailey, 2012; Bailey & Xu, 2012; Crisp & Mina, 2012, Goldrick-Rab, 2010; Jenkins & Fink, 2016; Smith & Stange, 2015). The bulk of prior research has focused mainly on four-year institutions, with clear limitations as to how transferrable those findings are when applied to two-year institutions. Prior research on two-year institutional characteristics has mostly utilized national datasets that are out of date and provide too few subjects per institution to robustly control for student characteristics.

In contrast, there is a small, growing body of research that utilizes more current student record data at the state level to examine community college effects on completion within a state

context (e.g., Clotfelter et al., 2013; Kurlaender, Carrell, & Jackson, 2016). For example, Wright et al. (2012) analyzed data from Tennessee's public two- and four-year colleges and found significant differences in institutional completion rates after controlling for incoming student characteristics, although no institutional variables were included in the model. Scott-Clayton and Weiss (2011) analyzed the effect of technical college²³ attendance on completion rates in the 34 community and technical colleges that make up the Washington Community and Technical College (CTC) system and found significant institutional variation within the system, even after accounting for individual characteristics.

The current study would add to the growing body of evidence examining 1) how two-year colleges vary in their ability to produce degree completers and successful transfers; 2) examine two-year institutional characteristics that are associated with completion; 3) add to a growing body of studies examining two-year institutions at the state, rather than national level, using a rich set of current student level unit record data; 4) examine potential underlying mechanisms whereby institutions contribute to likelihood of student completion (i.e., Bailey 2012; Jenkins & Fink, 2016; Smith & Stange, 2015; Stange, 2012); and 5) discuss implications from these findings for policy makers and practitioners at the state and national levels.

²³ In Washington State, technical colleges focus mainly on workforce degree seeking students. See section 4.1 for a more detailed description.

Chapter 3: Research Design and Methodology

3.1 Research Questions

The present study examines the public institutions comprising Washington State's community and technical college system, which are governed by the State Board of Community and Technical Colleges (SBCTC). The study specifically investigates if and how institution-level factors play a role in student completion outcomes, after student-level variables are taken into account. Three focal questions guided the research, as follows.

- *Is there significant variation among two-year institutions in student completion rates, as defined by the completion of a certificate, two-year degree, or successful transfer to a four-year institution, across Washington State's community and technical colleges, especially after adjusting for student-level characteristics (thereby reducing potential selection effects)?*
 - a. *At the aggregate institution level, what are the recent student completion rate means and variances, and which institution-level characteristics correlate with aggregate completion rates?*
 - b. *How much of the overall variation in student-level outcomes is attributable to institution-level differences?*
 - c. *How much of the overall variation in student-level outcomes is attributable to fixed student-level characteristics, and does the addition of these characteristics explain the differences, if any, among institutions in student completion (i.e., is the between-institution variation diminished)?*

- ***What fixed institutional characteristics are predictive of student completion rates***, and do any of these institution-level characteristics moderate student-level characteristic effects on completion?
 - a. How much of the variation in student completion is explained by institution-level characteristics, after controlling for student-level characteristics? Which institution-level characteristics, if any, are directly or uniquely predictive of student completion?
 - b. Are there any two-way, cross-level interactions among student- and institution-level characteristics on student completion? In other words, do any student-level effects on completion depend in part or whole on institution-level characteristics?
 - c. After controlling for both institution- and student-level effects, is there still significant (unexplained) variation among institutions in student completion? In other words, is there evidence that measurements are missing on key variables that might explain differences in student outcomes among two-year community colleges?

- ***What institutional cultures, policies, and practices are associated with increased completion rates*** in relatively high-performing two-year institutions, defined as those institutions with higher-than-expected completion rates given their student characteristics?
 - a. What specific institutional cultures, policies, or practices, such as completion initiatives or aspects of institutional cultures, are associated with any selected case's success rate? In other words, what is the evidence for key variables linked with student outcomes that have yet to be quantitatively measured?

- b. How do these specific institutional cultures, policies, or practices vary or align across cases of high-performing institutions?

By identifying both relatively fixed institutional characteristics, as well as policies and practices associated with better than expected student completion, the results of this study can be used to examine implications for improved policy and practices, both at the state and system levels, as well as at the individual institution level, in order for two-year institutions in Washington to better contribute to student completion likelihood.

3.2 The Case of Washington State's Community Colleges

As previously discussed in Chapter 2, researchers have discussed the benefits of utilizing state-level data systems to better understand community college institutional effects on student outcomes (e.g., Bailey, 2012; Calcagno, Bailey, Jenkins, Kniezl, & Leinbach, 2008; Crisp & Mina, 2012). Although research from isolated state-specific analyses are limited in their external validity (to other states nationwide), Bailey (2012) argues that a series of state-specific studies may be preferable to large national studies given the wide variation in how states utilize their two-year college systems (p. 12), as discussed previously in chapter two. Two recent state-level studies examining two-year institutional effects in North Carolina and California have shown significant variation among institutions even after controlling for student-level characteristics (i.e., potential selection effects) (Clotfelter, Ladd, Muschkin, & Vigdor, 2013; Kurlaender, Carrell, & Jackson, 2016). However, one of these studies did not test effects of any fixed institutional characteristics on student outcomes (Kurlaender, Carrell, & Jackson, 2016), and the other detected little in the way of fixed institution-level effects on student outcomes for the variables available (Clotfelter et al., 2013).

Washington State in particular presents an excellent case for a statewide analysis of two-year college effects on student completion outcomes. The state has a robust system of 34 community and technical colleges enrolling approximately 386,000 students annually. Twenty-nine institutions are considered “comprehensive” community colleges (i.e., they encompass all varieties of programs). There are also five technical colleges, for which the primary focus is workforce education even though they have also in recent years begun to offer transfer degrees, both academic and workforce oriented, as well as Bachelor’s degrees in several workforce areas. The distinction between “comprehensive” community colleges and technical colleges in Washington is thus evolving toward one solely of program mix and historical origins (Scott-Clayton & Weiss, 2011).

Washington is similar to California in using its community and technical college (CTC) system as a primary point of access to higher education: approximately 59% of Washington State’s public undergraduate population is enrolled in a public two-year college (SBCTC, 2016). Washington is also a nationally recognized leader in creating systemic transfer policies to four-year institutions (Jenkins & Fink, 2016) and for its excellent statewide data systems. Further, Washington’s student demographic characteristics largely mirror the national community college population, including percentage of minority²⁴ and low-income students, part-time and working students, and students with children (SBCTC, 2016).

Although Washington has comparatively the highest Bachelor’s completion rate for “transfer-in” students (among degree seeking community college students who successfully transfer to a four-year institution), its “transfer-out” rate (percentage of community college students who successfully transfer to a four-year institution) is one of the lowest in the country

²⁴ Washington has a relatively large percentage of Asian students, relative to the national community college population (AACC, 2016), something which I account for in my student-level covariates.

(Jenkins & Fink, 2016). Furthermore, students who begin college at a two-year institution in Washington *and* successfully transfer to a four-year institution are *at least* as likely to complete a Bachelor's degree as students who began college at a four-year institution (WSBCTC, 2013). Thus, a greater understanding of how two-year institutions can increase the rate of successful two-year degree completion and transfer is clearly a priority for the state, as it could potentially increase both the completion of meaningful workforce credentials and of Bachelor's degree completion and attainment rates.

Furthermore, although some states have successfully eliminated disparities between high- and low-SES students in both transfer-out and Bachelor's degree completion rates for students who began college at a two-year institution, Washington is among five states with the greatest gap between the two groups of students (Jenkins & Fink, 2016). Understanding how these institutions can better support lower-SES students to succeed in Washington's community and technical colleges would be of great benefit to the state. Finally, there is some evidence that two-year institutions in Washington may vary significantly in their ability to produce successful students. Scott-Clayton and Weiss (2011) analyzed a cohort of traditional age (< 26 years old) vocational intent students enrolled in all 34 community and technical colleges at that time, and found institutional program mix and focus (i.e., technical vs. community college) positively predicted certificate (although not degree) completion within three years of enrollment, even after accounting for individual student characteristics.

3.3 Conceptual Framework for Study

Student-centered frameworks. There are a variety of conceptual frameworks around college student persistence and completion (e.g., Crisp & Mina, 2012; Morrison & Silverman, 2012). Over the past four decades, researchers have identified a wide range of factors influencing

college student success (see for example: Braxton 2000; Braxton & Lee, 2005; Goldrick-Rab & Roksa, 2008; Goldrick-Rab, Carter, & Wagner, 2007; Hoxby, 2004; Morrison & Silverman, 2012; Schuetz, 2005), and have created a variety of sociological, psychological, economic, interactionist, and organizational models to address the problems of low student retention (i.e., drop out) and poor academic attainment (Braxton & Lee, 2005; Schuetz, 2005).

Most theoretical models of college student success have been focused on the *individual* (student) level, rather than the *institutional* level (Attewell, Heil, Reisel, 2011; Bailey & Alfonso, 2005; Clotfelter et al., 2013; Crisp and Mina, 2012; Goldrick-Rab, Carter, & Wagner, 2007; Schuetz 2005; Titus, 2004), and have been overwhelmingly generated from research on traditionally aged (18-24), residential students in four-year institutions (Bailey & Alfonso, 2005; Crisp & Mina 2012; Goldrick-Rab et al., 2007; Schuetz 2005). **Tinto's student integration model** (1993) is perhaps the most widely cited and adopted theoretical model for understanding college student retention and completion, and has exerted the most influence on researchers attempting to understand community college persistence and completion patterns (Attewell, et al., 2011; Bailey & Alfonso 2005; Braxton and Lee 2005; Del-Amin 2011; Goldrick-Rab et al., 2007; Hagedorn 2012; Schuetz, 2005; Wild & Ebbers, 2002). Tinto's model focuses on *social integration*, or how connected students are to peers and the institution, and *academic integration*, which is whether there is a match between the skills, abilities, and interests of the student and what is expected by the institution. The model is meant to highlight and explain why students leave colleges, thus allowing researchers and institutions to develop strategies and interventions to reduce attrition and increase completion rates.

Bean's student attrition model (1990) is employed as a model for explaining student outcomes (e.g., Hagedorn, 2012; Morrison & Silverman, 2012; Titus, 2004). Specifically, Bean

modeled student attrition in a similar manner as organizational theorists who study why employees leave work organizations. He conceptualized several “environmental pull variables,” such as employment and/or family obligations, the opportunity to transfer to a different institution, or a lack of adequate financial resources, as the drivers that influence a student’s decision to leave (or not) an institution. Bean also incorporated Tinto’s concepts of academic and social integration into his model.

In addition to the conceptual models used by Tinto and Bean, **Astin’s student normative context model** (1993b) focuses on how students’ peers influence their beliefs and attitudes, which, if the fit is right, can then lead to increased academic persistence and completion.

Applying extant frameworks to two-year institutions. Unfortunately, the three aforementioned frameworks are not necessarily applicable to students attending two-year institutions (Crisp & Mina, 2012; Deil-Amin, 2011). Many theorists (including Tinto) have pointed out that a focus on social integration has much lower utility in predicting and explaining non-traditional college students’ – which includes most community college students – attrition (Tinto 1993; Braxton, Hirschy, & McClendon, 2004; Braxton & Lee, 2005; Bailey & Alfonso, 2005; Attewell, Reisel, & Heli, 2011; Schuetz, 2005). Nonetheless, Tinto’s student integration model has been the most widely used conceptual framework to date for community college student outcomes compared to others (Astin & Oseguera, 2012; Attewell et al., 2011; Bailey & Alfonso, 2005; Goldrick-Rab et al., 2007; Schuetz, 2005). In their review of the literature, Attewell et al. (2011) specifically stated:

Our analyses of competing theories of noncompletion indicate that there is no single dominant factor that is associated with better chances of graduation. Some scholars have highlighted integration, others academic preparation in high school, and yet others the importance of paid work or of financial aid. Our research indicates that each of these factors plays an independent role and that none is completely or even largely mediated by

another. Our analyses of effect sizes, however, suggest that certain factors are more important in certain kinds of institutions (p. 552).

Incorporating institution-centered effects. Importantly, most prior research examining higher education student outcomes – attrition, persistence, and completion – have focused on *student-centered* analyses, evaluating student success measures from *any institution* over a fixed period of time post-enrollment (e.g., Dougherty & Kienzl, 2006). In contrast, studies such as those by Titus (2004; 2006) have focused more on *institution-centered* effects on student outcomes, and typically examine the percentage of first-time students who later succeed *at that same institution* (meaning those who graduated or stayed in their program at the school they originally enrolled in). For these institution-centered studies, a student-centered conceptual model must be carefully adapted (Bailey & Alfonso, 2005; Crisp & Mina, 2012; Goldrick-Rab et al., 2007; Schuetz 2005; Titus, 2004).

For example, in her review of the community college success research, Sara Goldrick-Rab (2010) examined studies focusing on relationships “between individuals and institutions, institutions and the policy settings, or some combination of the three” (page 441). She employed a multilevel conceptual model that conceptualized three broad factors that contribute to two-year student completion: 1) the policy context, or what Goldrick-Rab called the “*macro-level opportunity structure*,” 2) institutional effects, and 3) student characteristics, or what she termed “the social, economic, and academic attributes students bring to college” (ibid.). Similarly, in their review of non-completion theories for both two- and four-year institutions, Attewell et al. (2011) incorporated variables into the student integration framework, including financial aid and affordability variables (*external variables*); academic preparation at entry, demographics, hours worked during college, enrollment in remediation courses variables (*student characteristics*); and institution-level variables (*institutional characteristics*).

Present study's theoretical framework. The conceptual framework for this study, which I term the **integrated student-institutional effects model**, is largely based on Titus's work (2004; 2006), which merged earlier student-centered theories with Berger and Milem's (2000) **college impact model**. The college impact model hypothesizes that relatively fixed *institutional* characteristics, such as enrollment size, location (such as urban versus rural institutions), and per-student expenditures, influence aggregate student outcomes, and that individual *student* characteristics (e.g., socioeconomic status, age, gender, academic preparation, and ethnicity) also contribute to average student outcomes. In Titus's (2004; 2006) and subsequent researchers' (Horn & Lee, 2016) merging of the college impact model with previous student-centered models, not only are institutional and student characteristics thought to influence student outcomes, but they are largely thought to do so via institution-student interactions (also known as "organizational behaviors"), such as "engagement" (Kuh, et al., 2008), "integration" (Tinto, 1993), and "involvement" (Astin, 1993), or some combination of these behaviors.

While Titus applied this modified college impact model to four-year institutions, Calcagno and colleagues adapted it for research on two-year community colleges (Calcagno et al., 2008). More recently, Pike and colleagues proposed a nearly identical conceptual model that employs a similar "indirect" pathways between institution- and student-level effects and student-level outcomes (Pike, Kuh, McCormick, Ethington, & Smart, 2011). Although some form of "student engagement" is hypothesized in all of these models to facilitate effects of both student and institutional characteristics on aggregate institutional success outcomes, researchers interested in institutional effects often do not unpack this pathway in their research questions or methods (e.g., Calcagno et al., 2008; Horn & Lee, 2016). Similarly, I do not directly test this

mechanism or pathway in the current study. However, I account for it in my research design (see Multilevel Modeling in subsequent section); as Pike et al. (2011) note, “It is important to understand that student engagement, learning outcomes, and the relationships among student characteristics, engagement, and outcomes occur within an institutional context. That is, these relationships are nested within institutions” (p. 85).

The **integrated student-institutional effects model** I employ in this study, which is my iteration of the previously described models, including “indirect” pathways connecting institutional and student characteristics (via student engagement) to student outcomes, is illustrated in Figure 1.

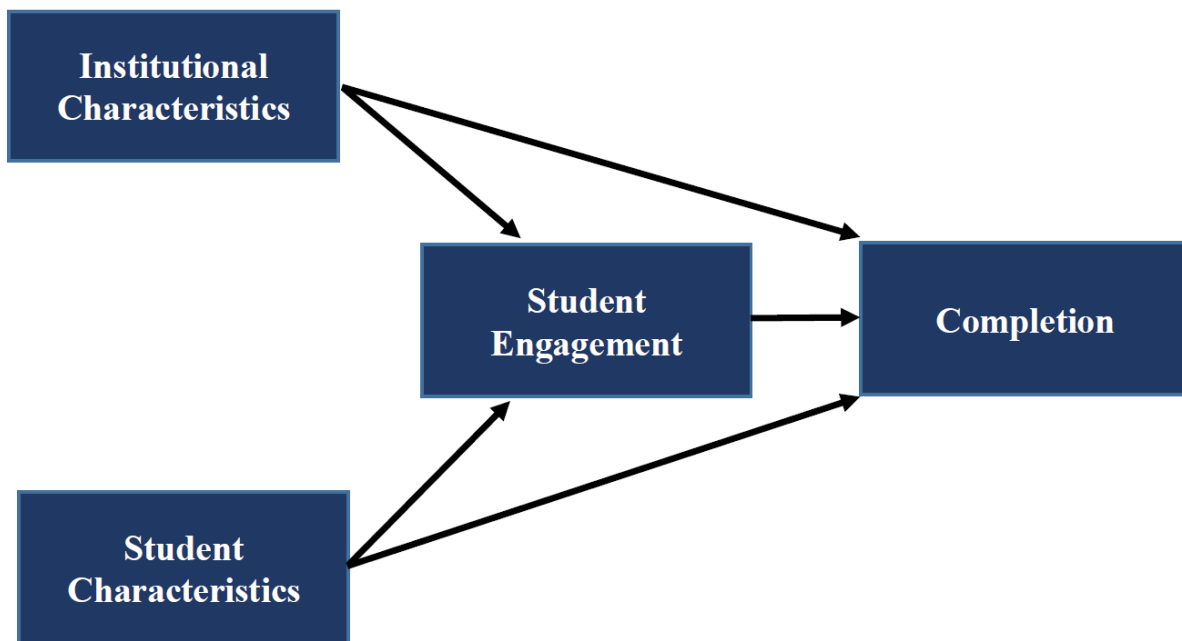


Figure 1. Integrated Student-Institutional Effects Conceptual Model

In the conceptual model above, institutional and student characteristics are assumed to be “fixed,” and both directly and indirectly influence student completion measures at the institutional level. Institutional and student characteristics may also influence institutional practices, or what can be conceived of as malleable institutional factors, which in turn interact

with student engagement to influence individual student persistence and completion measures at the institutional level. Although, as noted earlier, many “fixed” institutional characteristics are open to change under the right policy context, individual institutional practices hypothesized in this study, including specific support services, curricula, pedagogies, and/or organizational and motivational structures directly designed to influence student engagement and success measures within a given set of budgetary and system-wide policy constraints, are more likely to capture malleable differences in individual institutional practices that are associated with student completion, than are larger-scale measures such as spending, location, size and student faculty-ratio.

3.4 Mixed-Methods Research Design Overview

This study employs a mixed-methods explanatory sequential design (Creswell & Plano Clark, 2011) that capitalizes on the strengths of both qualitative and quantitative methods to address the research questions focused on Washington State’s two-year institutions’ effects on student completion. This method in particular has three phases (see Figure 2) that each inform the subsequent phase.

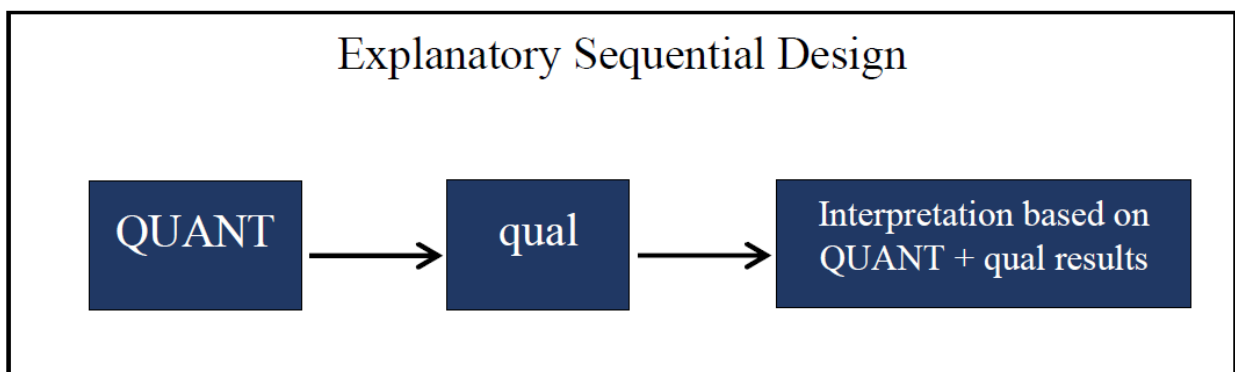


Figure 2. Mixed-Methods Explanatory Sequential Design

Mixed methods research designs are especially important in studies focusing on ways to improve student performance in the complex and nuanced setting of community colleges (Wang,

2017). They allow researchers to draw on the complementary strengths of both approaches (e.g., Tashakkor & Teddlie, 2003, p. 299) in order to minimize potential validity threats (Onwuegbuzie, Johnson, & Collins, 2011; Wolf, 2010). Overall, while quantitative studies may allow one to identify systematic effects (based on probabilistic reasoning and correlations), qualitative case studies can explore the “how” and “why” of particular phenomena, especially when the researcher is unable to experimentally manipulate the behavior or groupings of study participants to explain correlations (e.g., Ivankova, Creswell, & Stick, 2006).

The first (quantitative) portion of the present study represents the main focus of the study, in which correlation analyses, repeated measures analyses of variance, and multilevel regression models were used to test Research Questions 1 and 2. These questions specifically examined 1) whether significant variation exists in completion rates between Washington community and technical colleges, after controlling for student characteristics, and 2) what institutional characteristics were associated with this variation. The institution-level residual errors from the final (full) model of stage 1 of the study were then used to identify cases of institutions that outperformed model expectations (i.e., observed completion was much higher than predicted completion, top 2-3 institutions for each type of institution, defined as those focused on certifications/work force versus those focused on 2-year degree/transfer programs), as well as institutions with completion rates as expected by the model (i.e., observed completion rate near predicted value, residual error near zero).

These cases were then used as subjects for the second (qualitative) stage of the study, which provides further exploration of the main study focus, for examining Research Question 3, specifically exploring the internal policies, practices, and cultures of institutions identified as being relatively more effective at producing completers. For each case, structured interviews

with key personnel as well as document collection and review were conducted to identify and describe specific institutional programs, policies, and cultural norms/practices not captured in the quantitative measures of institutional characteristics which could be responsible for variation in student success across institutions (Bailey, 2012; Calcagno et al., 2008; Clotfelter et al., 2013; Horn & Lee, 2016). Finally, the third phase of the study integrates the results of the quantitative and qualitative analytic findings to provide a more complete, nuanced explanation of how institutions may be influencing two-year student completion.

3.5 Overview of Quantitative Methodology

Data Sources

The data for this study were drawn from extant data collected by the Washington State Board for Community and Technical Colleges (WSBCTC) as part of its Student Achievement Initiative.²⁵ The dataset includes de-identified individual student unit records, including demographic information, attendance status, course enrollments, financial aid status, as well as credits earned, certificate and degree completion (disaggregated by type), and transfer status (disaggregated by transfer into two- or four-year institutions) from all 34²⁶ public two-year institutions in the state. These data are stored in the WSBCTC Data Warehouse. In particular, I will be modeling data from two cohorts: one cohort of 31,534 first-time, degree seeking students who enrolled in any of the 34 Washington community or technical colleges during the 2010-2011 academic year, and one from a cohort of 27,191 first-time, degree seeking students who enrolled in the system during the 2011-2012 academic year. Any non-degree seeking students, international students, high school Running Start (concurrent enrollment) students, adult basic

²⁵ <https://www.sbctc.edu/about/agency/initiatives-projects/student-achievement-initiative.aspx>

²⁶ For the purposes of this study, the two colleges in the Pierce district were collapsed into a single institution, to reflect IPEDS reporting during the time period of the study. Thus $N = 33$.

education²⁷ students, and non-state-funded²⁸ students were excluded from analyses. All student data was de-identified by WSBCTC, and a unique identifier for each institution at which each student was initially enrolled was created to link students to their institutions.

Whereas student-level variables, including student-level characteristics (demographics) and student outcomes (completion of certificates, two-year degrees, and/or transfer to four-year institution), were drawn from the WSBCTC data (which are further detailed in below), institution-level variables were compiled from the publically available Integrated Postsecondary Education Data System (IPEDS) Data Center maintained by the National Center for Education Statistics.²⁹ As discussed previously in Chapter 2, IPEDS maintains the only federally mandated reporting of institutional characteristics in the United States (Cook & Pullaro, 2010).

Student Variables

Student predictors. Data from 58,725 students in this study were from two cohorts: one from 2010-11 entrants ($n = 31,534$) and one from 2011-12 entrants ($n = 27,191$). All students were first-time, degree seeking students, nested in the 33 community and technical colleges in the Washington community and technical college (CTC) system whose records over a three-year period beginning at enrollment were extracted for analysis. For the 2010-11 cohort, the smallest college had an average of 3,703 (total) students while the largest had an average of 32,704 students enrolled; in 2011-12, the smallest college averaged 3,709 students while the largest averaged 31,996 students enrolled. Mean college enrollment across both cohorts was 11,902 students and the median was approximately 10,500, with a fairly normal distribution across

²⁷ Degree seeking students who began in developmental education are included.

²⁸ This includes students taking classes offered “self-support”. These classes do not generate matching FTE funds from the state.

²⁹ <https://nces.ed.gov/ipeds/Home/UseTheData>

colleges. The dataset contained 10 demographic and academic characteristics variables for each student, including the student's degree intent based on their first term intent code,³⁰ the student's attendance status (i.e., full-time or part-time) during their first quarter/term of enrollment,³¹ gender, age, whether the student was an underrepresented minority (URM),³² a measure of academic preparation³³, a measure of socio-economic status (SES) based on need-based financial aid coded through PELL recipients,³⁴ self-reported prior education,³⁵ self-reported disability at time of initial enrollment, self-reported family status at time of enrollment, including whether or not the student had children and whether the student was a single parent.³⁶

In the multilevel models, student-level covariates were used to control for potential selection bias in terms of which types of students attend which colleges (i.e., to account for the variation in student outcomes due to individual student characteristics as distinct from institutional characteristics), as such covariates have been previously shown to account for significant variance in student outcomes (Calcagno, Bailey, Jenkins, Kienzl, & Leinbach, 2008; Bailey et al. 2006; Calcagno et al. 2008; Bound, et al., 2010; Clotfelter et al., 2013; Kurlaender, Carrell, & Jackson, 2016; Smith & Stange, 2015; Stange 2012). I specifically employed student-

³⁰ Student's degree intention at time of enrollment is collected via self-report into the SBCTC Data Warehouse. Choices are workforce certificate/degree or transfer.

³¹ Student's attendance status during first quarter of enrollment. Part-time is defined as enrolled in less than 12 credits.

³² URM students are defined here as African-American, Latino, Native American/Alaskan Native, Hawaiian Native/Pacific Islander, and students reporting being of mixed races including any of these ethnicities. The categories were created by this researcher from existing data where six categories of race/ethnicity were present. The WSBCTC does not report underrepresented minority students but instead reports "students of color." The system reports that approximately 40% of *all* CTC students in Washington are students of color, but does not report on URM students specifically.

³³ Because degree seeking CTC students in this study represent a wide range of ages, high school and/or college prep standardized test scores and/or high school GPA are not available for a large percentage of students. The academic preparation categorization was created by this researcher from a student's enrollment into a developmental education (below college level) Math or English course. Students were coded as either enrolled into both areas of developmental education, at least one area, or not at all (college-ready placement).

³⁴ Due to missing data, I was unable to use the self-reported family income and parental education data, and instead had to rely solely on need-based financial aid awarded through PELL grants.

³⁵ Students in this dataset were limited to first-time, degree seeking students. The WSBCTC collects data on whether a student has a high school diploma or GED at time of enrollment. A student who does not have a diploma or GED but who tests into college level or developmental level (equivalent of high school level) is allowed to enroll in these courses. In contrast, students who place below this level are entered into the basic skills program. These latter students are excluded from this dataset.

³⁶ The WSBCTC collects the following family status data: single parent with children or other dependents; member of a couple with children or other dependents; without children or other dependents.

level covariates highlighted in the theoretical models that have been previously empirically shown to affect completion and transfer likelihood, and adapted some of these covariates based on availability from WSBCTC's records. Importantly, because many community college students can be considered non-traditional college students (Klor de Alva, Schneider, & Klagge, 2010; Medwick, 2009), I included *age*, *attendance status*, and *family status* (see Table 1). The dataset also included whether or not the student earned a certificate, degree, or transferred to a four-year institution (described in more detail shortly) within four years after initial enrollment (200% of expected time to degree).

Table 1. *Student-Level Variables*

Variable	Theory/Hypothesis with Literature	Measure
Student Goals	Research has shown that a student's reasons for attending community college can be indicative of likelihood of completion and/or transfer (Bailey, Leinbach, & Jenkins, 2006; Bradburn & Hurst, 2001; Dougherty & Kienzl, 2006; LaSota, 2013). There is also research to indicate that student goals, especially community college student goals, are not static, and that institutions have a role in determining students' final goals (Alexander, Bozick, & Entwistle, 2008; Bailey, Leinbach, & Jenkins, 2006). Clearly, when measuring degree and completion rates, a student's intent goal should be a qualifier for inclusion into the cohort (Bailey, 2012).	Degree intent code (workforce degree seeking student=1, transfer degree seeking student=0)
Gender	More female students earn degrees than male students, and studies find unique (Clotfelter et al., 2013) and not unique (Attewell, et al., 2011; Dougherty & Kienzl, 2006) effects of gender on completion.	Gender (Female=1, Male=0)
Race/Ethnicity	Underrepresented minorities have lower degree completion and transfer rates (Attewell et al., 2011; Clotfelter et al., 2013; McIntosh and Rouse, 2009; Radford et al., 2010), although research shows mixed results as to unique effects after controlling for other variables, especially SES and academic preparation (Attewell et al., 2011; Crisp & Mina, 2012; Dougherty & Kienzl, 2006; Porchea et al., 2011).	Under-represented minority student (URM=1, non-underrepresented minority=0)
Age	Delayed entry into higher education and a student's age have been shown to have strong main and differential negative effects on student likelihood of completion and transfer (Adelman, 2006; Attewell et al., 2011; Calcagno et al., 2007; Dougherty & Kienzl, 2006; Porchea et al., 2011; Shulock & Offenstein, 2009). However,	Age
Part-time attendance	Prior research has shown a consistent and strong negative influence of enrolling part-time for community college students (Adelman, 2006; Attewell et al., 2011; Doyle, 2009a; Goldrick-Rab, 2010). Adelman (2006) found that first year, full-time students were more likely to complete a degree and Doyle (2009a) found that, after controlling for other characteristics, first year students who enrolled full-time were significantly more likely to transfer to a four-year institution.	Attendance status (started college part-time=1, started college full-time=0)
Single Parent status	Students who are married and/or have children are less likely to complete and/or transfer (Adelman, 2006; Attewell et al., 2011; Dougherty & Kienzl, 2006; Horn & Skomsvold, 2011; McIntosh & Rouse, 2009).	Single parent (Single with children=1, coupled with children=0)
Academic Preparation	Academic preparation at entry has been shown to have a large effect on community college completion and transfer rates (Adelman, 2006; Bound, et al., 2010; Clotfelter et al., 2013; Dougherty & Kienzl, 2006; Smith & Stange, 2015) as well differential and/or mediating effects for community college versus four year students (Attewell, et al., 2011; Dougherty & Kienzl, 2006, Porchea et al., 2011; Roksa & Calcagno, 2008). Recent research indicates preparation remains an important predictor of community college students' likelihood of completion and/or transfer (Clotfelter et al., 2013). Standardized measures of initial academic ability/preparation for community college students are often difficult to obtain (Bailey, 2012; Long & Kurlaender, 2009). They have been taken from high school standardized tests (e.g., Clotfelter et al., 2013; Kurlaender, Carrell, & Jackson, 2016), high school transcripts (e.g., Attewell, et al., 2011), PSAT scores (e.g., Smith & Stange, 2015), and self-report data (e.g., Dougherty & Kienzl, 2006). I model academic preparation through students' placement into developmental education Math, English, or both as a proxy for academic preparedness.	Academic Preparation (two variables) (enrollment into both precollege Math and English=1, no enrollment =0); (Enrollment into either precollege English or precollege Math=1, no enrollment=0)

Table 1. *Student-Level Variables, Continued*

Variable	Theory/Hypothesis with Literature	Measure
Financial Need as proxy for SES	SES has been shown to be one of the strongest predictors for students' completion (Adelman, 2006; Bowen, et al., 2009; Bailey & Dynarski, 2011; Dougherty & Kienzl, 2006) and has been shown to have significant main and interactive effects on likelihood of completion and transfer (Attewell et al., 2011; Dougherty & Kienzl, 2006; Melguizo & Dowd, 2009; Prince & Jenkins, 2005). Recent research on community college students indicates lower SES students have significantly decreased likelihood of earning a transfer degree and/or successfully transferring to a four-year institution, even controlling for other variables (e.g., Clotfelter et al, 2013; Jenkins and Fink, 2016). The amount of financial aid a community college student receives has also been shown to be strongly and uniquely predictive of student likelihood of transfer and degree completion (e.g., Attewell, et al., 2011; Prince & Jenkins, 2005).	Need-based Financial Aid (NBFA=1, Otherwise = 0)
High School Diploma status	Completing high school is an important measure of academic preparation (Adelman, 2006; Bound, et al., 2010) shown to positively predict college performance (Reardon, 2011). Self-report measures are also commonly used in measuring academic preparation (Dougherty & Kienzl, 2006).	Previous Education (High school graduate = 1, Otherwise = 0)
Students with a Disability	More than 80% of high school students with disabilities list a college degree as their goal, but relative to students without disabilities fewer enroll in college (U.S. Department of Education, 2016), and those who do complete at lower rates (42% versus 51%) than do students without a disability (Raue & Lewis, 2011).	Disability (Students with a disability = 1, Otherwise = 0)
Institution Attended	The institution the student was initially enrolled at in the first term of their cohort was the linked institution (Level 2 ID match variable)	Unique ID

Overall, there was very little missing data in the student dataset. The largest amount of missing data was for student ethnicity, with 5.3% of students not reporting their ethnicity. Less than 0.4% of the data were missing student age and need-based financial aid. All other data were complete. In traditional and multilevel regression modeling, cases with missing *predictor* data are generally excluded from analysis, which is listwise deletion (Little & Rubin, 2002; Enders, 2010). Listwise deletion in the present study resulted in the dataset being reduced from a total of 58,492 students (across both cohorts) to an analytical sample of 55,019 students.

Student outcomes. Defining student “success” is difficult for community colleges given their range of students, missions, and history. Researchers from various fields have chosen variables with different predictors, and outcome variables, as well as inconsistent definition of cohorts (Bailey & Xu, 2012; Mullin, 2012; Xang, 2017). For the present study, three

dichotomous outcome measures of “completion” were derived for each student from the available WSBCTC student-level data as follows.

- *Certificate completion.* The WSBCTC dataset used in these analyses included a record of the type of certificate a student earned at the same institution at which they started within four years of initial enrollment in college. Certificates were divided into the following categories: short certificates (<20 credits; 20-44 credits), medium-length certificates (45-89 credits), and long certificates of more than 90 credits. Certificates of less than 45 credits were not included in the outcome measure³⁷ and students earning only these awards were not coded as completers for the study. In the present study, certificate completion was defined as completing any medium or long certificate at the initial institution within four years of initial enrollment.
- *Two-year degree completion.* The WSBCTC dataset used in these analyses included a record of the type of two-year degree a student earned at that same institution within four years of initial enrollment in college. Degree types included: two types of two-year workforce degrees (ATA; AAS); a workforce degree with specific transfer potential (AAS-T); the general transfer degree (DTA); and 23 types of specific transfer degrees (e.g., AS-T, AS-T/MRP, DTA/MRP), including degrees for general pre-STEM majors, as well as degrees for pre-majors in such fields as business, music, education, art, biology, engineering, computer science, and pre-nursing. In the present study, degree

³⁷ This decision was based on research indicating that students who earn at least 45 college-level credits (equivalent to one academic year or three quarters or two semesters of full-time study) and earn a certificate in the WA two-year college system reached the “Tipping Point,” i.e., earned substantially more in the labor market than students who did not reach that threshold (Prince & Jenkins, 2005).

completion was defined as completing any two-year degree at the initial institution within four years of initial enrollment.

- ***Completion defined as transfer to a four-year institution.*** In addition to containing information on the type and length of certificate or degree awarded to each individual student in the cohort, the dataset included individual student transfer information showing subsequent enrollment in any two-year or four-year, public or private, in-state or out-of-state institution, as well as two-year vocational training institutes. I used these data in the creation of a “successful transfer” variable. Students in the dataset were coded as having transferred institutions at any point in the period (four years post initial enrollment) in one of the following ways: 1) transfer to another (public or private) two-year institution, 2) transfer to a four-year institution (public or private, in-state or out-of-state), or 3) transfer to a private career school or apprenticeship program. Transfer within the Washington CTC system was tracked by WSBCTC researchers, as was transfer to an in-state career school or apprenticeship program. Tracking of transfer out of state to a two- or four-year public or private institution was made possible through a data sharing agreement between the WSBCTC, the National Student Clearinghouse, and the Washington Education Research and Data Center (ERDC). Only students coded as successfully transferring to a four-year institution (2) were coded as “successful transfers” in this study.

Prior research has shown that community college students who successfully transfer to a four-year institution (with or without first earning an associate’s degree) complete their Bachelor’s degree at the same rate or slightly

better rates than those initially enrolled in a four-year institution (Bowen, Chingos, & McPherson, 2009; Melguizo, Kienzl, & Alfonso, 2011; Monaghan & Attewell, 2015; Jenkins & Fink, 2016; Shapiro, et al., 2013). In Washington State in particular, students who successfully transfer to four-year institutions subsequently complete Bachelor's degrees at the highest rate in the nation (Jenkins & Fink, 2016), and are at least as successful as "native" students at those institutions on a wide range of measures, including Bachelor's degree attainment, overall credit attainment, and grade point average (WSBCTC, 2013; ERDC, 2015).

Although some research indicates that students who earn an associate's degree are more likely to successfully transfer (Crook, Chellman, & Holod, 2012; Kopko & Crosta, 2016; Roksa & Calcagno, 2010), this only holds true for students who earn a transfer-oriented (AA, AS) degree, and not for students who earn a professional-technical degree (i.e., AAS, AAS-T), even if the professional-technical degree has a transfer possibility (Kopko & Crosta, 2016).

These three focal outcome variables were then used in seven separate analyses for each cohort to ensure that specific institution and student-level relationships were captured that also could take into account the student's enrollment goals. Cohorts were purposefully separated to capture different periods of economic (labor market) history as well as to provide a check on model robustness. The specific outcome models were as follows (my multilevel analysis approach will be described shortly).

1. **Any Award or Transfer.** *Across all students* (workforce- and transfer-related), predicting whether the student earned any certificate³⁸, two-year associate degree, and/or

³⁸ As defined previously, only certificates of at least 45 college level credits were included in this variable.

successfully transferred to a four-year institution within four years of initial enrollment in college at that same institution (1=yes, 0=no).

2. **Two-Year Degree or Transfer.** *Across only students who had a transfer goal*, predicting whether the student earned a two-year associate's degree and/or successfully transferred to a four-year institution within four years of initial enrollment in college at that same institution (1=yes, 0=no).
3. **Two-year Degree.** *Across only students who had a transfer goal*, predicting whether the student earned a two-year associate degree within four years of initial enrollment in college at that same institution (1=yes, 0=no).
4. **Transfer.** *Across only students who had a transfer goal*, predicting whether the student successfully transferred to a four-year institution within four years of initial enrollment in college at that same institution but did not complete a two year degree (1=yes, 0=no).
5. **Certificate or Workforce Degree.** *Across only students who had a workforce goal*, predicting whether the student earned a certificate (45+ credits) or degree within four years of initial enrollment in college at that same institution (1=yes, 0=no).
6. **Certificate.** *Across only students who had a work-force goal*, predicting whether the student earned a certificate of 45 credits or more, but not a two-year degree, within four years of initial enrollment in college at that same institution (1=yes, 0=no).
7. **Workforce Degree.** *Across only students who had a work-force goal*, predicting whether the student earned a degree within four years of initial enrollment in college at that same institution (1=yes, 0=no).

Institutional Variables

Examining which institutional factors contribute to students' likelihood of completion is one of the primary aims of this study. Because the size of the institution-level sample was quite small, $n = 33$ ³⁹ the multilevel models could not accommodate a large number of predictor variables. Thus, a thorough exploration of potential institutional predictor variables was undertaken using bivariate correlation analyses and analyses of variance of institutions' aggregate data prior to multilevel modeling. All institution-level data were gathered from the national IPEDS data center, as well as from annual "field guides" for all institutions released by the WSBCCTC for each year covered by this study (2010-2015). Table 2 lists institution-level variables available in the dataset for both cohorts across four years.

³⁹ Originally $n = 34$, but two colleges from the same district were collapsed into one due to IPEDS and WSCTC reporting: during the time of the study the colleges functioned as one institution with two campuses.

Table 2. *Institution-Level Variables*

Variable	Theory/Hypothesis	Measure
Location	Previous research on two-year colleges has shown a weak, inconsistent relationship with completion outcomes for institutional location (urban vs. rural) (Bailey et al. 2005; Bailey et al. 2006; Calcagno et al. 2008); studies of completion at 4-year institutions also show mixed results for this variable (e.g., Goenner & Snaith; 2004; Hamrick, et al., 2004).	(Rural = 1, 0 = Other) (Urban = 1, 0 = Other)
Size	Calcagno et al. (2008) found significant but small negative effects of larger institutional size, while other researchers (Clotfelter et al., 2013; Smith & Stange, 2015) found no effects of size on completion, and four-year institution research on the effect of institutional size is mixed (e.g., Astin & Oseguera, 2005; Porter, 2000; Ryan, 2004; Scott, Bailey, Kienzl, 2006; Titus, 2004).	Student headcount
Spending	Financial characteristics include average expenditures per FTE for instruction, academic support ⁴⁰ , student services ⁴¹ , and administration, ⁴² and grant funding and activity. Research on the relationship between institutional expenditures and student outcomes has produced mixed results. In general, greater institutional spending at four-year institutions tends to be associated with better student success (Bailey & Xu, 2012), with some research indicating that disadvantaged students show the greatest benefits from increased spending (e.g., Webber & Ehrenburg, 2010; Titus 2006). Research on the effects of spending at two-year institutions indicates an attenuated relationship (Calcagno et al., 2008) or fails to detect an effect (Bound, et al., 2010; Clotfelter et al, 2013; Stange, 2012). This is potentially ascribed to measures that are too broad or imprecise (Calcagno et al., 2008), or to overall levels of spending (Goldrick-Rab, 2010) that are too low, or with too little variation, to detect an effect. However, most researchers have included it in their models (but see Kurlaender, Carrell, & Jackson, 2016).	Tuition revenue/ Overall revenue State appropriations/ Overall revenue
Faculty to Student Ratio	High faculty to student ratios have been strongly associated with increased four-year institution completion rates (e.g., Bound, et al., 2010) but not so for community college completion rates (Bailey et al. 2006; Bound et al., 2010; Calcagno et al. 2008; Stange 2012). Studies examining the effect of part-time faculty on community college performance suggest that a lower percentage of part-time faculty predicts increased completion (e.g., Jacoby, 2006), although the relationship is weak (e.g., Calcagno et al. 2008 indicated it at $p < .10$), and other studies have been unable to detect a relationship (e.g., Ehrenburg & Zhang, 2005; Stange 2012) for community colleges. However, studies indicating a negative effect of increased part-time faculty percentage used potentially more representative samples, while those unable to detect an effect had fairly restricted samples for community colleges. ⁴³	Full-time Faculty to student (headcount) ratio
Program Mix	Previous research has indicated that institutional focus or program mix may influence completion rates (Armstrong & Mellissimos, 1994; Auguste, Cota, Jayaram, & Laboissière, 2010; Roksa, 2006; Scott-Clayton & Weiss, 2011), and recent research shows that students who enroll in a community college with a primary focus on academic/transfer degrees are more likely to transfer (Jenkins & Fink, 2016).	(WorkForce Orientation = 1, Other = 0)

⁴⁰ Academic support expenditures include expenses that support the primary institutional mission, in this case instruction, access, and community service (adapted from Calcagno et al., 2008).

⁴¹ Student service expenditures cover expenses for admissions, registration, advising and counseling services, and career services, among other things (adapted from Calcagno et al., 2008).

⁴² Administrative expenditures include day-to-day operational expenses excluding expenses for instruction, academic support, and student services (adapted from Calcagno et al., 2008).

⁴³ Ehrenburg & Zhang (2005) used College Board data from only two-year colleges that report student SAT scores, and Stange (2012) limited his sample to only community college students who entered college in 1992 with the intent of earning a Bachelor's degree.

Exploratory Analyses of Aggregate Institution-Level Data

Prior to analyzing student-level outcomes, I explored the institution-level data to begin to address Research Question 1 (examining whether significant variation among two-year institutions in student completion rates exists), as well as to determine which institution-level predictors to include in multilevel prediction models for fully answering Research Questions 1 and 2 (examining which institutional characteristics are predictive of student completion rates). To that end, repeated measures analyses of variance were employed for each cohort for each variable to test for changes over time in the institution-level data, within each of the two cohorts. Thereafter, aggregate institution-level data (means across the years), including aggregate completion rates, were analyzed with zero-order correlations (Pearson's r) against the predictors to determine which predictors correlated with completion outcomes as well as which predictors were redundant (i.e., were more correlated with each other than the outcomes). *SPSS* was used to conduct these analyses; findings are presented in Chapter 4.

Prediction Modeling Approach

Multilevel modeling. A multilevel modeling approach was used to evaluate Research Questions 1 and 2 due to the nested structure of the data. Multilevel modeling accounts for dependencies in the data (i.e., students nested within community colleges) and further allows the testing of institution-level effects on student-level outcomes. Instead of modeling institution-level aggregate values, multilevel modeling is able to weight unbalanced data for the varying number of students within institutions (Raudenbush & Bryk, 2002), as is decidedly the case with this dataset. In the calculations of the probabilities of the outcome variables, institutions with more students are given more weight, while those with fewer students are weighted less in the model. Additionally, in contrast to fully fixed effects models (as are many econometrics models),

multilevel models incorporate both fixed and random effects (also known as “mixed” models) into one model, and treat hierarchical factors, such as institution membership by students, as random effects. Using maximum likelihood with empirical Bayes calculations, these models directly incorporate clustering effects in the sample (degree of non-independence of outcomes of level 1 units, students, within level 2 units, institutions) into parameter estimates, standard errors, and associated degrees of freedom at each level of analysis (Raudenbush & Bryk, 2002). This leads to the ability to better generalize the fixed effects findings (student and institution-level characteristics) on the outcome (student completion) across levels of the random effect (across institutions).

Hierarchical generalized linear modeling (HGLM) was used in this case because outcomes were binary (1=completion, 0=no completion). This model uses a logit link function to estimate parameters, similar to a traditional (unilevel) logistic regression. Across all models, full information maximum likelihood estimation was employed and robust standard error estimates were used to interpret significance of model coefficients.⁴⁴ Finally, population-level estimates (as opposed to unit-specific-level estimates) are reported in keeping with the inferences desired for this paper since the sample included all students and institutions in the State of Washington (Raudenbush & Bryk, 2002, p. 303-304). *HLM7* was used to execute these models.

In keeping with the outcome variable definitions above, seven multilevel logistic outcome models were used to predict completion (1 = yes, 0 = no) for each of the two cohorts of students (2010 and 2011 college entrants). One model was used to understand the links between student and institution characteristics and student completion across all students and all types of

⁴⁴ This is to guard against non-normality of school variation; the sample size was sufficiently large to do so (Raudenbush & Bryk, 2002, p. 276).

completion (i.e., broad brush stroke). Thereafter, students were separated into two groups by their educational goal/intent (i.e., transfer or workforce) indicated in the year they enrolled.

Because students in Washington community and technical colleges can transfer to a four-year institution prior to earning a degree, a subset of students from the dataset was created for those with an initial goal of transferring to a four-year institution (since all students in the dataset were first-time and degree-seeking). Three outcome models were used for this subset of students to predict the binary outcome variables estimating *completion: degree or transfer* (1 = yes, 0 = no); *degree* (1 = yes, 0 = no); and *transfer* (1 = yes, 0 = no) for both entry cohorts of students (2010 and 2011).

In contrast to transfer-intent students, degree seeking workforce intent students often have an initial goal of earning a certificate prior to earning a degree. In Washington, some workforce degrees are structured so that students can “step out” at certain points with a certificate, hopefully to return later to complete the degree. Other areas (such as licensed practical nursing) offer “long” certificates of 90 credits that are the final goal for this discipline. As noted earlier, work by David Prince and Davis Jenkins (2005) has established that in order to achieve a high probability of substantial labor market benefits, students need to have completed at least 45 credits of college level work and earn a credential. Therefore, this study does not count completion of certificates of less than 45 college level credits as completions. Three multilevel logistic regression models were used for a subset of students with an initial goal of completing a workforce degree or 45+ credit certificate to predict the binary outcome variables indicating *completion: certificate or degree* (1 = yes, 0 = no); *certificate* (1 = yes, 0 = no); and *transfer* (1 = yes, 0 = no) for both cohorts of students (2010 and 2011).

Submodels for each outcome model. For each of the seven outcomes (as described on pages 108-109), there were five submodels. Model 1 was an intercept-only model with no predictors (baseline completion, adjusted for a student’s institution membership only). Model 2 added in student-level characteristics, Models 3 and 4 added in institution-level characteristics (one by one and all together, respectively), and Model 5 was a full model with both student- and institution-level characteristics. For the outcome with all students included, a sixth model was specified to test for cross-level interactions. For ease of interpretation, institution-level variables were effect coded or standardized (Z scores). Specifics of each model are given below.

- **Model 1** was an intercept-only *unconditional model* (no predictors) that served as a baseline of completion probability for students within institutions before accounting for fixed effects.⁴⁵ The baseline model was as follows:

$$\text{Model 1: } \quad \text{LN}(P/(1-P))_{ij} = \gamma_{00} + U_{0j}, \quad \text{where Prob(Completion)} = P.$$

In Model 1 above, the log-odds (logits) of completion for student i in the institution j is equal to the grand mean of completion status in logits (γ_{00}) plus the deviation between the student’s institutional mean log-odds and the log-odds grand mean (U_{0j}).

- **Model 2** tested *unique effects of student-level characteristics* (all Level 1 covariates). Remaining (between institution) variation in the institutional residuals

⁴⁵ Because the mean and variance of a binary outcome are not independent, the usual interpretation of intraclass correlation that applies with a continuous outcome variable, i.e., the percent of variation in the outcome variable explained by the nesting factor, it is not appropriate; pseudo- R^2 values are reported but caution in their interpretation is warranted.

(U_{0j}) represents the (random) main effect of institutional attendance. The second model was as follows:

$$\begin{aligned}
 \text{Model 2:} \quad \text{LN}(P/(1-P))_{ij} &= \gamma_{00} \\
 &+ \gamma_{10} * \text{WF_INT}_{ij} + \gamma_{20} * \text{FEM}_{ij} + \gamma_{30} * \text{PT}_{ij} \\
 &+ \gamma_{40} * \text{URM}_{ij} + \gamma_{50} * \text{DEVED}_{ij} + \gamma_{60} * \text{HSGRAD}_{ij} \\
 &+ \gamma_{70} * \text{DISAB}_{ij} + \gamma_{80} * \text{CHILDS}_{ij} + \gamma_{90} * \text{NBFINIAD}_{ij} \\
 &+ \gamma_{100} * \text{AGE}_{ij} \qquad \qquad \qquad + U_{0j}
 \end{aligned}$$

In Model 2 above, the added student-level variables represent a student’s degree intent (workforce or academic transfer) (γ_{10}), gender (γ_{20}), attendance status at time of enrollment (γ_{30}), underrepresented minority status (γ_{40}), college-level preparation (γ_{50}), previous education (γ_{60}), whether or not the student had a learning or physical disability (γ_{70}), whether the student was a single parent (γ_{80}), a measure of income⁴⁶ (γ_{90}), and the student’s age (γ_{100}), as described in the student-level variables section. The intercept, γ_{00} , can be interpreted as the unadjusted mean log-odds of completion of students across all institutions with average student-level characteristics values. Remaining (between-institution) variation is the institutional residual (U_{0j}).

- **Model 3** examined the *direct institution characteristic effects* of each of the institutional predictor variables.⁴⁷ Variables were entered into the model individually to estimate direct effects on the outcome variable as follows:

$$\begin{aligned}
 \text{Model 3s:} \quad \text{LN}(P/(1-P))_{ij} &= \gamma_{00} + \gamma_{01} * \text{CITY}_j + \gamma_{02} * \text{RURAL}_j &+ U_{0j} \\
 \text{LN}(P/(1-P))_{ij} &= \gamma_{00} + \gamma_{03} * \text{TUITIONREV}_j &+ U_{0j} \\
 \text{LN}(P/(1-P))_{ij} &= \gamma_{00} + \gamma_{04} * \text{STATEREV}_j &+ U_{0j} \\
 \text{LN}(P/(1-P))_{ij} &= \gamma_{00} + \gamma_{05} * \text{WFORIENT}_j &+ U_{0j} \\
 \text{LN}(P/(1-P))_{ij} &= \gamma_{00} + \gamma_{06} * \text{ftF_SR}_j &+ U_{0j}
 \end{aligned}$$

⁴⁶ This is a proxy for SES.

⁴⁷ Institutional variable definitions and calculations will be explored in Chapter 4.

In Model 3 above, the individually estimated institution-level variables represent location ($\gamma_{01} - \gamma_{02}$), tuition revenues as a percent of total institutional revenue⁴⁸ ($\gamma_{03} - \gamma_{04}$), whether the institution is primarily focused on workforce education (γ_{05}), and the full-time faculty to student ratio (γ_{06}). Model 3 allowed for the estimation of direct effects of each institutional predictor on student completion while controlling for students' institution membership. Remaining (between-institution) variation is the institutional residual (U_{0j}).

- **Model 4** examined the *unique institution characteristic effects* of all level 2 (institutional) predictor variables on the outcome variables of *completion* and *retention*. The model was as follows:

$$\begin{aligned}
 \text{Model 4:} \quad \text{LN}(P/(1-P))_{ij} &= \gamma_{00} \\
 &+ \gamma_{01} * \text{CITY}_j + \gamma_{02} * \text{RURAL}_j \\
 &+ \gamma_{03} * \text{TUITIONREV}_j + \gamma_{04} * \text{STATEREV}_j \\
 &+ \gamma_{05} * \text{WFORIENT}_j + \gamma_{06} * \text{ftF_SR}_j \quad + U_{0j}
 \end{aligned}$$

In Model 4 above, the institution-level variables represent location ($\gamma_{01} - \gamma_{02}$), revenues as a percent of total institutional revenue ($\gamma_{03} - \gamma_{04}$), whether the institution is focused on workforce education (γ_{05}), and the full-time faculty to student ratio (γ_{06}). Remaining variation is the institutional residual (U_{0j}).

- **Model 5** tested *both institution and student-level predictors together* in one (full) model as follows.

$$\begin{aligned}
 \text{Model 5:} \quad \text{LN}(P/(1-P))_{ij} &= \gamma_{00} + \gamma_{10} * \text{WF_INT}_{ij} + \gamma_{20} * \text{FEM}_{ij} + \gamma_{30} * \text{PT}_{ij} \\
 &+ \gamma_{40} * \text{URM}_{ij} + \gamma_{50} * \text{DEVED}_{ij} + \gamma_{60} * \text{HSGRAD}_{ij} \\
 &+ \gamma_{70} * \text{DISAB}_{ij} + \gamma_{80} * \text{CHILDS}_{ij} + \gamma_{90} * \text{NBFINIAD}_{ij} \\
 &+ \gamma_{100} * \text{AGE}_{ij} \\
 &+ \gamma_{01} * \text{CITY}_j + \gamma_{02} * \text{RURAL}_j \\
 &+ \gamma_{03} * \text{TUITIONREV}_j + \gamma_{04} * \text{STATEREV}_j \\
 &+ \gamma_{05} * \text{WFORIENT}_j + \gamma_{06} * \text{ftF_SR}_j \quad + U_{0j}
 \end{aligned}$$

⁴⁸ A measure of how over-enrolled an institution is, defined in Chapter 4.

Model 5 is interpreted similarly to the prior models, and its residuals served as the basis for selecting cases for answering Research Question 3 (exploring institutional cultures, policies, and practices that are associated with increased completion rates at selected institutions). Model 5 also allowed me to estimate posterior intercepts and standard errors for each of the 33 community colleges' residuals, U_{0j} 's, in order to estimate an approximate "value added" of each institution after controlling for student level covariates. Specifically, the posterior intercepts can be interpreted as the effect of college j , on student completion, after controlling for student level variables (e.g., Snijders & Bosker, 2012, p. 64).

- **Model 6.** Finally, a sixth model was used only to model "any completion" across all students in the cohort: it tested for *cross-level interaction terms* as follows.

$$\begin{aligned}
 \text{Model 6: } \quad \text{LN}(P/(1-P))_{ij} = & \gamma_{00} + \gamma_{10} * \text{WF_INT}_{ij} + \gamma_{20} * \text{FEM}_{ij} + \gamma_{30} * \text{PT}_{ij} \\
 & + \gamma_{40} * \text{URM}_{ij} + \gamma_{50} * \text{DEVED}_{ij} + \gamma_{60} * \text{HSGRAD}_{ij} \\
 & + \gamma_{70} * \text{DISAB}_{ij} + \gamma_{80} * \text{CHILDS}_{ij} + \gamma_{90} * \text{NBFINIAD}_{ij} \\
 & + \gamma_{100} * \text{AGE}_{ij} \\
 & + \gamma_{01} * \text{CITY}_j + \gamma_{02} * \text{RURAL}_j + \gamma_{03} * \text{TUITIONREV}_j \\
 & + \gamma_{04} * \text{STATEREV}_j + \gamma_{05} * \text{WFORIENT}_j \\
 & + \gamma_{06} * \text{ftF_SR}_j \\
 & + \gamma_{11} * \text{CITY}_j * \text{WF_INT}_{ij} \\
 & + \gamma_{12} * \text{RURAL}_j * \text{WF_INT}_{ij} \\
 & + \gamma_{13} * \text{TUITIONREV}_j * \text{WF_INT}_{ij} \\
 & + \gamma_{14} * \text{STATEREV}_j * \text{WF_INT}_{ij} \\
 & + \gamma_{15} * \text{WFORIENT}_j * \text{WF_INT}_{ij} \\
 & + \gamma_{17} * \text{ftF_SR}_j * \text{WF_INT}_{ij} \quad + U_{0j}
 \end{aligned}$$

3.6 Overview of Qualitative Methodology

Although recent studies have examined how individual institutions can vary in their ability to produce completers, and the examined (fixed) institutional characteristics associated with these differences, little is known about the underlying mechanisms that facilitate such differences (Bailey & Xu, 2012, Crisp & Mina, 2012; Jenkins & Fink, 2016; Smith & Stange, 2015; Wang, 2017). In other words, it has been extraordinarily difficult to isolate malleable

institutional characteristics potentially driving differential institutional effects in community colleges (i.e., Bailey and Xu, 2012; Crisp and Mina, 2012, Kurlaender, Carrell, & Jackson, 2016; McIntosh & Rouse, 2009; Smith & Stange, 2015; Stange, 2012) and more research into both the underlying mechanisms as well as the malleable institutional characteristics that can better explain variation in student outcomes is needed (Clotfelter et al., 2013; Kurlaender et al., 2015). As Juan Calcagno and his colleagues note, “research on the relationship between institutional characteristics and institutional effectiveness is crucial to understanding how community colleges can increase their very low completion and transfer rates” (p. 644). Moreover, research that uncovers malleable institutional policies and practices, as opposed to relatively fixed institutional characteristics such as location and size, will be key to improving two-year colleges’ ability to improve student completion rates.

Therefore, using results from the initial quantitative analysis, the qualitative phase of this research employs case studies of three high performing institutions and one institution representing an average performing institution for follow-up qualitative exploratory case studies. These case studies allow me to briefly explore the practices, strategies, and organizational cultures in these institutions, and identify potential practices and strategies from high performing institutions that may be applicable to other community colleges seeking to improve their student completion rates.

Case studies involve purposeful sampling and data collection via interviews and observations. In case studies data analysis is inductive and comparative and the focus is on making meaning and understanding (Merriam, 2009). Unlike other genres of qualitative research, case studies (may) also incorporate many sources of information, including quantitative data (Baxter & Jack, 2008). Data here were coded and analyzed for trends both within and between

institutions (triangulation) with the end goal of illuminating both practices and supporting organization cultures as they relate to student completion (Wolf, 2010).

A structured interview protocol was developed and interviews were conducted with the chief academic officer (often the vice president of instruction) as well as other instructional leaders (such as instructional deans and program directors) at each institution. Structured interviews included questions regarding institutional culture, relationships among areas of instruction and between instruction and student services, specific completion initiatives employed during the time period, use of institutional data, and coordination of completion initiatives during the time period in college of the cohorts examined in the quantitative portion of the study (2010-2015). See Appendix A for interview protocol.

Case Studies in Four Community Colleges

Case study methodology is especially appropriate for rich, in-depth examination of complex phenomena not able to be captured in broad measures like those used in this study such as the policies, practices and strategies for improving student completion rates adopted by highly effective institutions as identified in the quantitative portion of the study (LeCompte & Presissle, 1993; Merriam, 2009). The follow section will give my rationale for choosing four representative institutions on which to pursue case studies, my data collection activities, and the methods employed for data analysis.

Sampling

In order to choose the four colleges in which case studies were performed, criterion sampling was employed. Criterion sampling involves selecting cases that meet some predetermined criterion of importance (Patton, 2002, p. 238). The main criteria were to have three high performers and one average performer as identified in the HGLM quantitative portion

of this study. I used standardized (z -scores) empirical Bayes residual errors to identify “highly effective” institutions. This residual error is the difference between the institution’s mean model-predicted completion rate (i.e., the predicted rate adjusted for fixed student characteristics as well as fixed institutional characteristics) and the institution’s actual mean completion rate. Thus the residuals were used to identify *relatively* effective institutions, and do not indicate institutions with the highest completion rates overall, but rather completion rates that were substantially higher than what was predicted for the institution (given its student and institution characteristics) by the model. However, throughout this study, I term these institutions as “highly” effective for the purpose of distinguishing them from other institutions.

Correlational analyses revealed that residuals for institutions’ transfer completion performance were uncorrelated with residuals for workforce completion performance. Therefore, three categories were created (overall completion, transfer completion, and workforce completion). For each type of residual, each college was labeled as either high performing (top 11 institutions or 33%), low performing (bottom 11 institutions or 33%), or average performing (middle 11 institutions or 33%). Highly effective institutions were chosen as case study subjects from the highest performing in workforce student and transfer student completion categories (largest positive residuals) rather than in the overall category, starting with the 2011 entry cohort. However, once the top 2-3 performing institutions in each category were identified, their overall performance category was also examined. The highest performing institutions (for the workforce and transfer categories) not only ranked as the most under-predicted in their respective categories (workforce or transfer), they also ranked in the top three for overall performance. Finally, stability in performance on completion measures, as measured by residuals, in both cohorts (2010-2014; 2011-2015) was also a consideration in case selection. A similar process was

followed when selecting the average performing institution, with the exception that residuals closer to zero were considered as closest to representing the “average” category.

Additionally, although HGLM modeling did control for student and fixed institutional characteristics, I also considered characteristics when choosing the case study samples. In other words, in addition to identifying relatively effective institutions, I also examined (as a group) selected cases as appropriately representing the diversity within Washington State’s community college system. For example, I considered different locations (urban versus rural), different orientations (workforce versus transfer), and different sizes (large versus small). These considerations led me to include three (rather than my original intent of two) effective institutions (as well as one college representing the “average”): the resulting sample includes both technical and community colleges, as well as colleges from urban, suburban, and rural locations. The sample also represents a range of institutional orientations (workforce versus transfer), enrollments, and racial/ethnic diversity in their student populations.

For the interviews, first, senior administrators familiar with completion initiatives at the institution were approached (e.g., Vice Presidents of Instruction or Student Services) and interviewed using a semi-structured interview protocol. These administrators answered questions and then pointed me to subsequent individuals to interview if needed. These individuals were other administrators with a central role in designing and/or implementing completion initiatives during the relevant time period, some of whom had retired or moved to other institutions but nonetheless were contacted for interviews. In some cases several administrators from the same institution were interviewed simultaneously. I interviewed between two and ten individuals per institution, over a one month period of time.

Interviews

The majority of the qualitative data for this study comes from these interviews. Research interviews are defined as, “A process in which a researcher and participant engage in a conversation focused on questions related to a research study” (DeMarrais, 2004, p. 55). In this case, semi-structured interview protocols were developed with the purpose to get as much information related to the research questions as possible. While an interview protocol was in place, the semi-structured nature of the interview allows for some flexibility so as to permit follow up on topics where a subject is particularly knowledgeable (Merriam, 2009). Case study interviews focused on policies, practices, reform efforts and/or initiatives that were in place at the subject college during the 2010-2015 time period of the study. Questions focused specifically on 1) specific completion initiatives in place; 2) institutional culture, awareness, and approach to these initiatives; 3) organizational and budgetary considerations regarding these efforts; 4) the policies and practices that administrators believed to be most important to student completion efforts; 5) the applicability of an institution’s strategies to a) other instructional areas of the college, and b) to other colleges in the system. (See interview protocol in Appendix A.)

Anonymity was a concern in interviewing these colleges. Colleges and individuals in the Washington CTC system are well known to each other, and leaders from all instructional programming, student services, and administrative areas from all system colleges meet quarterly to discuss issues and stay connected. Furthermore, my role in the system was also a concern, as in addition to being the researcher for this study, I am also an instructional dean at a college in the system. Therefore, every effort was made to preserve the anonymity of colleges and individuals who took part in these case studies. When reporting feedback I intentionally kept identities (of informants and institutions) as vague as possible, although I recognize that the

possibility that knowledgeable people may be able to identify institutions and even specific informants. I have done my best to minimize this risk.

Coding and Analysis

Adhering to the suggestions of Bogdan and Biklen (2007), data analysis began simultaneous with data collection with both observations and memos generated by the researcher relating to what may become important, i.e., “issues raised in the setting and how they related to larger theoretical, methodological, and substantive issues” (p. 165). To guide the process of making meaning by consolidating, reducing, and interpreting what people have said and done and what the researcher has seen and read, a constant referral back to the purpose and research questions of the qualitative case study is placed at the forefront. The purpose of this study is to describe the internal institutional approaches of specific completion initiatives and strategies adopted by these institutions, via policies, practices, culture, and data use, that may have been key in understanding the particular effectiveness of high performing institutions (or for comparison to the average performing institution). A constant comparative method of data analysis was employed (Glaser & Strauss, 1967). In this tradition data analysis begins by identifying segments in the data that are responsive to the research questions (Merriam, 2009). These data segments (may) come from multiple interviews at different institutions and are a potential answer or part of an answer to the research questions. I compared one unit of information with the next and looked at recurring regularities in the data that fell into some category, which together seemed to answer a research question. To begin this process I open coded my data. Through such coding I built conceptual categories. While this technique is used by many traditions of qualitative research it is usually most associated with grounded theory wherein the categories are then sorted, named, possibly consolidated, and then tied to some

existing theory or hypothesis, if one exists (Merriam, 2009). I follow the example of Lightfoot (1983), who studied individual schools and presented each setting as a “portrait” before offering a cross-case analysis. Yin (2008) recommends beginning “with a simple and straightforward case study” (p. 162) before moving on to a cross-case analysis (Yin, 2008; Merriam, 2009). I followed this suggestion and present cases individually followed by a cross-case analysis.

Maintaining Reliability and Validity

Several mechanisms were used to achieve high standards of credibility, dependability, and transferability. First, multiple sources of data (interviews of key administrators with knowledge of practices during the time period of the study) and inspection of documents provided by informants, as well as analysis of information present on institutions’ websites, were analyzed to triangulate data relative to participants’ claims, and increase the degree of trustworthiness that the data reflects reality as perceived within the community colleges and state context under study (Merriam, 2009). Second, I conducted “member checks” to increase internal validity of data analysis through a process established for respondents to validate the data collected (Merriam, 2009). For example, in follow-up interviews and email correspondence, I debriefed findings to verify anything that remained unclear relative to the study’s goals. During each interview, I provided periodic summaries of main points and understandings so as to have a verbal confirmation from the respondent of what was meant or stated where there were questions or doubts regarding meaning-making. Thirdly, I maintained a record or “audit trail” of decisions I made regarding methods, procedures, and course corrections to ensure accurate reporting of study methodology, support purposeful decision-making relative to the scope and questions of the research study, and strengthen reliability, dependability, and consistency of study processes and findings (Merriam, 2009). Using a “grounded theory” approach, new decisions occurred

constantly in my data gathering, data analysis, and reporting of findings. Potential transferability of research findings was supported by “detailed description of the findings with adequate evidence presented in the form of quotes from participant interviews, field notes, and documents” (Merriam, 2009, p. 227).

Chapter 4: Institutional Variable Exploratory Results

4.1 The Washington State Community and Technical College System

Today, Washington State’s community and technical college system comprises 34 community and technical colleges, 29 of which are “comprehensive” community colleges, and five of which are “technical” colleges. All public two-year colleges in Washington have three missions: 1) academic transfer, intended for students who intend to pursue a Bachelor’s degree and aspire to transfer to a four-year institution; 2) workforce education (also called professional-technical education) for students who wish to develop vocational skills, and 3) adult basic education, for students who enter the system with academic skills that are substantially below college level preparedness. Twenty-one percent of the 34 colleges are located in large urban environments, 12% are located in rural environments, and the remaining 33% are located in suburban environments (see Figure 3, a map of college locations across the state).



Figure 3. Map of Washington State Community and Technical College System

History of Institutional Foci

In some states, such as Tennessee, there is a major difference between technical colleges and community colleges: technical colleges in Tennessee offer only workforce certificates and not associate's degrees (workforce or transfer) whereas community colleges offer two-year transfer degrees. In contrast, all two-year colleges in Washington offer a range of certificates and degrees, including workforce-oriented degrees (and certificates) as well as transfer-oriented degrees. Although historically very different, today the distinction between technical and community colleges in Washington is simply one of historical origin and primary institutional focus.

The first community college in Washington, Centralia College, was founded in 1925; by 1960, 10 more had been founded. All were specifically founded as junior colleges focused on a transfer degree-oriented mission (Beach, 2011; Brint & Karabel, 1989). Washington's technical colleges, on the other hand, were founded as "vocational technical institutes" (VTIs) in the 1940s through 1960s, and were focused on "pre-employment training and job upgrading-retraining." VTIs were part of local K-12 school districts in terms of governance.

Then, in the 1960s, a period in which 12 more junior colleges were founded, all of Washington's junior colleges were re-designated "community colleges," and henceforth were considered part of a statewide community college system that were no longer dependent on local school districts. At this point, several VTIs (such as today's South Puget Sound Community College) opted to join the system and became community colleges. Five VTIs decided to remain with local school districts until 1991, when they were re-designated by state legislative action as "technical colleges" and were merged with the existing community college system.⁴⁹ Today, all

⁴⁹ <https://www.sbctc.edu/about/history.aspx>

of the technical colleges in Washington offer transfer degrees, and have the same three broad mission areas as the community colleges in the state (academic transfer, workforce, and adult basic education).

Notably, in 2005, Washington's legislature approved the piloting of several applied baccalaureate degree programs in the community and technical college system. In 2010, the policy for allowing community and technical colleges to offer Bachelor's degrees became permanent, with a stated rationale of increasing Bachelor's degree completions in Washington, as well to meet the increasing need of workforce degree earners to progress on and complete Bachelor's degrees in their fields. To date, 25 of the 34 institutions in Washington's community and technical college system are now offering a least one Bachelor's degree program,⁵⁰ with several more programs currently in the application approval process.⁵¹

4.2 Institutional Variable Selection Rationale

Available Data for Institution-level Predictors

For each of the two student cohorts (entrants in 2010 and 2011), there were three years of data available from the Integrated Postsecondary Education Data System (IPEDS) for each institution-level variable (i.e., for 2010, data were available for 2011, 2012, 2013).

Unfortunately, due to college reporting at the time of the study, the two colleges in Pierce County, Pierce College – Fort Steilacoom, and Pierce College – Puyallup, had to be collapsed as a single institution (treated as Pierce Colleges combined) for the purpose of analyses. Given that there were only 34 institutions to begin, the sample size for analytic purposes was quite limited ($N = 33$). Given this limited number of institutions (and therefore the limited number of degrees of freedom for conducting prediction modeling), I wished to select only variables that were both

⁵⁰ <https://www.sbctc.edu/colleges-staff/programs-services/applied-baccalaureates/current-bachelor-programs.aspx>

⁵¹ <https://www.sbctc.edu/colleges-staff/programs-services/applied-baccalaureates/bachelors-development.aspx>

non-redundant with each other as well as theoretically grounded for use in student outcomes models. Additionally, I wished to include some predictors that could be potentially malleable – that is, open to policy change if it might potentially benefit student completions. Finally, I also needed to decide how to best use the three years of data (i.e., use one year, or all years combined). To begin, I reviewed the recent prior literature on key institutional variables used in two-year institution research.

Prior Research using Institutional Variables as Predictors of Student Outcomes

As described previously, researchers examining institutional characteristics predictive of community college student success have successfully adapted Berger and Milem’s (2000) college impact model to characterize types of institutional variables potentially important for student success. Calcagno, Bailey, Jenkins, Kienzl, and Leinbach (2008) specifically categorized four types of institutional characteristics: 1) general institutional characteristics, including institution size (full time enrollment, or FTE), student-to-faculty size ratio (lower is better), and certificate to degree awards ratio; 2) student compositional characteristics, including proportion of part-time, female, and under-represented minority students, 3) financial characteristics, including institutional expenditure, and 4) location characteristics (urban, suburban, or rural). Similarly, Horn and Lee’s (2016) major categories included: 1) structural, including mission, size, and selectivity; 2) demographic, such as age, SES, and gender mix of students; 3) financial, including institutional expenditures, and 4) contextual, including urbanization and local labor market conditions. Although these institutional characteristics are not immediately open to policy shifts/change at the institutional level in the short run (Horn & Lee, 2016), *some* characteristics may be open to longer term policy changes intended improve student outcomes, and can thus be considered “malleable” factors in the long run (Calcagno et al., 2008, Bailey, 2012a).

In a recent analysis of North Carolina's community college system, Clotfelter, Ladd, Muschkin, & Vigdor (2103) utilized seven institutional characteristics⁵² to predict student outcomes. These included structural characteristics (size, program mix, multi-campus institution status), financial characteristics (expenditures per FTE, instructional expenditures per FTE), and contextual characteristics (proximity to four-year institutions).

Again, given my institution sample size ($N = 33$), I could not include all variables previously utilized in the literature and still have sufficient power to detect effects. Immediately, I decided that individual student characteristics would be tested at the student level, rather than the institutional level (e.g., student demographic characteristics that are part of an institution's "composition," such as minority status and gender, were used as student-level predictors, and were not aggregated at the institution level). The remaining sections of this chapter are dedicated to describing the selection and operationalization of *institution*-level predictor variables for use in student outcomes models.

Potential Operationalizing Structural, Contextual, and Financial Variables

Size (structural). Institutional size is often included in the literature, although with mixed results. Calcagno et al. (2006; 2008) found significant but small effects of institutional size, with larger institutions predicting lowered completion likelihood (also Bailey et al., 2005), while other researchers (such as Clotfelter et al., 2013) found no effects of size on completion rates. Four-year college research on the effect of institutional size is mixed in its findings (e.g., Astin & Oseguera, 2005; Porter, 2000; Ryan, 2004; Scott, Bailey, Kienzl, 2006; Titus, 2004). Full time equivalent enrollments (FTE) have been one way to operationalize size (Bailey et al., 2005; Calcagno et al., 2006; Calcagno et al., 2008) for national studies, while Clotfelter et al.

⁵² This study had an institutional sample size of $N = 56$ (Clotfelter et al., 2013).

(2013) used the log of enrollment to measure institutional size. In this study I included the unduplicated headcount at the institution as a measure of size, since for the same workforce programs (e.g., nursing, welding) the amount of credits required and thus FTE generated can vary widely depending on institution, and because student-level part-time enrollment was already available for use.

Over-enrollment (structural). It is sometimes difficult to determine what exactly is meant by size. For example, some colleges have multiple campuses but report as a single institution. Others are part of a larger district which reports as a single campus. Clotfelter et al. (2013) included a measure for institutions with more than one campus, although the variable was not significant in their completion model. Interestingly, however, the revenues generated by tuition as a percent of total institutional revenues can act as a proxy for how well an institution's enrollment matches its intended enrollment (size) and thus presumably its capacity. In Washington, institutions are allotted a total FTE dollar match to locally generated funds from state funds to support the running of the institution. This amount was originally a significant portion of operating costs but has recently shrunk in size relative to tuition revenue. Each college, based on historical enrollments, is given a "target" FTE allotment. After a college has hit this target, all FTEs generated beyond this point are not matched by state funds. Therefore, schools with a relatively high percentage of tuition per total revenue are most likely to be overenrolled relative to their capacity. The amount of FTE per tuition dollar is a similar construct, but tuition as a share of revenues, as will be seen shortly, was found to be more correlated with outcomes; additionally, it was found to have a high degree of overlap with FTE per tuition.

Location (contextual). Previous research has also shown an inconsistent relationship for institutional location (e.g., urban vs. rural) of two-year colleges with outcomes (Bailey et al. 2005; Calcagno et al. 2006; Calcagno et al. 2008; Clotfelter et al., 2013), and four-year studies also show mixed results (e.g., Goenner & Snaith; 2004; Hamrick, et al., 2004). Because Washington is a large and geographically diverse state with potentially large distances separating institutions, I thought it important to include a measure of location. Initial data explorations indicated that locations in the two “extremes,” which included colleges in large urban centers (Seattle, Tacoma, and Spokane) and those in very rural areas, were the most associated with outcome variables.

Proximity to four-year institution (contextual). Clotfelter et al. (2013) found the presence of a four-year institution in the same county negatively predicted completion measures for community college students. Presumably, this results from the fact that such institutions attract the better prepared students, leaving the CC with more of the less prepared. Similarly, in their study examining whether community college attendance presents a handicap in earning a four-year degree Kurlaender and Long (2009) used presence of an open access four-year institution nearby as a control measure. As will be seen shortly, urban colleges were positively correlated with the presence of a four-year institution,⁵³ and such presence was negatively correlated with rural schools. Because location also had strong associations with the aggregate level outcomes, location (not proximity to four-year institution) was used as a predictor in the following models to predict student outcomes.

⁵³ Only four-year institutions that had an acceptance rate greater than 75% in the same county as the community college were included.

Institutional spending (financial). Financial characteristics include average expenditures per FTE for instruction, instructional support, academic support,⁵⁴ student services,⁵⁵ and administration,⁵⁶ and measures of grant funding and activity. Research on institutional expenditures has produced mixed results. In general, greater institutional spending at four-year institutions tends to be associated with better student success (see Bailey & Xu, 2012 for review), with some research indicating that disadvantaged students show the greatest benefits from increased spending (Webber & Ehrenburg, 2010; Titus, 2006). As mentioned in an earlier chapter, the effects of institutional spending at two-year institutions indicates an attenuated relationship (Calcagno et al., 2008) or fails to detect any effect on completion and transfer (Bound, et al., 2010; Clotfelter et al, 2013; Stange, 2012). Differences in findings have been potentially ascribed to measures of institutional spending that are too broad or imprecise (Calcagno et al., 2008), or to overall levels of spending that are simply too low to detect an effect (also known as floor effects) (Goldrick-Rab, 2010).

In Washington, total institutional expenditures (and their variation) tend to be limited by a formula (and floor effects). Furthermore, there is little consistency among Washington's institutions on how to categorize expenditures. For example, college A may classify all instructional deans, assistant deans, and directors under instructional expenditures, whereas college B may classify these same positions under instructional support; meanwhile, college C may classify them as administrative support. Further, as will be seen shortly, instructional expenditures were not consistently associated with aggregate student outcomes. Thus, given

⁵⁴ Academic expenditures include expenses that support the primary institutional mission, in this case instruction, access, and community service (adapted from Calcagno et al., 2008).

⁵⁵ Student service expenditures cover expenses for admissions, registration, advising and counseling services, and career services (adapted from Calcagno et al., 2008).

⁵⁶ Administrative expenditures include day-to-day operational expenses excluding expenses for instruction, academic support, and student services (adapted from Calcagno et al., 2008).

considerations of statistical power, inconsistencies in colleges' reporting of spending, and the lack of consistent evidence in the literature for effects of institutional expenditures at the two-year level, I decided not to include spending measures for use in the prediction models.

Faculty-to-student ratio (structural). High faculty to student ratios (more is better) have been strongly associated with increased four-year institution completion rates (e.g., Bound, et al., 2010), but not so for community college completion rates (Bailey et al. 2006; Bound et al., 2010; Stange, 2012). Studies examining the effect of part-time faculty shares on community college performance suggest that a lower percentage of part-time faculty predicts increased completion (e.g., Jacoby, 2006), although the relationship is weak (e.g., Calcagno et al. 2008 indicated it at $p < .10$). Other studies have been unable to detect a relationship between increased proportion of part-time faculty and completion (e.g., Ehrenburg & Zhang, 2005; Stang, 2012) at the community college level. However, studies indicating a negative effect of increased part-time faculty percentage used potentially more representative samples, while those unable to detect an effect had fairly restricted samples for community colleges.⁵⁷ In the IPEDS data for the present study, there were two measures of faculty to student ratios available for use. The first was generated by WSBCTC and is based on full-time teaching equivalencies per student FTE (FTEF). This was found to be non-useful for the present study because it blends together full-time and part-time faculty (FTEF for three adjuncts teaching one class each is the same as one full-time faculty teaching three classes), and there were also inconsistencies in how institutions report full-time faculty load (for example, a full-time faculty member given a 2/3 release for the year to work on a project would still be counted as a full FTEF). Thus, I generated a second

⁵⁷ Ehrenburg & Zhang (2005) used College Board data from only those two-year colleges that report student SAT scores, and Stange (2012) limited his sample to only those community college students in 1992 who indicated that a Bachelor's degree was their final intent.

measure. First, I totaled the number of tenured and tenure track faculty reported to IPEDS during each cohort's three year time period, and created a mean count of tenured plus tenure-track faculty per institution across those years. Then I divided that mean count by the mean student headcount over the same time period. The final variable was thus a measure of tenured (and tenure-track) faculty per student for each institution, for each cohort. This full-time faculty to student ratio variable was found to be more correlated with aggregate student completion rates than the all faculty variable provided by IPEDS.

Certificate-to-degree ratio (structural). Not surprisingly, research has indicated that completion of shorter and potentially less rigorous credentials is easier to achieve than completion of a two-year degree. Thus, schools that focus on producing certificate completers versus degree completers tend to have higher completion rates than those focusing more or solely on degree completions (Bailey, 2011; 2012). In addition, there is evidence that higher completion rates in Washington's technical colleges may be driven by certificate completion, not degree completion (Scott-Clayton & Weiss, 2011). Further, examining the ratio of certificates to degrees conferred can act as an indicator of institutional focus (Calcagno et al., 2008; Cook & Pullaro, 2010) and the measure is gaining use in measurements of higher education financing as well (e.g., Desrochers & Hurlburt, 2015). Although I examined this variable as part of my exploratory analyses (forthcoming), ultimately, I did not include institutions' certificate-to-degree ratio as a variable in the hierarchical prediction models because: 1) students were all originally degree-seeking students as part of the study inclusion criteria, 2) I was already controlling for students' individual degree majors at the student-level of the model (see again Chapters 3 and 5), and 3) I directly modeled certificate and degree completion as outcomes.

Program mix or “institutional focus” (structural). One of the main institutional characteristics I was interested in examining for this study was program mix or “institutional focus.” Previous research has indicated that this variable may influence completion rates (Armstrong & Mellissimos, 1994; Auguste, Cota, Jayaram, & Laboissière, 2010; Roksa, 2006). For example, a recent study of traditionally aged students in Washington found that students enrolled in technical colleges were more likely to complete certificates (but not degrees) than students enrolled in community colleges (Scott-Clayton & Weiss, 2011). Further, recent research has also shown that students who enroll in a community college with a primary focus on academic/transfer degrees rather than in an institution with a workforce focus are more likely to transfer (Jenkins & Fink, 2016). In contrast, Clotfelter et al. (2013) found no relationship between the portion of students taking courses for college credit (versus developmental and basic education) in an institution and student completion there, and Calcagno et al. (2008) also found no relationship between the certificate or degree orientation of the institution, which they used as a rough proxy for institutional focus (p. 636), and student completion.

As described earlier, all comprehensive community and technical colleges in Washington offer a range of degrees, including workforce degrees and certificates, as well as transfer degrees and share the same three broad mission areas (academic/transfer, workforce, and adult basic education). Moreover, many “comprehensive” community colleges have significantly grown their workforce areas, with a large focus on high tech and aerospace fields and several have a significant focus on workforce programs.

Defining institutional focus was thus a multi-step task. First, for each cohort, I examined the correlations among the percentage of full-time equivalent enrollments (FTEs) for each type of program, for each cohort. As can be seen in Tables 3 and 4, a college’s percentage of transfer

FTEs was significantly negatively correlated with its percentage of professional-technical and workforce FTEs; and, also not surprisingly, percentage of workforce FTEs was positively correlated with professional-technical FTEs. These relationships differed little between the two cohorts.

Table 3. *Correlations among Enrollment Types (2010 Cohort)*

Variable	<i>M</i>	<i>SD</i>	1.	2.	3.
1. % Transfer	0.42	(0.16)	--		
2. % Prof-Tech	0.35	(0.17)	-.92 **	--	
3. % Basic Skills	0.14	(0.07)	-.20	-.16	--
4. % Workforce	0.53	(0.22)	-.86 **	.86 **	-.01

Note. *N* = 33 institutions. ***p* < .01.

Table 4. *Correlations among Enrollment Types (2011 Cohort)*

Variable	<i>M</i>	<i>SD</i>	1.	2.	3.
1. % Transfer	0.43	(0.16)	--		
2. % Prof-Tech	0.34	(0.17)	-.91 **	--	
3. % Basic Skills	0.14	(0.07)	-.29	-.09	--
4. % Workforce	0.52	(0.22)	-.83 **	.89 **	.08

Note. *N* = 33 institutions. ***p* < .01.

Next, *k*-means cluster analysis was employed, based on the following six variables:

- 1) the percent of FTEs generated from academic transfer course enrollments;⁵⁸
- 2) the percent of FTEs generated from workforce course enrollments;
- 3) the percent of FTEs generated from developmental education course enrollments;
- 4) the percent of FTEs generated from basic skills course enrollments;
- 5) the percentage of cohort degree seeking workforce students (versus degree seeking transfer students) at each institution; and
- 6) the ratio of certificates to degrees awarded.

⁵⁸ Using each institution's FTE matrix, provided by the WSBCTC, it is possible to calculate the percentage of students enrolled in each of the following four areas: 1) academic/transfer, 2) workforce, 3) developmental education (pre-college) and 4) basic education.

The idea behind this cluster analysis was to determine whether there were two to three major clusters of college orientations: those with a substantial workforce focus, those with a substantial transfer focus, and those that had a mixed focus. Table 5 displays the results of the 2- and 3-cluster assignments by college for the 2011 cohort. As a check on these findings, I also conducted a hierarchical cluster analysis using the same set of variables (see Figure 4 for 2010 cohort). The results of each of these analyses indicated that the two-group clustering assignment was the most sensible and consistent across analyses and cohorts. Indeed, the same six institutions were clustered together in three of the four analyses, with all of these schools classified as being workforce-oriented (all others were classified as transfer-oriented).

Therefore, for the subsequent prediction models, I adapted Jenkins and Fink's (2016) approach (they categorized institutional program mix by percent of degrees awarded in workforce and transfer areas as a proxy for an institution's overall focus) and categorized institutions into either a workforce or a transfer orientation based on the enrollment percentage by course intent (transfer vs workforce), i.e., the percentage of students enrolled in workforce versus transfer classes.

Table 5. Results for 2- and 3-Group K-Means Cluster Analyses (2011 Cohort)

ID	2 clusters	3 clusters
1	1	1
4	1	1
5	1	1
6	1	1
7	1	1
8	1	1
9	1	1
10	1	1
11	1	1
12	1	1
13	1	1
14	1	1
15	1	1
16	1	1
17	1	1
18	1	1
19	1	1
20	2	2
21	1	1
22	1	1
23	1	1
23	1	1
24	1	1
25	1	1
26	1	1
27	1	1
28	1	1
29	2	2
30	2	2
31	2	2
32	2	2
33	2	2
34	1	3

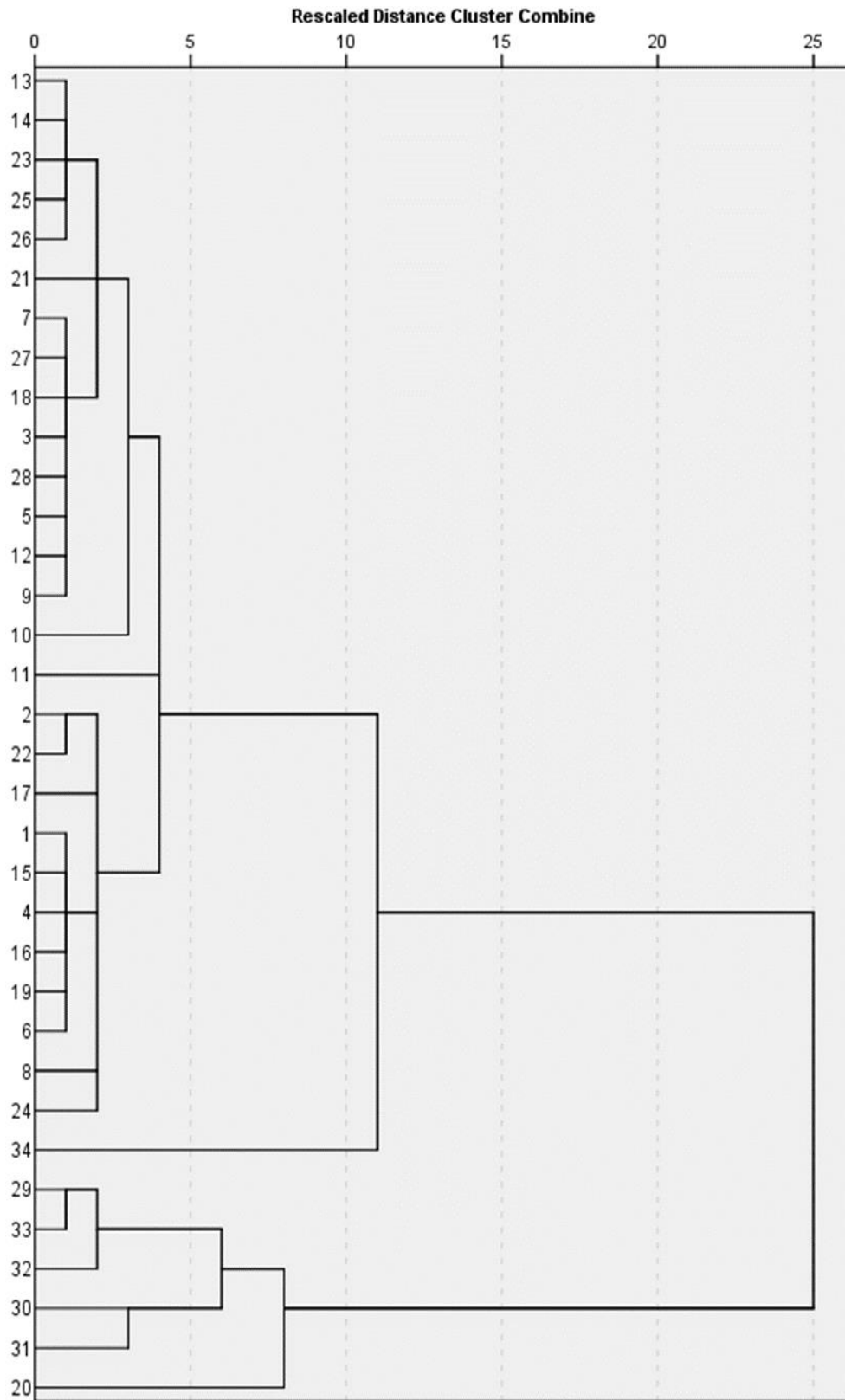


Figure 4. Hierarchical Cluster Analysis Dendrogram (2010 Cohort)

4.3 Institutional Variables: Testing for Change over Time

For each cohort (2010 and 2011), to determine whether there were any changes across the three years of corresponding institution-level data for each cohort separately (i.e., 2011, 2012, and 2013 for the 2010 cohort, and 2012, 2013, and 2014 for the 2011 cohort), a series of one-way repeated measures analyses of variance (RM ANOVA) with Dunn-Sidak posthoc follow-up tests was conducted. In all analyses, Mauchly's test of sphericity was significant and therefore the Greenhouse-Geisser adjusted F -test for the main effect of Time was used. Results from these models showed mixed findings.

Variables with no significant changes over time. For both cohorts, there were no significant differences over time for most institutional variables. This included percentage of revenue from tuition, instructional expenditures per full-time equivalent (FTE) student enrolled, total number of students enrolled (headcount), total FTE enrolled, student-to-faculty ratios, percentage of transfer degree courses offered, percentage of below-college-level courses offered, percentage of basic skills courses offered, percentage of professional/technical courses offered, percentage of female students enrolled, percentage of part-time students, percentage of students with children, or median age of students enrolled (all Greenhouse-Geisser F -test $ps > 0.05$).

Variables with consistent changes over time. This said, a small handful of significant changes over time that were consistent across both cohorts were found (all Greenhouse-Geisser F -test $ps < 0.05$). First, across both cohorts, institutions' academic support expenditures per FTE increased steadily from approximately \$650 in 2011 to approximately \$1,100 per FTE in 2014. Second, the number of students served per FTE increased from about 1,300 students in 2011 to 1,700 in 2014. Third, the percentage of African American students enrolled increased, albeit

slightly, from approximately 6% to approximately 7.5%. Finally, the percentage of Latino/a students enrolled also increased, from about 14% in 2011 to 17% in 2014.

Inconsistencies across cohorts in changes over time. Last but not least, there were a few significant changes over time that were inconsistent among the two cohorts. First, there was a significant decrease over time in percentage of institutional revenue from state appropriations (from about 36% in 2010 to 30% in 2012) for the first cohort, but the pattern was reversed by 2014 for the second cohort (this pattern was also observed for state appropriations per FTE) (Greenhouse-Geisser *F*-test $ps < 0.05$). A similar pattern of reversal was found for percentage of white students enrolled as well: while there was a significant decrease in the first cohort from 65% in 2011 to 62% in 2013, the pattern was reversed back up to 64% by 2014 in the second cohort (Greenhouse-Geisser *F*-test $ps < 0.05$).

Second, while there were no significant differences over time for the first cohort on instructional support expenditures per FTE, a significant increase over time was observed in the second cohort, with spending increasing from about \$1,300 to \$1,550 per FTE from 2012 to 2014. A similar pattern was found for percentage of Asian and Native American student enrollments, with significant increases over time detected only for the second cohort: from 10% in 2012 to 11% in 2014 and from 2.9% in 2012 to 3.2% in 2014, respectively.

Finally, while there were no significant differences over time for the first cohort on percentage of students receiving financial aid, there was a significant decrease found for the second cohort, from approximately 51% in 2012 to only 44% receiving aid in 2014.

Composite variable creation. Given that 1) there were mostly no significant differences among institutional variables over time, 2) there were some inconsistencies among the two cohorts, I created means for each variable across each cohort's three-year period, for each

institution. These composite variables were subsequently used in correlational analyses as well as multilevel models.

4.4 Institutional Variables: Correlations with Aggregate Student Outcomes

Using the aggregate student outcomes for each institution (i.e., computing the percentage of completers for “any” completion, completion of a certificate or degree for workforce-oriented students, completion of a degree or transfer for transfer-oriented students, and completion of a two-year degree), zero-order (bivariate) correlations were conducted to test associations between institution-level predictors and those outcomes

2010 Cohort. For the 2010 cohort (see Table 6), institutional workforce orientation was positively correlated with two of the aggregate student outcome variables (percentage of students who earned any award or transferred, and percentage of students earning a certificate or degree), and was also significantly positively correlated with state appropriations as a percent of total revenue⁵⁹ and certificate-to-degree ratio. Tuition as a percent of total revenue, the overenrolled indicator, was negatively correlated with one of the outcome variables, earned degree (additionally, it was negatively correlated with state appropriations, academic support per FTE, full-time faculty to student ratio, rural colleges, and certificate to degree ratio, but positively correlated with size and proximity to four-year institutions). State appropriations as a percent of total revenue was positively correlated with the outcome variables any award or transfer and earned certificate or degree (additionally, it was positively correlated with workforce orientation, academic support per FTE, and the certificate to degree ratio of an institution, but negatively correlated with size). Institution size was negatively correlated with three of the four aggregated

⁵⁹ This may be seen as a rough inverse of the overenrolled variable (tuition/total revenues) although this variable also includes specific allotments for targeted programs, such as manufacturing and STEM courses, and thus is not as precise an indicator as tuition/total revenues.

Table 6. Zero-order Correlations among Institutional Variables (2010 Cohort)

Variable	<i>M</i>	(<i>SD</i>)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	
1. % Any Award	0.33	(0.09)																		
2. % Cert/Degree	0.27	(0.10)	.89**	--																
3. % Degree/Transfer	0.22	(0.05)	.33	.00	--															
4. % Degree	0.16	(0.04)	.46**	.51**	.59**	--														
5. Workforce Orient	0.35	(0.17)	.67**	.77**	-.10	.30	--													
6. Tuition % Rev	0.18	(0.09)	-.34	-.30	-.27	-.37*	-.31	--												
7. State Approp % Rev	0.33	(0.05)	.59*	.64**	-.01	.29	.46**	-.37*	--											
8. Instruct Exp/FTE	5624	(989)	-.04	-.01	-.07	-.04	-.05	.06	.06	--										
9. Acad Supp/FTE	748	(250)	.37*	.26	.15	.05	.32	-.46**	.35*	-.01	--									
10. Stud Served/FTE	1370	(656)	.16	-.14	.45**	-.08	-.14	-.33	-.09	-.05	.37*	--								
11. Instr Supp/FTE	1326	(504)	.16	.23	-.01	.21	.16	-.31	.19	.07	.39*	.12	--							
12. Stud:Fac Ratio	25.78	(5.59)	.26	.21	.12	.09	.24	-.25	.26	-.03	.04	.10	-.17	--						
13. FT Fac:Stud Ratio	0.008	(0.003)	.03	.00	.12	.12	.30	-.40*	.24	-.39*	.25	.07	.10	.01	--					
14. Size (Headcount)	12551	(6374)	-.37*	-.39*	-.23	-.46**	-.30	.61**	-.41*	.00	-.42*	-.19	-.60**	-.08	-.34	--				
15. City location	0.21	(0.42)	-.09	-.24	-.03	-.41*	-.09	.28	-.16	.05	-.01	.15	-.36*	-.01	.01	.46**	--			
16. Rural location	0.12	(0.33)	-.04	.01	.07	.21	-.07	-.36*	.14	.22	.12	.14	.47**	-.25	.12	-.42*	-.19	--		
17. Cert-to-Deg Ratio	0.60	(0.65)	.60**	.71**	-.52**	-.22	.61**	-.08	.54**	.00	.23	-.13	.15	.18	-.07	-.12	.02	-.10	--	
18. Prox to 4-Year Inst	0.67	(0.48)	.07	.02	-.07	-.20	.08	.40*	.02	-.10	-.04	-.20	-.23	-.11	-.07	.42*	.37*	-.53**	.18	

Note. *N* = 33 institutions. All categorical variables dummy coded, including Workforce Orientation, City and Rural locations (Suburban is reference category), and Proximity to 4-year Institution. **p* < .05, ***p* < .01.

completion measures, and institutions located in an urban environment were negatively correlated with earning a degree (urbanicity was positively correlated with size). Finally, an institution's certificate-to-degree ratio was positively correlated with two of the aggregate student outcomes (any award or transfer and earned certificate or degree), and negatively correlated with earned degree or transfer.

2011 Cohort. For the 2011 cohort (see Table 7), correlations were similar to those for the 2010 cohort. Comparatively, in 2011, an institution's workforce orientation was more (negatively) predictive of degree/transfer completion rate, and less positively predictive of two-year degree completion rate. Additionally, academic support per FTE was less positively predictive of the percent of students earning any award in 2011, whereas rural location of the college was more (positively) predictive of percentage of degrees completed. Finally, the certificate-to-degree ratio was more (negatively) predictive of degree completion in 2011 compared to 2010.

Summary. Given the observed correlations, and as already mentioned in the previous section's rationale for predictor selection, the following institution-level variables were ultimately employed in the student-level prediction models that follow in the next chapter.

- Size (Student headcount)
- Location (City and Rural, with Suburban as reference category)
- Tuition % of Revenue (a measure of institutional "over-enrollment")
- Workforce Orientation (Compared to Transfer Orientation)
- Full-time Faculty:Student Ratio

Table 7. Zero-order Correlations among Institutional Variables (2011 Cohort)

Variable	<i>M</i>	(<i>SD</i>)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
1. % Any Award	0.31	(0.06)	--																
2. % Cert/Degree	0.26	(0.07)	.94 **	--															
3. % Degree/Transfer	0.22	(0.05)	.13	-.09	--														
4. % Degree	0.16	(0.04)	.31	.26	.83 **	--													
5. Workforce Orient	0.35	(0.17)	.57 **	.73 **	-.38 *	-.01	--												
6. Tuition % Rev	0.19	(0.09)	-.22	-.29	-.13	-.35 *	-.32	--											
7. State Approp % Rev	0.32	(0.05)	.56 **	.60 **	-.13	.09	.51 **	-.45 **	--										
8. Instruct Exp/FTE	5672	(971)	-.02	.04	-.12	-.04	-.02	.05	.00	--									
9. Acad Supp/FTE	902	(282)	.27	.26	.07	.12	.26	-.49 **	.42 *	.05	--								
10. Stud Served/FTE	1493	(681)	-.13	-.13	.03	.00	-.06	-.37 *	-.02	-.01	.44 *	--							
11. Instr Supp/FTE	1414	(480)	.23	.27	.08	.22	.15	-.35 *	.20	.16	.49 **	.18	--						
12. Stud:Fac Ratio	25.00	(5.27)	.22	.20	.01	.03	.23	-.27	.23	-.08	.07	.02	-.20	--					
13. FT Fac:Stud Ratio	0.008	(0.003)	.08	.06	.18	.21	.27	-.40 *	.30	-.38 *	.21	.10	.06	.02	--				
14. Size (Headcount)	11903	(6220)	-.38 *	-.36 *	-.30	-.42 *	-.34	.67 **	-.52 **	.07	-.51 **	-.27	-.58 **	-.08	-.49 **	--			
15. City location	0.21	(0.42)	-.17	-.22	-.28	-.47 **	-.11	.22	-.22	.03	-.14	.08	-.44 *	-.03	.01	.36 *	--		
16. Rural location	0.12	(0.33)	.14	.13	.31	.40 *	-.06	-.34	.16	.17	.35 *	.16	.42 *	-.29	.12	-.41 *	-.19	--	
17. Cert-to-Deg Ratio	0.60	(0.65)	.63 **	.72 **	-.62 **	-.42 *	.61 **	-.11	.52 **	.07	.19	-.11	.18	.14	-.07	-.10	.02	-.10	--
18. Prox to 4-Year Inst	0.67	(0.48)	.07	.05	-.22	-.29	.07	.40 *	.00	-.08	-.24	-.22	-.24	-.11	-.07	.37 *	.37 *	-.53 **	.18

Note. *N* = 33 institutions. All categorical variables dummy coded, including Workforce Orientation, City and Rural locations (Suburban is reference category), and Proximity to 4-year Institution. **p* < .05, ***p* < .01.

Chapter 5: Quantitative Analyses of Student Data (Multilevel Models)

5.1 Sample Descriptive Statistics

The sample analyzed consisted of a total of 58,492 degree-seeking students who had first enrolled in one of the 34 Washington community and technical colleges between summer of 2010 and spring of 2012 (although, as explained earlier, the institutional $N = 33$ for this sample).

There were 31,423 students in the 2010 entry Cohort and 27,069 in the 2011 Cohort.

Disaggregated descriptive statistics for both cohorts are shown in Table 8.

Table 8. *Disaggregated Sample Descriptive Statistics across all Students*

Variable	2010 Cohort				2011 Cohort			
	Mean	(SD)	Min	Max	Mean	(SD)	Min	Max
<i>Student-Level Outcomes</i>								
Any Award (1=yes)	0.31	(0.46)	0	1	0.29	(0.46)	0	1
Earned Cert/Degree (1=yes)	0.24	(0.43)	0	1	0.24	(0.43)	0	1
Earned Deg/Transfer (1=yes)	0.22	(0.42)	0	1	0.21	(0.41)	0	1
Earned Degree (1=yes)	0.15	(0.36)	0	1	0.16	(0.36)	0	1
<i>Student-Level Predictors</i>								
Workforce Deg Intent (1=yes)	0.49	(0.50)	0	1	0.47	(0.50)	0	1
Gender (1=Female)	0.48	(0.50)	0	1	0.48	(0.50)	0	1
Part-Time (1=yes)	0.22	(0.42)	0	1	0.21	(0.41)	0	1
Under-Rep Minority (1=yes)	0.28	(0.45)	0	1	0.30	(0.46)	0	1
DevEd Math + Engl (1=yes)	0.25	(0.43)	0	1	0.25	(0.44)	0	1
DevEd Math or Engl (1=yes)	0.66	(0.47)	0	1	0.66	(0.47)	0	1
Graduated High School (1=yes)	0.79	(0.41)	0	1	0.78	(0.41)	0	1
Disability (1=yes)	0.06	(0.24)	0	1	0.06	(0.24)	0	1
Has Children/Depend (1=yes)	0.22	(0.42)	0	1	0.22	(0.41)	0	1
Single Parent (1=yes)	0.11	(0.31)	0	1	0.11	(0.31)	0	1
Need-based Fin Aid (1=yes)	0.43	(0.50)	0	1	0.46	(0.50)	0	1
Age (Years)	24.60	(9.00)	16	80	24.39	(8.77)	14	74
<i>Institution-Level Predictors</i>								
Size (Headcount)	12551	(6374)	3703	32744	11902	(6220)	3709	31996
Location: City	0.21	(0.42)	0	1	0.21	(0.42)	0	1
Location: Rural	0.12	(0.33)	0	1	0.12	(0.33)	0	1
Tuition % of Revenue	0.18	(0.09)	0.05	0.42	0.19	(0.09)	0.04	0.40
Workforce Orient Status	0.35	(0.17)	0.07	0.86	0.35	(0.17)	0.06	0.83
FT Fac:Student Ratio X 100	0.77	(0.19)	0.44	1.16	0.77	(0.23)	0.21	1.20

Note. $N = 31,423$ degree-seeking students in the 2010 Cohort and 27,069 in the 2011 Cohort.

As can be seen in Table 9, the students averaged 24-25 years old; this is much older than traditionally aged students enrolling for the first time at four-year institutions. Because there was some skew in the data, I also computed the median ages as well, and found the medians to be 20 and 19 for the 2010 and 2011 cohorts, respectively (much closer but still older than traditionally aged four-year college students). Across both cohorts, about half of the students were female, and nearly half indicated a workforce intent for their degree (49% and 47% for each cohort, respectively). About 22% of students were part-time, and only 28 to 30% of students were self-identified as under-represented minority. About a quarter of the students in each cohort had taken developmental education coursework in both Math and English (meaning they were below college level academic preparedness in those areas), and approximately two-thirds had enrolled in at least one developmental education course. A sizable portion of the sample reported having children or dependents (22%), and 11% said they were single parents. Finally, just under half of the students in both cohorts received need-based financial aid (43% and 46%, respectively).

For the 2010 Cohort, 31% of first time, degree-seeking students had earned any award (certificate of 45 or more credits or an associate's degree) or had successfully transferred to a four-year institution within four years of initial enrollment; 24% had earned either a certificate or degree, and 22% had earned a degree or had transferred to a four-year institution. For the 2011 Cohort, the statistics after four years were quite similar: 29% had earned any award (certificate of 45 or more credits or an associate's degree) or had successfully transferred to a four-year institution within four years of initially enrolling in college, while 24% had earned either a certificate or degree, and 21% had earned a degree or transferred (see again Table 9).

Disaggregated zero-order correlations among student-level variables are provided in Appendix B. Based on those observed correlations, and to best tap into the non-traditional

student status represented in the community college population, I decided to use one predictor variable capturing single parents with children, instead of two predictors (all students with children and single parent status), in the prediction models. Additionally, for brevity, I decided to include only one measure of college academic preparedness – students identified as having had enrolled in both English and Math developmental education courses, rather than students who had enrolled in at least one development Math or developmental English course (I also note that subsequent model checks with both of these latter predictors entered together did not change results substantively).

5.2 Overview of Models

Recall that hierarchical generalized linear modeling (HGLM) was used to test relationships between institution- and student-level predictors student-level completion, a binary outcome. Recall also that the student-level outcome variable was defined in several ways (see Table 9), and for each type of student intent and outcome, sub-models were estimated.

- 1) **Model 1:** Baseline (no fixed predictors; only institution membership was included as random factor)
- 2) **Model 2:** Model 1 + Student-level characteristics added as fixed effects predictors together, to determine unique effects of each on outcomes, as well as approximate proportion of variance in outcomes accounted for by student characteristics
- 3) **Model 3:** Model 1 + Institution-level characteristics added as fixed effects predictors, one at a time, to determine direct effects (student characteristics not included)
- 4) **Model 4:** Model 1 + Institution-level characteristics added as fixed effects predictors together, to determine unique effects on outcomes, as well as approximate proportion of variance in the outcome accounted for by the institutional characteristics (student characteristics not included)
- 5) **Model 5:** Model 2 + 4: Both student and institutional characteristics added together as fixed effects to determine the total approximate variance in the outcomes explained by the model
- 6) **Model 6:** Model 2 + 4 + Two-way cross-level interactions among institution and student characteristics added to test whether joint effects exist (only for all-students)

Table 9. Models Used by Type of Outcome and Student Intent

Outcome	Student Intent	Models
Any Award or Transfer	Any degree-seeking students	1-4,6
Certificate or Degree	Degree-seeking workforce students	1-5
Certificate	Degree-seeking workforce students	1-5
Degree	Degree-seeking workforce students	1-5
Degree or Transfer	Degree-seeking transfer students	1-5
Transfer	Degree-seeking transfer students	1-5
Degree	Degree-seeking transfer students	1-5

5.3 Approximate ICC and Pseudo-R² Computation Method

Pseudo-R² and the approximate intraclass correlation coefficient (ICC) were calculated using a method that assumes the outcome, Y, is a dichotomization of an unknown latent continuous variable, Y, with a level-1 residual that follows the logistic distribution (Snijders & Bosker, 2012). The mean and variance of the logistic distribution are 0 and $\pi^2/3 \approx 3.29$, respectively (Evans, Hastings, & Peacock, 2000). Accordingly, I employed an expanded use of the McKelvey-Zavoina *pseudo-R²* measure for explained variance for both fixed and random effects (McKelvey & Zavonia, 1975), as described in Snijders and Bosker (2012 p. 305-306).

Specifically, the explained model variance R_{dicho}^2 is calculated as: $\frac{\sigma_F^2}{\sigma_F^2 + \tau_0^2 + \sigma_R^2}$ where σ_F^2 is the variance of the predicted outcomes for each participant (explained variance), τ_0^2 is the unexplained variance of the level two intercepts, and σ_R^2 is a constant derived from the unexplained variance in a logistic distribution, calculated as $\pi^2/3$ or 3.29.

5.4 Multilevel Prediction Model Results

Model results are provided in Tables 10-17 for Models 2, 3, 4, and 5-6.

Table 10. Results for Model 2: Unique Student Characteristic Effects (2010 Cohort)

<i>Fixed Effects</i>	All Students:			Transfer-Intent Students									Workforce-Intent Students								
	Any Award			Trans/Deg			Transfer			Degree			Cert/Deg			Certificate			Degree		
	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>
Intercept (Mean)	-1.30	0.07	<.001	-1.81	0.08	<.001	-2.88	0.13	<.001	-2.67	0.09	<.001	-1.51	0.10	<.001	-1.51	0.10	<.001	-2.65	0.09	<.001
Workforce Intent	-0.03	0.01	.018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gender (Female)	0.11	0.01	<.001	0.12	0.02	<.001	-0.02	0.03	.486	0.18	0.02	<.001	0.08	0.02	<.001	0.08	0.02	<.001	-0.01	0.03	.553
Part-Time Enrol	-0.28	0.02	<.001	-0.23	0.03	<.001	0.21	0.03	<.001	-0.77	0.04	<.001	-0.35	0.03	<.001	-0.35	0.03	<.001	-0.53	0.04	<.001
URM	-0.09	0.01	<.001	-0.11	0.02	<.001	-0.06	0.03	.077	-0.12	0.03	<.001	-0.07	0.02	.002	-0.07	0.02	<.001	-0.17	0.03	<.001
DevEd Math+Eng	-0.15	0.02	<.001	-0.21	0.02	<.001	-0.11	0.04	.002	-0.22	0.03	<.001	-0.13	0.02	<.001	-0.13	0.02	.001	-0.04	0.03	.159
HS Grad	0.06	0.02	<.001	0.08	0.03	.004	0.11	0.04	.011	0.05	0.03	.139	0.06	0.02	.002	0.06	0.02	<.001	0.18	0.03	<.001
Disability	-0.10	0.03	<.001	-0.14	0.05	.003	-0.22	0.08	.007	-0.06	0.05	.237	-0.09	0.04	.005	-0.09	0.04	.005	-0.09	0.05	.052
Single Parent	-0.15	0.02	<.001	-0.24	0.05	<.001	-0.10	0.07	.162	-0.28	0.05	<.001	-0.14	0.03	<.001	-0.14	0.03	<.001	-0.23	0.04	<.001
Financial Aid	-0.07	0.01	<.001	-0.10	0.02	<.001	-0.25	0.04	<.001	0.03	0.02	.252	0.00	0.02	.392	0.00	0.02	.870	0.05	0.03	.083
Age	0.09	0.01	<.001	-0.19	0.03	<.001	-0.35	0.06	<.001	-0.05	0.04	.196	0.19	0.02	<.001	0.19	0.02	<.001	0.10	0.02	<.001
<i>Random Effect</i>	<i>Var</i>			<i>Var</i>			<i>Var</i>			<i>Var</i>			<i>Var</i>			<i>Var</i>			<i>Var</i>		
Between-Colleges	0.13			0.06			0.15			0.04			0.23			0.23			0.08		
<i>Fit Indices</i>																					
Pseudo-R ²	0.057			0.069			0.139			0.151			0.100			0.103			0.098		

Note. All predictors either standardized into z-scores or effect coded.

Table 11. Results for Model 2: Unique Student Characteristic Effects (2011 Cohort)

<i>Fixed Effects</i>	All Students:			Transfer-Intent Students									Workforce-Intent Students								
	Any Award			Trans/Deg			Transfer			Degree			Cert/Deg			Certificate			Degree		
	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>
Intercept (Mean)	-1.53	0.06	<.001	-2.05	0.08	<.001	-3.28	0.13	<.001	-2.49	0.09	<.001	-1.61	0.09	<.001	-2.25	0.13	<.001	-2.61	0.09	<.001
Workforce Intent	-0.03	0.02	.041	--	--	--															
Gender (Female)	0.07	0.01	<.001	0.079	0.02	.001	-0.12	0.03	<.001	0.15	0.02	<.001	0.06	0.02	.007	0.15	0.03	<.001	-0.05	0.03	.063
Part-Time Enrol	-0.45	0.02	<.001	-0.49	0.03	<.001	-0.24	0.05	<.001	-0.56	0.04	<.001	-0.43	0.03	<.001	-0.28	0.04	<.001	-0.49	0.04	<.001
URM	-0.13	0.02	<.001	-0.19	0.02	<.001	-0.15	0.04	<.001	-0.17	0.03	<.001	-0.06	0.02	.008	0.07	0.03	.013	-0.20	0.03	<.001
DevEd Math+Eng	-0.15	0.02	<.001	-0.20	0.02	<.001	-0.15	0.04	<.001	-0.18	0.03	<.001	-0.11	0.03	<.001	-0.17	0.03	<.001	-0.02	0.03	.469
HS Grad	0.11	0.02	<.001	0.08	0.03	.003	0.08	0.04	.060	0.07	0.03	.036	0.15	0.03	<.001	0.06	0.03	.090	0.20	0.04	<.001
Disability	-0.13	0.03	<.001	-0.18	0.05	<.001	-0.30	0.09	.002	-0.10	0.06	.082	-0.08	0.04	.067	0.00	0.05	.966	-0.12	0.06	.035
Single Parent	-0.14	0.02	<.001	-0.22	0.05	<.001	-0.09	0.08	.249	-0.25	0.06	<.001	-0.12	0.03	<.001	-0.08	0.04	.049	-0.13	0.04	.001
Financial Aid	-0.06	0.02	<.001	-0.08	0.02	<.001	-0.20	0.04	<.001	0.00	0.02	.997	0.02	0.02	.433	0.00	0.03	.975	0.04	0.03	.136
Age	0.07	0.02	<.001	-0.20	0.03	<.001	-0.26	0.06	<.001	-0.14	0.04	<.001	0.17	0.02	.001	0.22	0.02	.001	0.04	0.02	.080
<i>Random Effect</i>	<i>Var</i>			<i>Var</i>			<i>Var</i>			<i>Var</i>			<i>Var</i>			<i>Var</i>			<i>Var</i>		
Between-Colleges	0.07			0.02			0.05			0.04			0.17			0.38			0.08		
<i>Fit Indices</i>																					
Pseudo-R ²	0.066			0.080			0.086			0.071			0.096			0.117			0.094		

Note. All predictors either standardized into z-scores or effect coded.

Table 12. Results for Model 3: Direct Institutional Characteristic Effects (2010 Cohort)

<i>Fixed Effects</i>	All Students:			Transfer-Intent Students									Workforce-Intent Students									
	Any Award			Trans/Deg			Transfer			Degree			Cert/Deg			Certificate			Degree			
	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	
Intercept (Mean)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Size (Headcount)	-0.75	0.06	<.001	-0.13	0.05	.019	0.06	0.09	.522	-0.13	0.05	.019	-0.19	0.06	.006	-0.19	0.09	.042	-0.21	0.06	.001	
Location: City	-0.04	0.12	.752	-0.22	0.09	.017	0.38	0.14	.013	-0.22	0.09	.017	-0.12	0.17	.468	-0.12	0.17	.468	-0.29	0.11	.016	
Location: Rural	-0.01	0.14	.930	0.17	0.09	.074	-0.23	0.18	.195	0.17	0.10	.112	0.06	0.20	.764	0.06	0.20	.764	0.26	0.13	.057	
Tuition Rev	-0.14	0.06	.035	-0.08	0.05	.146	-0.04	0.09	.670	-0.08	0.05	.146	-0.16	0.09	.098	-0.16	0.09	.098	-0.21	0.06	.002	
WF Orientation	0.25	0.05	<.001	-0.04	0.09	.661	-0.28	0.15	.061	-0.04	0.09	.661	0.36	0.07	<.001	0.36	0.07	<.001	0.18	0.06	.007	
FT Fac:Stu	0.01	0.07	.858	0.03	0.06	.646	0.01	0.09	.938	0.03	0.06	.646	0.02	0.09	.818	0.02	0.09	.818	0.13	0.06	.052	

Note. All predictors either standardized into z-scores or effect coded. Model fit indices and random effects not computed for this set of analyses given that each predictor represents its own model.

Table 13. Results for Model 3: Direct Institutional Characteristic Effects (2011 Cohort)

<i>Fixed Effects</i>	All Students:			Transfer-Intent Students									Workforce-Intent Students									
	Any Award			Trans/Deg			Transfer			Degree			Cert/Deg			Certificate			Degree			
	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	
Intercept (Mean)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Size (Headcount)	-0.11	0.04	.019	-0.09	0.03	.011	0.00	0.05	.965	-0.12	0.04	.006	-0.11	0.08	.167	-0.01	0.12	.904	-0.17	0.06	.011	
Location: City	-0.10	0.08	.255	-0.14	0.06	.025	0.18	0.09	.067	-0.27	0.06	<.001	-0.05	0.14	.746	0.22	0.21	.305	-0.31	0.11	.008	
Location: Rural	0.10	0.10	.303	0.21	0.07	.007	-0.16	0.12	.197	0.34	0.08	<.001	0.04	0.16	.800	-0.20	0.25	.439	0.26	0.13	.051	
Tuition Rev	-0.06	0.05	.225	-0.03	0.04	.466	0.09	0.05	.116	-0.09	0.04	.058	-0.08	0.08	.305	0.02	0.12	.880	-0.15	0.06	.021	
WF Orientation	0.15	0.04	.001	-0.10	0.06	.102	-0.15	0.10	.129	-0.05	0.05	.480	0.28	0.06	<.001	0.35	0.10	.002	0.11	0.06	.101	
FT Fac:Stu	0.02	0.05	.671	0.03	0.04	.361	0.03	0.06	.569	0.03	0.06	.547	0.01	0.08	.875	-0.09	0.12	.434	0.11	0.06	.083	

Note. All predictors either standardized into z-scores or effect coded. Model fit indices and random effects not computed for this set of analyses given that each predictor represents its own model.

Table 14. Results for Model 4: Unique Institutional Characteristic Effects (2010 Cohort)

<i>Fixed Effects</i>	All Students:			Transfer-Intent Students									Workforce-Intent Students								
	Any Award			Trans/Deg			Transfer			Degree			Cert/Deg			Certificate			Degree		
	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>
Intercept (Mean)	-0.76	0.06	<.001	-1.08	0.07	<.001	-2.41	0.11	<.001	-1.60	0.07	<.001	-0.90	0.09	<.001	-0.90	0.09	<.001	-1.84	0.07	<.001
Size (Headcount)	-0.16	0.07	.032	-0.10	0.07	.196	-0.05	0.13	.696	-0.12	0.07	.104	-0.12	0.11	.293	-0.12	0.11	.293	-0.03	0.09	.710
Location: City	0.11	0.10	.279	0.16	0.10	.129	0.49	0.17	.010	-0.13	0.10	.200	-0.03	0.15	.838	-0.03	0.15	.838	-0.18	0.12	.144
Location: Rural	-0.13	0.11	.278	-0.13	0.12	.299	-0.35	0.21	.110	0.06	0.12	.618	0.04	0.18	.826	0.04	0.18	.826	0.15	0.14	.283
Tuition Rev	-0.05	0.06	.432	-0.09	0.06	.142	-0.11	0.11	.322	-0.03	0.06	.617	-0.01	0.09	.898	-0.01	0.09	.898	-0.11	0.07	.146
WF Orientation	0.21	0.05	<.001	-0.22	0.09	.021	-0.36	0.15	.025	-0.04	0.09	.630	0.34	0.08	<.001	0.34	0.08	<.001	0.13	0.06	.044
FT Fac:Stu	-0.11	0.05	.048	-0.02	0.06	.767	0.05	0.11	.621	-0.07	0.06	.255	-0.12	0.08	.162	-0.12	0.08	.162	0.01	0.07	.827
<i>Random Effect</i>	<i>Var</i>			<i>Var</i>			<i>Var</i>			<i>Var</i>			<i>Var</i>			<i>Var</i>			<i>Var</i>		
Between-Colleges	0.06			0.06			0.18			0.05			0.15			0.15			0.08		
<i>Fit Indices</i>																					
Pseudo-R ²	0.031			0.026			0.023			0.089			0.067			0.067			0.028		

Note. All predictors either standardized into z-scores or effect coded.

Table 15. Results for Model 4: Unique Institutional Characteristic Effects (2011 Cohort)

<i>Fixed Effect</i>	All Students:			Transfer-Intent Students									Workforce-Intent Students									
	Any Award			Trans/Deg			Transfer			Degree			Cert/Deg			Certificate			Degree			
	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	
Intercept (Mean)	-0.78	0.05	<.001	-0.98	0.04	<.001	-2.42	0.07	<.001	-1.47	0.05	<.001	-0.95	0.08	<.001	-1.83	0.13	<.001	-1.90	0.08	<.001	
Size (Headcount)	-0.11	0.06	.076	-0.09	0.04	.029	-0.12	0.07	.081	-0.05	0.05	.344	-0.05	0.11	.670	-0.07	0.17	.663	0.02	0.10	.874	
Location: City	-0.02	0.08	.805	-0.09	0.05	.109	0.21	0.09	.027	-0.23	0.07	.001	0.02	0.13	.889	0.26	0.21	.218	-0.30	0.13	.023	
Location: Rural	0.06	0.09	.528	0.17	0.07	.026	-0.17	0.13	.187	0.29	0.08	.001	0.06	0.15	.681	-0.09	0.25	.709	0.21	0.15	.157	
Tuition Rev	0.05	0.05	.374	0.04	0.03	.233	0.13	0.06	.034	-0.02	0.04	.654	0.02	0.09	.835	0.10	0.14	.495	-0.08	0.08	.356	
WF Orientation	0.15	0.04	.002	-0.13	0.05	.014	-0.15	0.09	.086	-0.09	0.07	.151	0.30	0.07	<.001	0.45	0.11	.001	0.05	0.07	.442	
FT Fac:Stu	-0.06	0.04	.184	0.01	0.03	.698	0.03	0.06	.567	0.00	0.05	.915	-0.10	0.07	.208	-0.21	0.12	.085	0.09	0.07	.212	
<i>Random Effect</i>	<i>Var</i>		<i>p</i>	<i>Var</i>		<i>p</i>	<i>Var</i>		<i>p</i>	<i>Var</i>		<i>p</i>	<i>Var</i>		<i>p</i>	<i>Var</i>		<i>p</i>	<i>Var</i>		<i>p</i>	
Between-Colleges	0.04		<.001	0.01		<.001	0.03		<.001	0.01		<.001	0.11		<.001	0.29		<.001	0.09		<.001	
<i>Fit Indices</i>																						
Pseudo-R ²	0.017			0.005			0.009			0.011			0.047			0.086			0.031			

Note. All predictors either standardized into z-scores or effect coded.

Table 16. Results for Models 5-6: Unique Combined Effects (2010 Cohort)

	All Students:			Transfer-Intent Students									Workforce-Intent Students								
	Any Award			Trans/Deg			Transfer			Degree			Cert/Deg			Certificate			Degree		
<i>Fixed Effects</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>
Intercept (Mean)	-1.40	0.06	<.001	-1.84	0.09	<.001	-2.93	0.15	<.001	-2.69	0.10	<.001	-1.57	0.10	<.001	-1.57	0.10	<.001	-2.68	0.10	<.001
<i>Student</i>																					
Workforce Intent	-0.01	0.02	.572	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gender (Female)	0.11	0.01	<.001	0.12	0.02	<.001	-0.02	0.03	.490	0.18	0.02	<.001	0.09	0.02	<.001	0.09	0.02	<.001	-0.01	0.03	.600
Part-Time Enrol	-0.29	0.02	<.001	-0.24	0.03	<.001	0.21	0.03	<.001	-0.77	0.04	<.001	-0.36	0.03	<.001	-0.36	0.03	<.001	-0.53	0.04	<.001
URM	-0.09	0.01	<.001	-0.11	0.02	<.001	-0.06	0.03	.066	-0.12	0.03	<.001	-0.07	0.02	.002	-0.07	0.02	.002	-0.17	0.03	<.001
DevEd Math+Eng	-0.15	0.02	<.001	-0.21	0.02	<.001	-0.11	0.04	.002	-0.22	0.03	<.001	-0.13	0.02	<.001	-0.13	0.02	<.001	-0.04	0.03	.147
HS Grad	0.07	0.02	<.001	0.08	0.03	.004	0.11	0.04	.014	0.05	0.03	.130	0.07	0.02	.003	0.07	0.02	.003	0.18	0.03	<.001
Disability	-0.10	0.03	<.001	-0.14	0.05	.003	-0.22	0.08	.007	-0.06	0.05	.224	-0.09	0.04	.013	-0.09	0.04	.013	-0.09	0.05	.053
Single Parent	-0.16	0.02	<.001	-0.24	0.05	<.001	-0.10	0.07	.157	-0.28	0.05	<.001	-0.15	0.03	<.001	-0.15	0.03	<.001	-0.23	0.04	<.001
Financial Aid	-0.07	0.01	<.001	-0.10	0.02	<.001	-0.26	0.04	<.001	0.03	0.02	.281	0.00	0.02	.821	0.00	0.02	.821	0.04	0.03	.114
Age	0.09	0.01	<.001	-0.19	0.03	<.001	-0.36	0.06	<.001	-0.05	0.04	.202	0.20	0.02	<.001	0.20	0.02	<.001	0.10	0.02	<.001
<i>Institutional</i>																					
Size (Headcount)	-0.12	0.06	.054	-0.08	0.07	.236	-0.06	0.11	.624	-0.10	0.06	.114	-0.12	0.10	.268	-0.12	0.10	.268	-0.07	0.09	.445
Location: City	0.05	0.08	.519	0.19	0.09	.058	0.41	0.16	.015	-0.06	0.09	.461	-0.12	0.14	.389	-0.12	0.14	.389	-0.10	0.12	.402
Location: Rural	-0.06	0.10	.578	-0.14	0.11	.242	-0.27	0.19	.167	0.01	0.11	.938	0.07	0.16	.678	0.07	0.16	.678	0.07	0.14	.627
Tuition Rev	-0.07	0.05	.179	-0.12	0.06	.041	-0.11	0.09	.263	-0.06	0.05	.285	-0.01	0.09	.864	-0.01	0.09	.864	-0.05	0.07	.525
WF Orientation	0.10	0.05	.045	-0.16	0.08	.069	-0.23	0.14	.116	-0.03	0.08	.728	0.32	0.07	<.001	0.32	0.07	<.001	0.09	0.06	.144
FT Fac:Stu	-0.09	0.05	.064	-0.01	0.06	.891	0.06	0.10	.538	-0.07	0.05	.214	-0.11	0.08	.176	-0.11	0.08	.176	0.02	0.06	.731
<i>Cross-Level Interact</i>																					
WF Int * Size	0.00	0.02	.874																		
WF Int * City	-0.16	0.03	<.001																		
WF Int * Rural	0.08	0.04	.035																		
WF Int * Tuition	0.03	0.02	.065																		
WF Int * WF Orient	0.18	0.03	<.001																		
WF Int * F:S Ratio	0.00	0.02	.893																		
<i>Random Effect</i>																					
Between-Colleges	0.04		<.001	0.05		<.001	0.14		<.001	0.03		<.001	0.12		<.001	0.12		<.001	0.07		<.001
<i>Fit Indices</i>																					
Pseudo-R ²	0.062			0.070			0.140			0.153			0.107			0.107			0.098		

Note. All predictors either standardized into z-scores or effect coded.

Table 17. Results for Models 5-6: Unique Combined Effects (2011 Cohort)

	All Students:			Transfer-Intent Students									Workforce-Intent Students									
	Any Award			Trans/Deg			Transfer			Degree			Cert/Deg			Certificate			Degree			
<i>Fixed Effects</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	<i>Coeff</i>	<i>SE</i>	<i>p</i>	
Intercept (Mean)	-1.54	0.06	<.001	-2.02	0.08	<.001	-3.27	0.14	<.001	-2.47	0.10	<.001	-1.59	0.10	<.001	-2.26	0.14	<.001	-2.65	0.10	<.001	
<i>Student</i>																						
Workforce Intent	0.00	0.02	.913	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Gender (Female)	0.07	0.01	<.001	0.07	0.02	.001	-0.12	0.03	<.001	0.15	0.02	<.001	0.06	0.02	.005	0.15	0.03	<.001	-0.05	0.03	.070	
Part-Time Enrol	-0.45	0.02	<.001	-0.49	0.03	<.001	-0.24	0.05	<.001	-0.56	0.04	<.001	-0.43	0.03	<.001	-0.28	0.04	<.001	-0.49	0.04	<.001	
URM	-0.13	0.02	<.001	-0.18	0.02	<.001	-0.15	0.04	<.001	-0.16	0.03	<.001	-0.06	0.02	.011	0.08	0.03	.010	-0.20	0.03	<.001	
DevEd Math+Eng	-0.15	0.02	<.001	-0.20	0.02	<.001	-0.15	0.04	<.001	-0.19	0.03	<.001	-0.11	0.03	<.001	-0.17	0.04	<.001	-0.03	0.03	.365	
HS Grad	0.11	0.02	<.001	0.08	0.03	.003	0.08	0.04	.065	0.06	0.03	.042	0.15	0.03	<.001	0.06	0.03	.067	0.21	0.03	<.001	
Disability	-0.13	0.03	<.001	-0.18	0.05	.001	-0.30	0.09	.002	-0.10	0.06	.080	-0.08	0.04	.067	0.00	0.05	.983	-0.12	0.06	.034	
Single Parent	-0.14	0.02	<.001	-0.22	0.05	<.001	-0.09	0.08	.273	-0.26	0.06	<.001	-0.13	0.03	<.001	-0.08	0.04	.050	-0.13	0.04	.001	
Financial Aid	-0.06	0.02	<.001	-0.09	0.02	<.001	-0.20	0.04	<.001	-0.01	0.02	.823	0.02	0.02	.400	0.00	0.03	.969	0.04	0.03	.156	
Age	0.07	0.02	<.001	-0.20	0.04	<.001	-0.27	0.06	<.001	-0.14	0.04	<.001	0.17	0.02	<.001	0.23	0.02	<.001	0.04	0.02	.076	
<i>Institutional</i>																						
Size (Headcount)	-0.08	0.06	.174	-0.07	0.04	.091	-0.10	0.07	.169	-0.03	0.05	.590	-0.05	0.11	.648	-0.08	0.16	.608	0.00	0.09	.988	
Location: City	-0.03	0.08	.738	-0.08	0.05	.142	0.21	0.10	.037	-0.22	0.07	.003	0.01	0.13	.938	0.22	0.20	.262	-0.27	0.11	.025	
Location: Rural	0.10	0.09	.276	0.13	0.07	.069	-0.17	0.13	.208	0.24	0.08	.007	0.06	0.16	.691	-0.09	0.23	.709	0.19	0.13	.154	
Tuition Rev	0.02	0.04	.625	-0.02	0.03	.504	0.07	0.06	.271	-0.07	0.04	.104	0.03	0.09	.705	0.11	0.13	.414	-0.05	0.08	.508	
WF Orientation	0.11	0.05	.024	-0.08	0.05	.117	-0.09	0.09	.304	-0.05	0.06	.424	0.31	0.07	<.001	0.43	0.11	<.001	0.07	0.06	.302	
FT Fac:Stu	-0.07	0.05	.098	-0.01	0.03	.727	0.03	0.06	.645	-0.03	0.04	.537	-0.12	0.07	.129	-0.20	0.11	.089	0.04	0.06	.566	
<i>Cross-Level Interact</i>																						
WF Int * Size	-0.02	0.02	.444																			
WF Int * City	0.05	0.03	.106																			
WF Int * Rural	-0.04	0.04	.292																			
WF Int * Tuition	0.02	0.02	.440																			
WF Int * WF Orient	0.13	0.03	<.001																			
WF Int * F:S Ratio	-0.02	0.02	.226																			
<i>Random Effect</i>																						
Between-Colleges	0.03		<.001	0.01		<.001	0.03		<.001	0.01		<.001	0.11		<.001	0.25		<.001	0.06		<.001	
<i>Fit Indices</i>																						
Pseudo-R ²	0.069			0.080			0.088			0.072			0.099			0.123			0.098			

Note. All predictors either standardized into z-scores or effect coded.

Model 1: Institution as Random Effect (“Empty” Model)

2010 Cohort. In the null model the predicted logit for a typical college student in the 2010 cohort sample is $\gamma_{00} = -0.73$ ($SE = 0.07$), which is statistically different from zero, $t(32) = -11.19$ $p < .001$, and there was considerable variation for the intercepts in this sample of institutions $\tau_{00} = 0.14$, $\chi^2(32) = 784.25$, $p < .001$ for the overall completion measure (of earning a certificate or degree or successfully transferring to a four-year institution). Estimated odds of overall (i.e., any type) completion within a typical institution is $\exp(-.73) = 0.48$, and thus the estimated probability of overall completion was approximately 33%. This value is close to the observed (disaggregated) overall completion rate of students (ignoring institutional variability) of 31% in the 2010 cohort sample. Explained variance using $pseudo-R^2 = 0.03$, indicating that the random effect of institution attended explained approximately 3% of the variance in outcomes.

2011 Cohort. Similarly, in the null model for 2011 cohort sample the predicted logit for a typical college student was $\gamma_{00} = -0.81$ ($SE = 0.05$), which is statistically different from zero, $t(32) = -17.11$, $p < .001$, and there was considerable variation for the intercepts in this sample of institutions $\tau_{00} = 0.07$, $\chi^2(32) = 399.71$, $p < .001$ for the overall completion measure. Estimated odds of overall completion within a typical institution is $\exp(-0.81) = 0.45$, and thus the estimated probability of overall completion is approximately 31%. This is close to the overall completion rate of students (ignoring institutional variability) of 29% in the 2011 cohort sample, as would be expected. The $pseudo-R^2 = 0.02$, indicating the random effect of institution attended explained approximately 2% of the variance in outcomes.

Model 2: Unique Effects of Student Characteristics

Model 2 included all of the student (level-1) covariates, but no level 2 predictors, to estimate the effects of the student level characteristics on the outcome variable. Demographic

variables (i.e., gender, ethnicity, prior education) represented by level-1 covariates were treated as control variables in this study and used to account for as much within school variation as possible in order to isolate the potential unique effects of institutional characteristics, and institution attended. All variables used in these models were either effect coded or standardized (z-scores) for ease of interpretation. I allowed only the intercepts to vary and fixed all student-level (level 1) coefficients in these models because the focus of the study is on the mean chance of “completion” at the institutional level rather than the varying relationships between the student-level covariates and the outcome variable(s). Table 10 shows the results for all outcomes in the 2010 cohort; Table 11 shows the same for the 2011 cohort. In all models the intercept (γ_{00}) represents the “average” student and the remaining institutional variation represents the random effect of specific institutional attendance (τ_{00}), which remained significant at the .001 level in all models.

For the main success indicator of all students: any award or transfer, all level-1 covariates were significant at the $p < .001$ level for both the 2010 and 2011 cohorts. All other variables held constant, female students, high school graduates, and older students were more likely to complete any award for both cohorts. In contrast, transfer students, students receiving need-based financial aid, students with a reported disability, and students enrolled in both levels of developmental education were less likely to complete any award, all other variables being held constant in the model. Students who reported being single parents, and students who began college as part-time students had the greatest predicted handicap to completing any award, all other variables being held constant at average values.

For transfer-intent students, all level-1 covariates were significant for the main outcome measure of completion for these students, earned degree or transferred, in the same direction as

for the any award outcome with the exception of age, which was negatively predictive of completion for transfer students (in both cohorts) rather than positively as was reported for all students.

Similarly, for the main outcome measure of completion for workforce students, earned certificate or degree, all level-1 covariates were significant (or marginally significant) and in the same direction as with the any award criterion, with the exception of students receiving need-based financial aid (in both cohorts), which was not significantly predictive of workforce completion all other factors being held constant. Again, in contrast with transfer students where older students were less likely to complete, age (being older) conferred a significant and positive advantage for workforce students, when all other variables were held constant.

Models 3 and 4: Direct and Unique Institutional Characteristics

2010 Cohort. For the 2010 cohort institutional size (headcount), tuition revenue as a percent of total revenue (a measure of institutional over-enrollment), and the programmatic focus of the institution (workforce versus transfer) were all directly predictive of overall student completion (any award or transfer). Institutional size was directly (negatively) predictive of all completion outcomes except transfer student transfer success, indicating that, with this exception, students are predicted to have lower completion rates in larger institutions. Tuition as a percent of total revenue is also negatively predictive of overall student completion, indicating that students attending institutions that are over-enrolled for their capacity have decreased predicted completion rates. This seems driven primarily by workforce student completion measures, as tuition as a percent of total revenue is significantly negatively predictive of workforce student degree completion and marginally negatively predictive of overall workforce student completion and certificate completion. An institution's orientation (workforce versus

transfer) was significant for overall student completion, indicating that workforce students are predicted to have high completion rates at workforce oriented institutions and transfer students greater predicted completion rates at transfer oriented institutions, and this overall effect seems largely driven by workforce student (degree and certificate) completion. An institution's location is not directly predictive for overall student completion, but does have differential effects for workforce and transfer student completion, indicating a potential interaction effect.

When modeled together, institutional size and the programmatic focus of the institution remain significant predictors of success, with students attending larger institutions predicted to be less likely to complete overall, and students predicted to be more likely to complete when attending an institution with a focus that matched their goals, including workforce students attending a workforce oriented institution and transfer students attending a transfer oriented institution. Interestingly, an institution's full-time (tenured or tenure track) faculty to student ratio becomes significantly predictive in the unique model but in an unexpected direction, with institutions that have higher percentages of tenured or tenure track instructors per student predicted to have lower success. Tuition as a percent of overall revenue did not remain significant when all predictors were modeled together, probably due the large overlap in variation between this indicator and overall institutional size (institutions that are significantly over-enrolled are also likely to be larger overall). Still, it is reasonable to assume that there was some decreased likelihood of success for students attending over-enrolled institutions. Institutional orientation remains predictive of both overall workforce and transfer student success in that workforce students are predicted to do better, and transfer students worse at workforce oriented institutions, Institutional location again appears to be differentially predictive of workforce and transfer student success, with transfer students being more likely to transfer and

less likely to complete a degree, and workforce students less likely to complete at degree at urban institutions, indicating a potential interaction effect.

2011 Cohort. For the 2011 cohort, institutional size and orientation (workforce versus transfer) had direct effects on outcomes for all students with respect to attainment of any award or transfer, similar to the 2010 group. Notably however, tuition as a percent of total revenue was no longer directly significant. Institutional size remained (directly) negatively predictive for overall transfer student success and for both workforce and transfer student degree completion. Location was (directly) negatively predictive for overall transfer student success, and for degree completion of both workforce and transfer students, with differential predictiveness indicating a possible interaction. The direct effect of institutional orientation (workforce versus transfer) was also significant for workforce student overall success and for certificate completion.

When all predictors were added to the model simultaneously, size became marginally (negatively) predictive of overall student completion, and remained significant for overall transfer student success. An institution's orientation (workforce versus transfer) remained uniquely significant when all level two variables were added to the model, with overall transfer success being negative in sign (predicting that transfer students will do better in transfer oriented institutions) and overall workforce success being positive (indicating that workforce students should do better in workforce oriented institutions). Location remained variably predictive for workforce and transfer student success, although this was probably due to differences in direction of effects, and was not uniquely predictive in the overall measure of student completion.

Models 5 and 6: Full Models

In the full model (Model 5) for each cohort, both student and institution-level predictors were included, and for the all-students model, interactions were tested (Model 6). At both the student and institutional levels, variables were either effect coded or standardized (Z scores) were utilized for ease of interpretation; I allowed only the intercepts to vary and fixed all student-level (level-1) coefficients in these models because the focus of the study is on the mean chance of “completion” at the institutional level rather than the varying relationships between the student-level covariates and the outcome (s). In all models run for this study, the intercept represents the “average” student’s likelihood of completion (in logits) in that model (γ_{00}) and the remaining institutional variation (τ_{00}) representing the random effect of institutional attendance remained significant at the $p = .001$ level. Model 6, used only for the all students: any award or transfer outcome, also included interaction terms examining whether the institutional characteristics differentially affected students pursuing a workforce degree versus students pursuing a transfer degree.

2010 Cohort. The predicted logit for a typical college student in the 2010 cohort sample is $\gamma_{00} = -1.40$ ($SE = .06$), which is statistically different from zero, $t(26) = -22.38$, $p < .001$, and there remained significant variation of institutional intercepts, representing the random effect of institutional attendance, $\tau_{00} = .04$, $\chi^2(26) = 291.36$, $p < .001$ for the overall completion measure (any award or transfer). The estimated odds of completion for a student at an “average” institution was 0.25, and thus the mean predicted probability of a first-time, degree-seeking college student earning any award or transferring to a four-year institution within four years of first enrolling in a Washington community or technical college was 20%, holding all predictors constant, for the 2010 cohort.

For students with an intent to earn a transfer degree, the predicted probability of earning a two year degree or successfully transferring to a four-year institution (the main measure of completion for transfer students) within four years of initially enrolling in a two-year institution was 14% ($\gamma_{00} = -1.84$ (SE = .09), $t(25) = -20.66$, $p < .001$, estimated odds of completion = .16). Similarly for students with a workforce degree intent, the predicted probability of earning a certificate of at least 45 college-level credits or a two-year degree (the main measure of completion for workforce students) was 17% ($\gamma_{00} = -1.57$ (SE = .10), $t(26) = -16.30$, $p < .001$, estimated odds of completion = .21).

Size. A college's size (headcount enrollment) was negatively predictive of the main completion measure for all students (any award or transfer), all other variables being held constant at average values in the model; students attending relatively larger institutions (+1 *SD* greater than average headcount) had a predicted completion rate of 18%, compared with 20% for students attending averaged sized institutions, and 22% for students attending smaller institutions.

Institutional orientation. There was a significant main effect of a college's orientation (a continuous measure of a college's workforce orientation): overall, students attending workforce oriented institutions (i.e., those that were +1 *SD* greater than average in their percentage of students enrolled in workforce programs) were more likely to complete any award or transfer (21%), and students were less likely to complete by this overall measure when attending a transfer oriented institution (18%) or an institution with an equal focus on transfer and workforce programs (20%), when all other predictors were held constant at average. Additionally, workforce students attending workforce-oriented institutions were far more likely to earn a certificate. With all other factors in the model held constant at average, workforce students

attending a workforce oriented institution had a 22% predicted probability of completion, versus these same students attending a transfer oriented institutions who had a 13% predicted probability of completion. There was also a significant interaction between the student's intended goal (workforce or transfer) and the orientation of the institution: workforce students had higher predicted overall completion than did transfer students when both attended workforce oriented institutions (24% versus 19%), while transfer students had higher predicted completion than workforce students when both attended transfer oriented institutions (21% versus 16%) when all other predictors were held constant at average (see Figure 5).

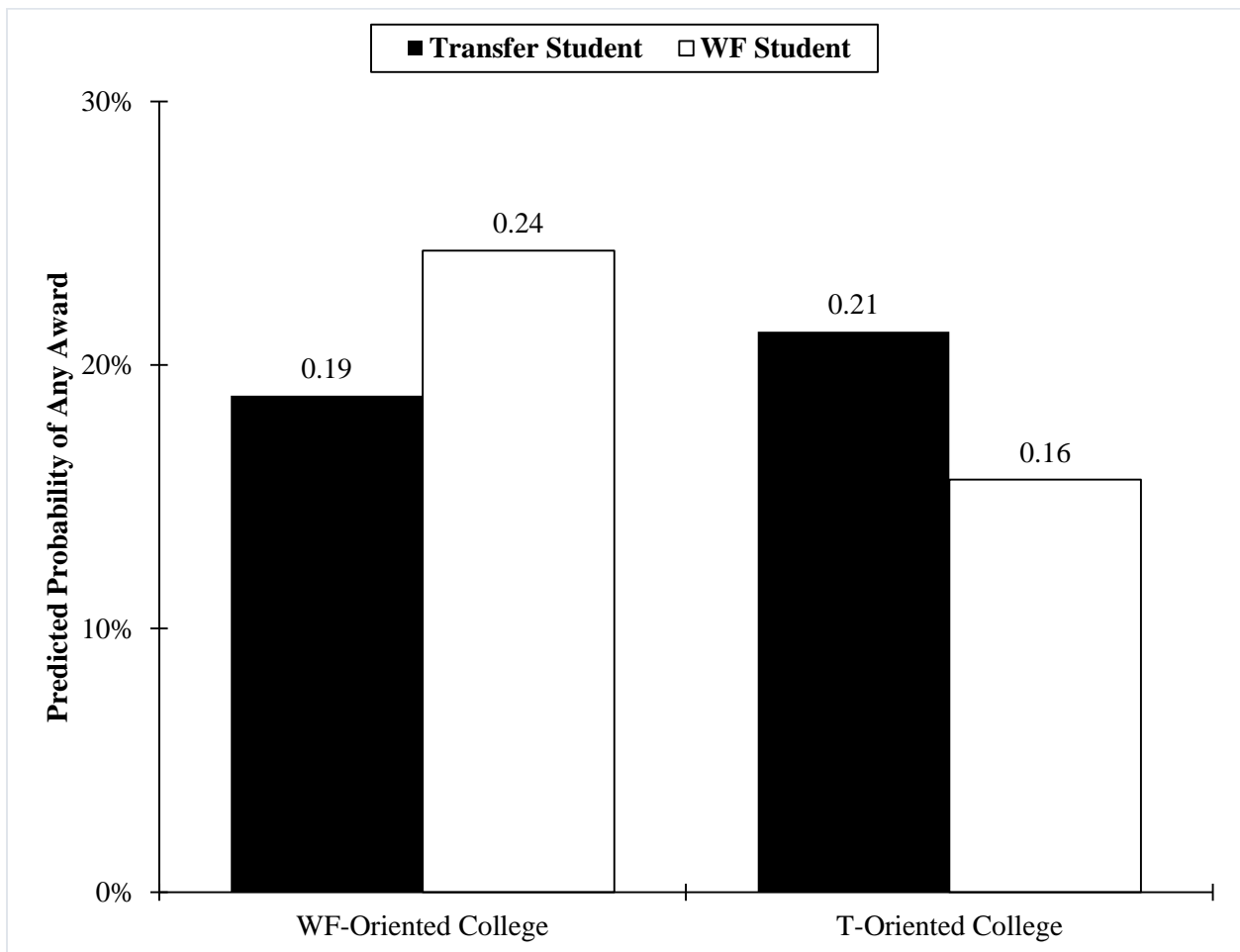


Figure 5. Predicted Probability of Any Award or Transfer for Different Institution Orientations by Student Degree Intent (2010 Cohort)

Location. Although there was no significant main effect of college location for all students (on the any award or transfer outcome), students with an intent to transfer were (marginally) significantly more likely to successfully complete ($\gamma = .19$ (SE = .09), $t(25) = -1.99$, $p = .058$) when attending urban institutions: all other factors being equal, transfer students attending an urban institution had a 16% predicted probability of completion, versus students attending suburban or rural institutions who had a 12% predicted probability. This could be the result of students at urban institutions being significantly more likely to transfer (before earning a degree) to a nearby four-year institution compared to students in less urban areas. There was also a significant interaction between college location and student degree intent. All other variables being held constant at average values, transfer students had a greater predicted rate of completion (any award or transfer) at urban colleges (24%) than did workforce students (18%). Conversely workforce students had a great predicted likelihood of overall completion than transfer students at suburban and small city colleges (21% vs. 19%) and at rural institutions (20% vs. 18%).

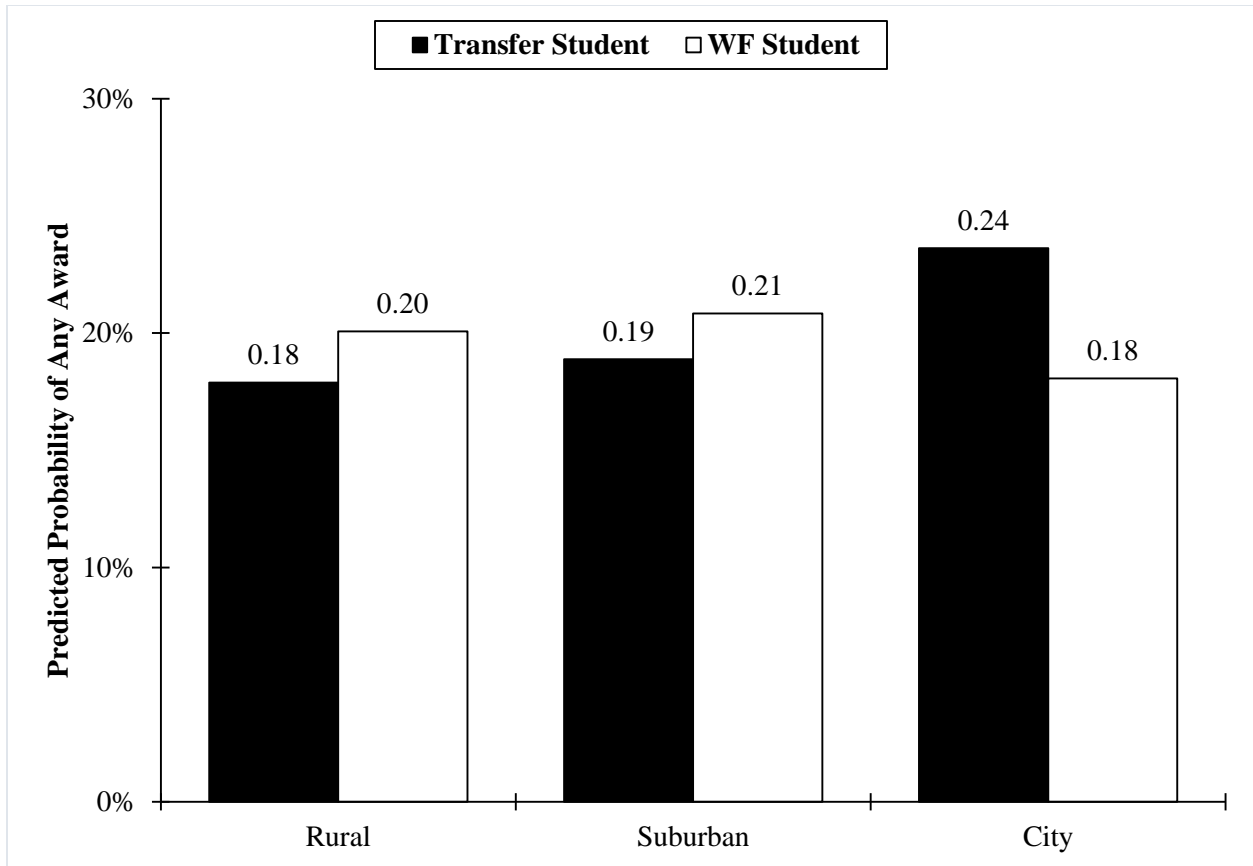


Figure 6. Predicted Probability of Any Award or Transfer for Different Institution Locations by Student Degree Intent (2010 Cohort)

Over-enrollment (tuition revenue share). While there was no main effect of this variable for all students, when the model was restricted to students with an intent to transfer there was a significant negative effect of attending an over-enrolled institution on a student's predicted likelihood of completion (any award or transfer): transfer students attending over-enrolled institutions had a 12% predicted probability of completion, while such students attending institutions that were not over-enrolled had a 15% predicted probability of completion. There was also a (marginally) significant interaction ($\gamma = 0.03$ ($SE = 0.02$), $t(26) = 1.84$, $p = .065$) between a student's degree intent and how over-enrolled an institution was (as measured by the percent of tuition revenue per total institutional revenues). Transfer students in significantly overenrolled institutions (regardless of the college's overall size) had lower predicted completion

rates (18%) than workforce students (19%) attending over-enrolled institutions, all other variables being held constant at average values. Conversely, transfer students in the least overenrolled institutions had greater predicted completion rates (22%) than did workforce students (20%) attending institutions that were the least over-enrolled. This effect seems to be driven large by transfer students. When the model is restricted to transfer only students (i.e., defining completion as earning a degree or transferring) and all other predictors are held constant, transfer students were less likely to complete (degree or transfer) at institutions with higher tuition revenues as a percentage of total revenue.

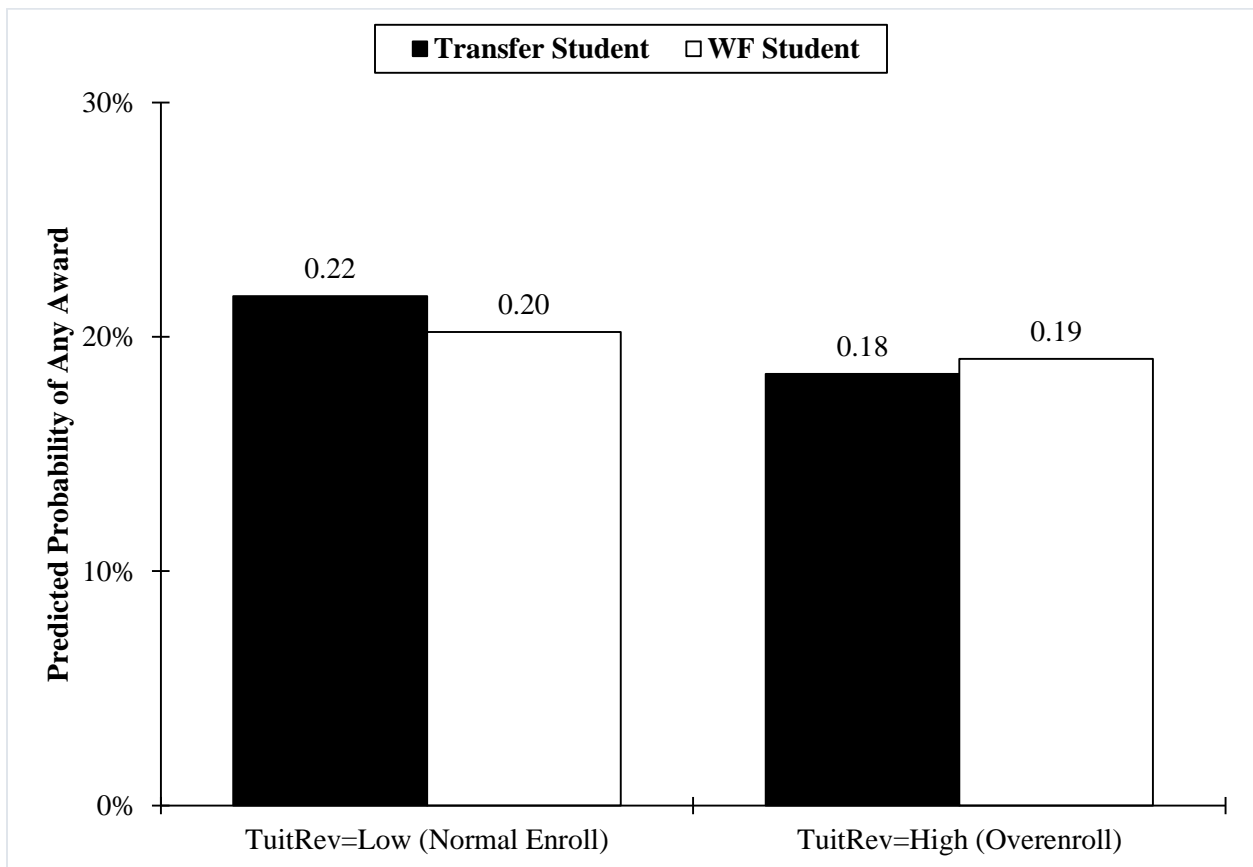


Figure 7. Predicted Probability of Any Award or Transfer for Levels of Over-enrollment by Student Degree Intent (2010 Cohort)

Full-time faculty:student ratio. Finally, the ratio of tenure (or tenure-track) faculty to students was (marginally) negatively significant in the model covering the all completions

outcome ($\gamma = -0.09$ ($SE = 0.05$), $t(26) = -1.93$, $p = .064$). All other variables being held constant at average, students attending institutions with *more* tenure-line faculty per student had a *decreased* likelihood of completion (18%), versus students attending institutions with the average ratio (20%) or a lower tenure-line faculty to student ratio (21%).

Student covariates. Most individual student characteristics were significantly predictive across all outcomes and results were discussed earlier in this chapter. Holding all other variables in the model constant at average values, being female and completing high school positively predicted completion probability, while being an underrepresented minority (URM) student, enrolling in developmental education, having a disability, and being a single parent negatively predicted completion for all students and the main measures of transfer and workforce completion. Starting college part-time represented a significant negative predictor of completion, with the exception of transfer without completing a degree, where it positively predicted completion. Receiving need-based financial aid was negatively predictive for all students, for any award or transfer, and for transfer intent students, but was not significantly predictive for workforce students' probability of completion. Holding all other variables constant at average values, age positively predicted completion for all students and for any award, but a student's age negatively predicted transfer student completion, with older students having significantly lower predicted probability than younger students. Conversely a student's age positively predicted completion for workforce students, with older students predicted to have greater likelihood of completion, all other factors being equal.

2011 Cohort. The predicted logit for a typical college student in the 2011 cohort sample is $\gamma_{00} = -1.54$ ($SE = 0.06$), which is statistically different from zero, $t(26) = -24.61$, $p < .001$, and there remained significant variation of institutional intercepts, representing the random effect of

institutional attendance, $\tau = 0.03$, $\chi^2(26) = 192.50$, $p < .001$ for the overall completion measure (of earning any award or successfully transferring to a four-year institution). Estimated odds of overall completion within a typical institution were 0.21, and thus the mean predicted probability of a first-time degree-seeking college student earning any award or transferring to a four-year institution within four years of first enrolling in a Washington community or technical college was 18%, holding all predictors constant, for the 2011 cohort. This is significantly lower than the actual completion rate of 29%, potentially indicating that unmeasured institutional effects remain (as is indicated in the model).

For transfer intent students, the predicted probability of earning a two year degree or successfully transferring to a four-year institution (the main measure of completion for transfer students) within four years of initially enrolling in a two-year institution was 12% ($\gamma = -2.02$ ($SE = .08$), $t(26) = -24.79$, $p < .001$, estimated odds = 0.13). Similarly for students with a workforce degree intent, the predicted probability of earning a certificate of at least 45 credits or a two year degree (the main measure of completion for workforce students) was 18%, ($\gamma = -1.59$ ($SE = 0.10$), $t(26) = -16.23$, $p < .001$, estimated odds of completion = 0.20).

Size. Unlike the 2010 Cohort, a college's size was no longer significantly (negatively) predictive of completion for all students. However, larger size was still marginally negatively predictive ($\gamma = -0.07$ ($SE = .04$), $t(26) = -1.76$, $p = .091$) for students pursuing a transfer degree: holding all other factors constant at average values transfer students attending larger institutions have an 11% predicted probability of completion, while students attending smaller institutions have a 12% predicted probability of completion.

Location. There was no main effect of a college's location for all students (any award or transfer), similar to the finding for 2010, nor were there significant interaction effects for the

sample of all students. However, transfer students attending a rural institution had greater predicted completion (any award or degree) probability with marginal significance ($\gamma = 0.13$ ($SE = 0.07$), $t(26) = 1.90$, $p = .069$). With all other variables in the model held constant at average, transfer students enrolled in rural institutions had a predicted probability of completion of 13% versus students enrolled at non-rural institutions (10%). Additionally, transfer students attending urban institutions were significantly more likely to transfer prior to earning a degree, while those attending rural institutions were significantly less likely to transfer prior to earning a degree and significantly more likely to earn a degree, all other variables held constant at average in the model. Similarly, workforce students were significantly less likely to earn a degree at an urban institution, in relation to students attending rural or suburban institutions, all other factors held constant at average values.

Institutional orientation. Similar to the 2010 cohort, the program orientation of the institution attended (workforce versus transfer) had a significant main effect for all students' completion (any award or transfer) probability. All other variables held constant at average, students enrolled in institutions with a workforce orientation had a 19% predicted likelihood of completion, compared to students enrolled in institutions with an equal focus on transfer and workforce programs (18%), and students attending transfer oriented institutions (16%). Moreover, students with a workforce intent were significantly more likely to complete at a workforce oriented institution (22%) versus a transfer oriented institution (13%), all other factors held constant at average, which is consistent with the 2010 cohort results. Additionally, and again similar to the 2010 cohort, there was a significant interaction between students' degree intent (workforce or transfer) and the program orientation of the institution. Workforce students enrolled in institutions with a focus on workforce programs had better predicted completion rates

(21%) than those enrolled at institutions with a significant transfer focus (14%). Conversely, transfer students enrolled in institutions with a significant transfer program orientation had slightly better predicted completion rates (18%) than did transfer students attending institutions with a significant workforce orientation (17%).

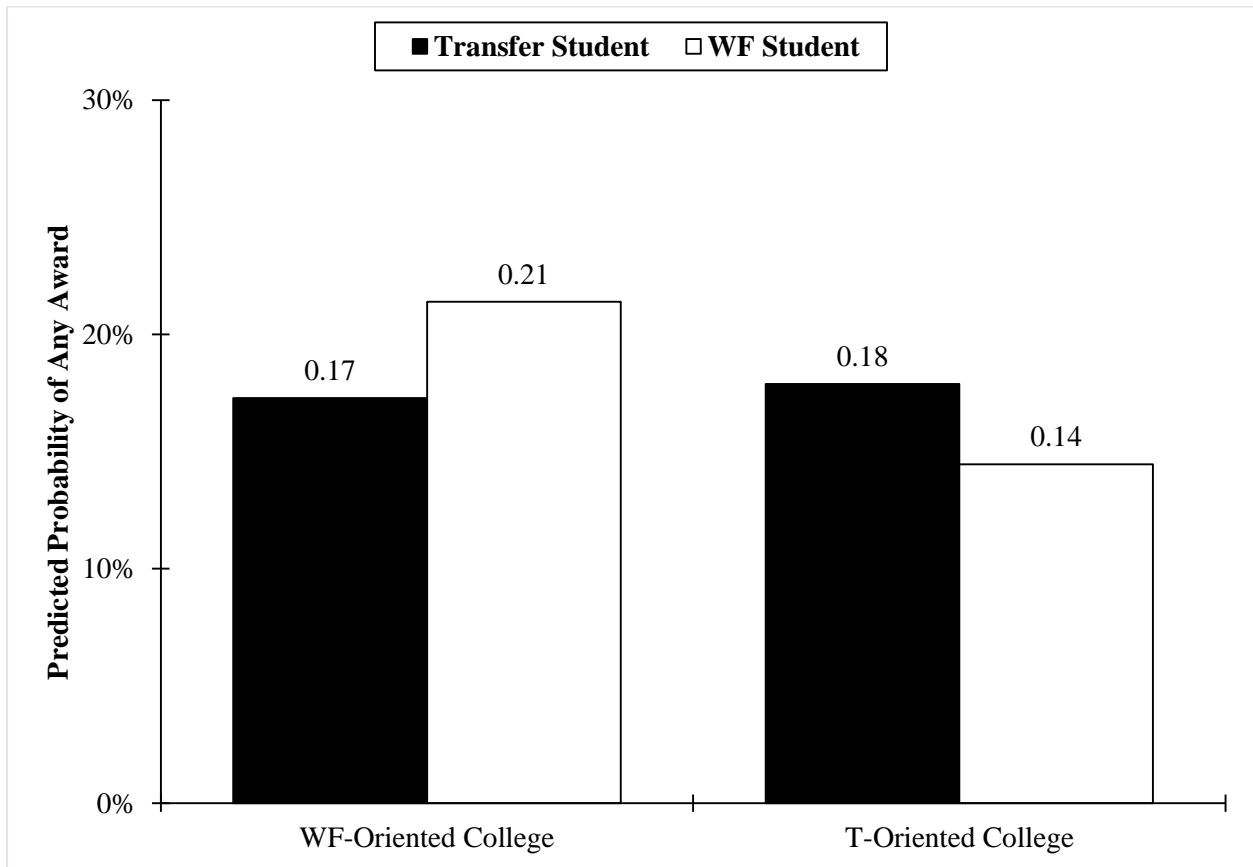


Figure 8. Predicted Probability of Any Award or Transfer for Different Institution Orientations by Student Degree Intent (2011 Cohort)

Full-time faculty:student ratio. Finally, the ratio of tenure (or tenure-track) faculty to students was again (marginally) negatively significant in the model ($\gamma = -0.07$, $SE = 0.05$, $t(26) = -1.72$, $p = .098$). All other variables being held constant, students attending institutions with *more* tenured faculty per student had a *decreased* likelihood of completion (17%), compared to students attending institutions with the average ratio (18%) or a low ratio (19%).

Student covariates. Most individual student characteristics were significantly predictive across all outcomes for the 2011 cohort. Similar to the 2010 cohort, being female positively predicted completion holding all other variables in the model constant at average values for all students (any award or transfer) and for overall measures of transfer (degree or transfer) and workforce student (certificate or degree) completion. Interestingly, being female negatively predicted transfer students' transfer completion (but positively predicted degree completion) and was negatively predictive of workforce students' degree completion. Starting college as a part-time student negatively predicted completion rates for all populations and outcomes, which was also similar to the 2010 cohort results. Being an under-represented minority student (URM) negatively predicted completion rates for all populations and outcomes, except for workforce student certificate completion, where it positively predicted completion, all other variables held constant at average values. Placing into developmental education for both math and English negatively predicted completion rates for all outcomes and populations with the exception of workforce students' degree completion (where it was not significant), which was again the same finding as for the 2010 cohort.

Similar to the 2010 cohort, students with a high school diploma or GED (versus those without) positively predicted completion rates for all students (any award or transfer) and the overall measures of workforce student (certificate or degree) and transfer student (degree or transfer) completion, but high school attainment was not significantly predictive of transfer students' likelihood of transferring before finishing a degree. Students with a self-reported disability had significantly lower predicted rates of completion for all measures of completion with the exception of transfer student degree completion. Similar to the 2010 cohort results, being a single parent with children or dependents negatively predicted completion rates for all

outcomes with the exception of transfer student transfer completion, holding all other variables constant at average values. Receiving need-based aid (NBFA) was associated with significantly lower predicted completion rates for all students and for overall measures of transfer (degree or transfer). However, receiving NBFA did not significantly predict workforce student completion, which is consistent with 2010 results, nor was it significantly predictive of transfer students' degree completion. Finally, consistent with the 2010 cohort results, a student's age positively predicted completion rates for all students and for overall measures of workforce student (certificate or degree) completion, but was significantly negatively predictive of overall transfer (degree or transfer) completion.

5.5 Adjusted Measures of Institutional Effectiveness

Results from the full model were then used to estimate posterior intercepts and standard errors for each of the 33 community colleges' in order to estimate the approximate "value added" of each institution to student outcomes. Specifically, the posterior intercepts (i.e., predicted completion status in logits) can be interpreted as the effect of college j on student completion, after accounting for student- and institution-level fixed effects (Snijders & Bosker, 2012, p. 64). The comparative standard error can then be used to test institutions' intercepts for their statistical significance from zero (Snijders & Bosjker, 2012, p. 65). This information can then be conceived as a possible indicator of the "effectiveness" of individual institutional practices, policies, and culture (as well as other unmeasured variation) after accounting for the broad (fixed) institutional characteristics represented in the institution-level predictors.

I used the residual files for conducting this analysis for three of the outcomes for each cohort: 1) all students: any award or transfer completion, 2) transfer-intent students: degree or transfer completion, and 3) workforce-intent students: certificate or degree completion. I

specifically examined the highest and lowest Empirical Bayes (EB) estimates of the predicted intercepts of each institution after controlling for student and institution characteristics (i.e., Model 5). Institutions with positive residuals had higher-than-predicted completion rates, while those with negative residuals had lower-than-predicted completion rates.

I theorized that these positive residuals are potentially predictive of internal institutional practices, policies, and culture that are likely effective at increasing student likelihood of completion – these would be the unmeasured fixed institutional characteristics. Conversely, colleges with lower than predicted residuals would not be considered as effective at promoting student completion, indicating either ineffective practices or a lack of helpful practices. Finally, institutions with mean residuals near zero can be thought of as having the “average” effect on student completion rates (net of student and measured institutional characteristics) relative to the sample, and can be conceived of as a comparison group. Bailey and Xu (2012) call this a measure of *input-adjusted institutional effectiveness* (Bailey & Xu, 2011) and Clotfelter et al. (2013) call this *overall adjusted college effects*.

Using standardized EB estimates (z -scores), each of the 33 institutions in the sample were sorted into high, average, and low performers for each of the three aforementioned outcomes, for each cohort. A comparison between institutional rankings for workforce versus transfer completion residuals revealed that individual institutions sometimes switched order dramatically depending on outcome and cohort. Thus, the overall completion measure and consistency between cohorts were taken into account in selecting which institutions to use as case studies in the next phase of this study (see next chapter).

5.6 Limitations in the Quantitative Analysis

Several key factors are worth considering in this examination of institution-level effects on student completion rates. First, the dataset used in these studies was rich in that it contains all first-time, degree-seeking students who entered the Washington State Community and Technical College System during the academic years of 2010 and 2011. Furthermore, the dataset included variables relating to gender, ethnicity, age, degree intent, academic preparation, attendance, and several measures of non-traditional student status (i.e., students who are older, part-time students, students with disabilities, and students with children/dependents), all of which have been shown to be significant in previous research on community college student completion rates. However, several variables relating to student socio-economic status (SES) that have been shown to be important in previous studies were not included in the present study because of the large amount of missing data (for example, on parent education level and family income). Furthermore, although placement (enrollment) into developmental education was used as a proxy for a student's academic preparedness, standardized test scores from high school or college entrance examinations would likely be a more powerful predictor. However, neither of these is ever consistently available for Washington's community college students. Finally, the measure of part-time attendance, although highly explanatory in my models, was a measure of the students' attendance status during the first quarter of enrollment in college only (which is a fairly typical way to represent this construct). A more complete measure would have been to examine the overall credits attempted per quarter during the student's enrollment period to create a more comprehensive measure.

Importantly, and as mentioned in Chapter 2, one of the biggest issues in attempting to identify and analyze the unique contributions of a given institution on a given student's likelihood of completion is the non-random sorting of students into institutions (i.e., selection

bias). Short of creating a randomized trial (impractical and potentially unethical), multilevel models that control for all observed student-level influences on the outcome are key for, otherwise, variation that is a result of differences in student populations and not institutional characteristics or practices is ascribed to institutional effectiveness (the major issue of all “value added” models). Recent studies have shown that community college students do not sort into institutions by measures of perceived institutional quality (as do four-year students) but rather based on location, as in the proximity to a students’ home (Stange, 2012). Although this study does contain a level-2 predictor for students’ institution location context (i.e., urbanicity), it does not take into account where students live relative to their institution, or the distance of the institution to other nearby institutions (e.g., college “choice” options).

Furthermore, due to the small level-2 sample size of 33 institutions, I was not able to include and control for aggregate individual characteristics at level 2 (e.g., percentage of under-represented minorities in a college), or their cross-level interactions with individual-level characteristics (e.g., aggregate demographic characteristics of an institution may moderate or even diminish negative individual level effects on outcomes). This is important as Altonji and Mansfield (2014) have shown that, under reasonable assumptions, controlling for these means “controls for all of the across-group variation in the unobservable individual characteristics,” thus giving the researcher greater confidence that his/her results are indeed attributable to differences in institutional practices or characteristics, and not due to unobserved student differences.⁶⁰ Similarly, I was not able to control for institutional spending or other level-2 predictors that may have unique (although likely small) predictive properties.

⁶⁰ Nonetheless, this remains a matter of confidence in interpretation of probabilistic correlations and not a substitute for the causal conclusions one can make from a randomized trial design.

Finally, this study is focused on *institutional* contributions to community college student completion rates, and not on student characteristics' contributions or overall student completion rates in Washington State. The data in this study are limited to four years post initial first-time enrollment in college, which is less time than several student-focused studies have shown to be useful in measuring overall community college completion rates. Furthermore, similar to other studies of institutional characteristics and effectiveness, completers were limited to the institution in which they initially enrolled. Students who attended a Washington community or technical college relatively close to another two-year institution may be more likely to transfer, and thus lower an institution's measured completion rate. Here, institutional-level location variables were used to control for this effect.

For example, a recent report on all degree-seeking community college students in Washington State utilizing National Clearinghouse data (Shapiro, Dunder, Wakhungu, Yuan, Nathan, & Hwang, 2017) examined all first-time, degree-seeking students (full- and part-time) who enrolled in the fall quarter of 2010. Results show a 35% completion rate (of any certificate or degree, but not transfer) at the same institution in which a student initially enrolls within six years of initial enrollment. This is similar to my overall completion measure (including transfers) of 31%, however it is significantly higher than my certificate or degree completion rate of 24%. Potentially the two biggest differences are the time covered, since the current study only examines student completion for four years post-initial enrollment rather than six; and, potentially more importantly, I limited my results to certificates of more than 45 college-level credits, which eliminates a large percentage of short certificate completers.

Finally, the National Clearinghouse study limited its cohort definition to students who enrolled (only) in fall quarter of 2010, while the current study includes students who started at

any point in the 2010-2011 academic year. The results for the current study remain relatively close to numbers from similar national and state studies, with the additional caveat that the current study is meant to examine institutional effects, and not overall student completion numbers. So, while including all certificates or extending the time to completion another two years might have changed the overall completion numbers for the 2010 cohort, it is doubtful that such changes would dramatically alter the proportional differences between institutions that are my focus.

Chapter 6: Qualitative Analyses of Institutions (Case Studies)

6.1 Introduction and College Descriptions

Community colleges have historically been designed as institutions providing access to students who are academically under-prepared for admission to a four-year institution, and/or as a low cost alternative to taking the first two years of required credits at (the relatively) more expensive four-year colleges and universities (Brink & Karabel, 1989; Cohen, Brawer, & Kisker, 2014). Thus it is unsurprising that low-cost, high access institutions admitting the least prepared (and often neediest) post-secondary students have such low completion rates (Jenkins, 2011). Indeed, several educational historians have argued that the low success rates of community colleges are by design, the result of social engineering policies from the early and mid-twentieth century designed to avoid “diluting” resources at the more elite institutions (Beach, 2011; Brint & Karabel, 1989). Given the increasing importance of having post-secondary credentials in the modern economy, community colleges across the country are looking to redesign their institutions for increased effectiveness in terms of certificate/degree completion and successful transfer to four-year institutions. However, this redesign will likely need to be accomplished with relatively little additional funding, given current public higher education funding patterns (Desrochers, & Hurlburt, 2016; Zumeta, Breneman, Callan, & Finney 2012).

These case studies are designed to briefly examine the practices of three highly effective community colleges in Washington in terms of student completion (relative to the model prediction for these colleges) in order to examine unobservable variables missing from the quantitative model previously described examining institutional contributions to students’ likelihood of completion. The qualitative portion of this study offers insights and generates knowledge regarding: 1) a brief description of aspects of institutional culture, including attitudes

and awareness of student completion rates, attitudes toward workforce and transfer programs and faculty, and the relationship between instruction and student services; 2) budgetary, data, and organizational aspects associated with completion efforts; 3) the degree of coordination and planning that occurred around those efforts; and 4) community college administrators' perspectives about factors that lead to increased student completion rates at highly effective institutions.

Multi-level modeling results indicated that there was significant remaining institutional variation associated with student completion rates, after controlling for incoming student characteristics and fixed institutional factors. These case studies examine three colleges with higher than predicted student completion rates given their student body characteristics, and one college with completion rates that match those predicted in the hope of discovering policy and practice variables that might be better manipulated, and adopted (or adapted) at other institutions in the state hoping to improve student completion outcomes. Two of the highly effective colleges represent institutions with better than predicted workforce student completion rates, and one represents better than predicted transfer student completion rates. As discussed in previous sections, institutions were identified and categorized as effective (11 institutions), average (11 institutions), and less effective (11 institutions) based on the model residuals. The three highly effective colleges chosen for these case studies were at or near the top among institutions labeled "effective" for both cohorts studied. The fourth institution represents an average performing college, where differences between predicted and actual workforce and transfer student completion rates were both near zero.

6.2 Case Study: College M

Institutional and Student Characteristics at College M

College M was identified as being highly effective in terms of workforce student completion by the quantitative portion of this study. The college is a medium sized institution with an average headcount enrollment of just over 10,000 students, located in a suburban area adjacent to a large city. The college has a relatively diverse student body, including a higher percentage of older, minority, and non-traditional students relative to most community colleges in the state. The median age for all students attending the institution during the time period of the study was 31 with an average age of 29; 45% of all students during that time period identified as white, substantially lower than the system-wide average. As a technical college, College M has historically focused on workforce education: approximately 54% of institutional FTEs were generated in workforce courses and more than 90% of students in my study cohorts were pursuing a workforce degree. The college had undergone a fairly dramatic shift in programming over the previous decade, including the implementation of several BAS degrees⁶¹ and the implementation of and increasing focus on transfer education. Theoretically, the college had the same broad three missions (educational programming for academic/transfer, workforce, and adult basic education) and associated programming (e.g., community education and specialized contract training) as others in the system. Yet, the main “mission” of the institution as understood by administrators and faculty remained strongly focused on career education, in other words, enabling students to secure a high-demand, living wage job.

Moreover, administrators interviewed saw this as a social justice issue, allowing for increased social mobility among Washington State’s population. For example, while the college has several transfer oriented degrees, it does not offer the general transfer degree (AA/DTA) but

⁶¹ As noted in previous chapters, in Washington state the Bachelor of Applied Science degrees now offered at approximately 70% of two-year institutions, remains focused on career education, although students earning certain BAS degrees also continue on to graduate education (SBCTC, personal correspondence).

instead builds on its workforce mission and only offers specific transfer degrees focused on business, science, nursing, and engineering. Previous to the study period (2010-2015), the college had a strong focus on successful employment (of students) post-program enrollment, and was listed as a finalist for the Aspen Prize for Community College Excellence⁶² during the time period of the study.

Institutional Culture: Workforce and Transfer

As described, College M is a workforce-oriented institution, and career and technical education is central to its mission. The college's workforce programs are seen by faculty and administrators as cutting edge within their genre, and as the main focus of the institution. Academic/transfer faculty were described by interviewees as providing a supportive role to the career and technical focus of the institution. Pedagogical approaches such as contextualizing transfer courses and content that are often highly polarizing on a more traditional comprehensive community college campus (and relatively absent from largely transfer oriented institutions) are seen as "normal" at College M. Academic/transfer faculty also represent a minority of faculty at this institution, which interviewees felt changed the traditional intra-faculty dynamic from that of more traditional community colleges, where academic/transfer faculty are likely to be viewed as more "central" or "core" to the institutional mission.

College M has a wide range of workforce programs, from traditional vocational programs (such as welding and diesel technology) to cutting edge programs in manufacturing, health care, and information technology. Administrators interviewed in the study described a specific institutional focus to move toward programs that were focused on current, high-demand, high-

⁶² <http://highered.aspeninstitute.org/aspen-prize/>

wage careers, and to phase out programs that were traditionally offered by the college that did not specifically lead to “living wage” careers.

Institutional Culture: Data

College M has a strong history of pursuing grants and initiatives focused on student success and completion. Compared with other institutions where I interviewed for this study, data has historically played a more central role at M, at least at the program level, than has been common among institutions in the state. Many of the college’s workforce programs have external evaluators and/or accrediting bodies, and faculty at College M have traditionally reviewed student employment (post program completion) data, and addressed issues as they arose via program reviews and/or with advisory boards. Additionally, the college was in the first cohort of two-year institutions in Washington State to participate in the national Achieving the Dream⁶³ (AtD) initiative, beginning three years prior to the start of this study, with a large focus on data analysis and improving completion rates. Thus, whereas other institutions interviewed described a culture where data were actively questioned or critiqued, faculty and staff at College M moved fairly seamlessly into the “data culture” that began to appear on campuses throughout the state during the time period of the study.

During the period of the study the use of data became increasingly important and widespread at College M, and the focus of data use changed. Although some retention and completion data had, as one administrator put it, “always been involved in any major decision... proposals did not go forward without data,” the use of data was limited to a programmatic, rather

⁶³ Achieving the Dream is a national nonprofit organization that works with colleges, state and national systems to improve community college completion rates. The organization allows individual institutions to apply to work with the organization via grants that focus on building a data-driven culture of evidence at individual community colleges, focusing on completion rates and key “gateway” and “milestone” courses along the way as indicators. Nationally, Achieving the Dream works to build better ways to track completion rates and focus policy on increased completion for community college students (<http://achievingthedream.org/focus-areas>).

than an institutional focus, and the accessibility of data was somewhat limited. Most faculty did not have access to data (or training) in a manner that made it easy to incorporate its potential implications into teaching, although program review had always included the use of data. One administrator felt that much of the “use” of data “was potentially more philosophical than actual” at the beginning of the study period. For example, program faculty had traditionally been most concerned with the percentage of students who successfully gained employment, rather than the share that completed a degree. In some cases the percentage of students who successfully passed certification or licensure was also regularly examined.

Administrators interviewed for this study described AtD as being central to the increased availability and use of data, especially data focused on specific course pass rates and overall degree completion, which are data elements that AtD encourages colleges to develop and use (Achieving the Dream, 2012). AtD also helped in building institutional capacity in terms of making data more available to faculty and staff. Additionally, as a workforce oriented institution, College M applied for (and received) large workforce grants from the U.S. Department of Labor (such as Air Washington⁶⁴) during this time period, both individually and as a part of a consortium, and the data requirements for grant applications and subsequent monitoring of participant progress, outcomes, and completion rates also helped increase institutional capacities and the awareness of data. However, administrators stressed that data use during the time period of the study cohort at the college was still in a “ramping up” stage and not fully integrated into institutional operations.

Institutional Culture: Equity

⁶⁴ Air Washington was a consortium of 20 community and technical colleges in Washington that received a \$20 million workforce grant from the U.S. Department of Labor’s Trade Adjustment Assistance Community College Career Training (TAACCCT) program to strengthen the aerospace industry in Washington State.

Despite having a fairly diverse student body (in comparison with other two year institutions in the state), College M administrators interviewed did not feel that equity had been an intentional focus at the level it could (or should) have been during the time period of the study. Although many colleges who participated in AtD felt that the process was a catalyst for examining issues of equity between race/ethnic groups in terms of student access, progress through courses, and degree completion, individuals interviewed at College M felt that it was not as prominent as it should have been during the time period. Those interviewed for this study especially noted that the ability to disaggregate data by different student populations was lacking. However, one administrator felt that, because of College M's very diverse student body, the institutional attitude could be summed up as, "we considered all of our students to be diverse and thus did not see the point of focusing specifically on issues of equity." However, those interviewed indicated that the work during the time period on course success and completion rates by subgroup led directly to the institution's current (post-study period) focus on equity, which was described as "major."

Coordination

During the period of the study, College M did not have a strong practice around formal institutional planning: the college did not have a strategic plan in place and individuals interviewed did not have a clear idea of how budgeting decisions had been made to support (or not support) initiatives surrounding student completion during this time. It is possible those decisions were made in areas of the college that I did not interview, although the lack of awareness about this among instructional leaders (e.g., vice presidents of instruction and instructional deans) interviewed was notable, as several were in their current or similar positions during the time period of this study. Despite this, the institution seemed to have fairly uniform

and widespread agreement on the “mission” of this institution, which was seen as specifically to “meet students where they were” academically and to build supportive programs and curriculum with a focus on completion (and especially) a final goal of employment, whether post-two- or post-four-year degree. There appeared to be a widespread awareness that grants and initiatives were to be acquired and undertaken in order to specifically further this mission. It appears that the historical narrow focus of the campus on workforce education led to fairly homogenous views on institutional mission that potentially functioned in place of a more formal institutional plan or coordinating unit.

Specific Practices Addressing Completion

Administrators interviewed had cogent and consistent responses when queried about why they thought College M was potentially more effective than other institutions at getting (workforce) students to completion. All individuals interviewed spoke of the college’s focus on offering courses in a block scheduling format,⁶⁵ and on admitting students to programs in structured cohorts. Administrators felt that these two practices, which meant that students often had to attend full-time once formally admitted to a program, led directly to increased student retention and completion through a variety of mechanisms. Administrators noted that full-time attendance, predictable scheduling, and (especially) the formation of close social bonds among students in a cohort, and among students and faculty, have all been shown in the literature to increase student success (Wang, 2017).

Advising was also noted as a key influence on student success at the institution.

Administrators interviewed used the term “coordinated advising” throughout semi-structured

⁶⁵ Block scheduling occurs when students take fewer courses at a time for a longer period than is typical per day, thus students “finish” one course before the end of the quarter and start another. The end result at the end of the quarter is the same number of hours and courses as traditional scheduling.

interview discussions. “Wrap-around” student advising and support is a large part of the student experience at College M. Faculty counselors⁶⁶ are assigned to specific programs, and are dedicated to the students in those programs. These counselors interact closely with all of the program faculty in these areas, attend advisory board meetings and report out on student progress, and meet regularly with students. In fact, students with complaints about faculty are required to first meet with the faculty counselor assigned to their program before they are allowed to move those complaints forward to the dean. In addition, program faculty act as strong mentors and advisors to program students, and provide a wide-range of “wrap-around” services, including helping students to register, organizing work-life-school balance, getting students additional academic support when needed, and providing counseling.

During the time period of the study the college also instituted mandatory college success courses⁶⁷ for students entering into most programs, required in the first quarter of attendance. Finally, administrators spoke of the institutional commitment to meet students where they were academically and structure courses and programs in such a way as to “scaffold” their learning at a level required for course success and degree completion. There was a widespread understanding that many students came to the college unprepared for academic success, and that instruction and advising needed to work to address these deficiencies in a structured way.

Additionally, administrators noted the need for students to feel truly welcome at the college,

⁶⁶ Some institutions in Washington community and technical colleges have staff advisors and counselors that work on a traditional 12 month contract, while others have faculty counselors who receive a faculty contract and work similar hours to faculty. College M is an example of the latter structure.

⁶⁷ These courses are designed to help students better navigate the college environment and succeed. Topics often include career and education planning, understanding services offered at the college, study skills, and other success techniques. Research to date shows inconclusive associations with completion measures (Karp, Bickerstaff, Rucks-Ahidiana, Bork, Barragan, & Edgecombe, 2012).

where they might not have felt welcome at other institutions in part because of age, ethnicity, or unsuccessful previous educational experiences.

6.3 Case Study: College L

College L is located in a dense, highly diverse urban location in a large city and was identified as being highly effective in terms of workforce student completion by the quantitative portion of this study. The college has one of the most diverse two-year college populations in the state, with a significant number of first generation, underrepresented minority, and international students; approximately 45% of the students in the institution identify as white. Because College L is located in a highly urbanized, highly ethnically and socially diverse area, and is part of a community college district with several campuses, it does not have the same feel as a comprehensive community college located in a smaller suburban or rural area. Administrators interviewed for this case study (implicitly) described the institution as a more transfer (versus workforce) oriented institution, with 30% of institutional FTEs generated by workforce courses, and 45% of institutional FTEs generated by academic/transfer courses. However, 55% of students in the study cohorts were pursuing a workforce degree.

Since the cohorts under study were limited to degree seeking students, the difference between the two figures is probably due to two factors: a large portion of transfer classes are being taken by 1) Running Start students (high school students who are simultaneously enrolled in college classes, these students were excluded from this study), and 2) students from other institutions attending transfer classes who are not listed as degree seeking at College L. This is somewhat unsurprising given College L's location; there are several four-year colleges and universities within a 15 mile radius of the institution as well as approximately eight other community or technical colleges within the same distance, and students will often enroll in a

class or two at a neighboring institution when classes are unavailable at their own. College L is a relatively large institution with an average headcount of just over 16,000 students. Average age of students was 24 and the median age was 27, which is close to the system median of 26.

Institutional Culture: Workforce and Transfer

Administrators interviewed for this case study described two completely separate cultures existing between the workforce and transfer areas of the college during the time of the study. Unlike other institutions where one area was often acknowledged as paramount in the institution, most interviewees at College L described each area as viewing the other as being the main focus of the institution, and receiving more attention and resources. For example, individuals representing the workforce area of the college described the difference like this, “Transfer programs are the real focus of this institution, [whereas] workforce programs are an afterthought to administration.” Similarly, the transfer area felt as though the college focused, “too much on workforce programs” and not enough on the transfer areas. Administrators described an institution where the two areas were “culturally decentralized,” with perceptions on both sides that the other was being treated better. Unlike College M, there was not a perceived “hierarchy” at College L, where one area of faculty were seen as “better,” instead there seemed almost to be two colleges existing in one institution, with little awareness on each side of what the other was doing and some misunderstanding and resentment between the two areas. This is fairly typical for community colleges in the state.

Administrators described a gradual shift over the time period of the study toward a more collaborative model between the two areas, driven mostly by the adoption and development of BAS degrees, which required significant integration of both transfer and workforce content and courses. Also during this time instructional deans began to have mixed areas of supervision: each

dean had both workforce and transfer programs in his/her area of supervision, the result of a conscious decision on the part of senior administration to better integrate the two main instructional areas of the college.

Administrators interviewed described workforce faculty that strongly identified with their students first and then with their programs. Although faculty advising is specifically *not* part of the duties of tenured faculty at College L (per the faculty collective bargaining agreement), nearly all workforce faculty functioned informally both as advisors and mentors for students in their programs, and were described as being deeply invested in the success of their students. The college had also made a conscious focus on high-wage, high-demand careers in the workforce area. For example, the college has highly respected and sought after programs in computer networking, programming and web design, nursing, allied health, and business. The college has also taken advantage of its location in a large city and offers specialized programs in high end woodworking, graphic design, apparel design, and commercial photography. The college has no “traditional” vocational programs, such as welding, automotive/diesel programs, machining, office assistant, or HVAC.⁶⁸

In contrast, academic transfer faculty, although also deeply invested in overall student success, identified much more by discipline (e.g., History) or an area of study (e.g., Humanities). Moreover, potentially because academic/transfer faculty tended to interact with students quarter by quarter, rather than over a longer term of 1-2 years as was common for workforce faculty, and were described by interviewees as not viewing themselves as specifically part of a “program,” they thus potentially had a different type of relationship with students. Transfer administrators described the transfer program as “excellent” and “at least” as rigorous as what would be found

⁶⁸ HVAC stands for heating ventilating and air conditioning systems.

in a four-year institution, with the added advantage of having small lecture and lab courses in all transfer areas.

Institutional Culture: Data

Overall, administrators at College L interviewed for this study described data use during this period as somewhat unsystematic. One senior administrator explained that data were often used as an “afterthought” or to demonstrate progress on initiative outcomes rather than employed in decision making prior to reforms. Interviewees described an institution where data were regularly pulled and shared with various groups on campus, but with little to no context or interpretation. College L had a culture that seriously questioned the validity and usefulness of data regarding pass rates, completion rates, and potential student barriers (such as class times) as they were presented, normally by senior administration.

When I further questioned interviewees as to why they felt this was the case, several points were raised. First, prior to this time period data had often been used punitively, for example, as a rationale to close a program or eliminate a faculty position. Thus faculty often viewed data as being associated with “bad news.” Second, many faculty in the transfer area saw the use of data and metrics as part of the “corporatization” of higher education, and associated data with the paradigm shift they saw happening at the college. For example, full-time equivalent student enrollments, or FTEs, for many technical (workforce) programs in high demand, as well as STEM FTEs, are funded at higher rates than those in the Humanities, Social Sciences, and Arts.

Interestingly workforce faculty and associated staff had a different interpretation of data use, and reported being much more amenable to the shift to a data culture. In part this was due to the more structured nature of workforce programs, many of which have external evaluators

and/or accrediting bodies that had been using outcome and similar data for the prior decade or more, and the workforce area reported using data to make decisions during this time period. Examples included whether or not to close or shift the focus of a program, and the shift from employment alone as a measure of completion or success to earning a degree in addition to gaining employment.

Institutional Culture: Equity

College L has one of the highest percentages of under-represented minority students in the state's CTC system, and individuals interviewed described a focus on equity as "paramount" to the institution and institutional culture. All of the administrators interviewed had cogent and well-informed definitions of equity, and could readily give examples of how equity was addressed and incorporated into decision making during this time. Unlike at other institutions interviewed, a focus on equity in completion, especially in the workforce area, was apparent during the time period of the study. Interviewees described differential allocations of resources to support different marginalized groups and reiterated several times how the college defines itself as a place to "serve those who have not been served well in other places." That said, there had clearly been growth in the area of equity, with an increased focus on data and disaggregation of outcomes by subgroup during the 2010-2015 time period. The workforce area described large growth in the understanding of the difference between equality and equity, while the transfer area described becoming more targeted on issues of equity, especially in the area of advising. This increased focus was largely attributed to participation in AtD, which the college started before the time period of the study, and finished during it.

Coordination

During the time period of this study, College L, like most colleges in the system, saw a rapid increase in the numbers it held of federal grants (from agencies such as the U.S. Departments of Labor and Education, and The National Science Foundation), private grants (from groups such as The Gates Foundation) and state grants administered by the SBCTC. Furthermore, the college engaged in “grants” efforts such as Achieving the Dream, that were really more connected to the national completion agenda than were traditional program or student group specific grants. One surprising finding was that administrators interviewed for this case study did not perceive a large amount of site-based coordination regarding these grants and initiatives during the time period of the study. The college had no formal grant department during this time (despite receiving a relatively large number of the previously mentioned grants and funds for supported initiatives) and described a culture of reform that was largely driven by three factors. These were: 1) a core of faculty and student services staff that were leaders in soliciting and implementing reform efforts aligned with the national completion agenda; 2) the college is part of a larger district that has its own planning and development staff that “passed on” directives to apply for certain grants or initiatives to individual colleges in the district; and 3) the college’s location in a high density urban core with an extremely diverse student population, meant that agencies with ties to national completion agenda reform efforts, such as the Gates Foundation and College Spark Washington,⁶⁹ often sought out the college to participate, rather than the other way around.

The interviewees noted that the workforce area of the college had a more organized and focused approach to seeking grants and initiatives in comparison with the academic/transfer area, and described participating in several district and regional approaches to getting grants focused

⁶⁹ <http://www.collegespark.org>

on student success and completion. Implicit in these conversations, however, was the college's focus on equity, which drove much of the effort to secure grant funding and participate in initiatives. Furthermore, it appeared to me that initiatives not sought by the college itself (but rather by the district) but of which it became a part (such as AtD) were quickly adapted to help further the college's clear focus on equity.

Specific Practices Addressing Completion

Each institution interviewed was asked a series of questions exploring practices that interviewees felt were directly contributing to student completion rates at their institution. At college L administrators identified several key factors potentially influencing the college's greater efficacy in getting workforce students to completion, relative to other two-year colleges in the state.

Although both areas described efforts to provide advising mentors for students that offer advising, counseling, and other wrap-around support to students, the workforce area in particular had established a strong practice along these lines during the time period of the study. Individuals described a focus on one-on-one faculty to student connections with a focus on mentorship and wrap-around support. One administrator gave examples of faculty from several different programs personally calling individual students who 1) had stopped attending but were still lacking one or more classes to complete, and 2) personally calling students who were missing class on a regular basis or had stopped coming during the quarter. Administrators also noted that most workforce programs at College L are offered in a structured cohort format, with limited entry points and relatively set schedules for all students attending. Moreover, the cohort nature of the programs requires students to attend at full- or close to full-time, but note that full-time students are also often able to hold down jobs while in these programs because their set

schedules over one or two years allows for time management planning in a way that students taking transfer courses, where schedules changes each quarter, cannot do. It was also noted that, despite fact that faculty at College L were exempt from formal advising roles per the faculty collective bargaining agreement, nearly all workforce faculty served informally as mentors, advisors, and counselors to their students, and noted that these students rarely engaged these services from the “official” departments maintained by the college. For example, each workforce program area (via faculty) provided its own student orientation that seemed more effective at establishing relationships and expectations than the general orientation offered by the college and attended mainly by transfer students. Finally, individuals interviewed at College L attributed the close relationships that developed between workforce program faculty and students primarily as the result of structured cohorts that led to multi-quarter interactions between faculty and students, and noted that these relationships really seemed to “pay off” in terms of student persistence and completion.

Administrators also cited a deliberate focus on programs that lead directly to high-wage, high-demand jobs and careers. In the views of those interviewed, having a job with good pay “waiting” for you at the end of two or three potentially difficult years (where students often had to balance jobs, school, partners, and children) provided a clear context and motivation for workforce students in these programs to persist to completion. Because of this focus, the college offered few entry-level certificates,⁷⁰ and focused rather on two-year degrees. This decision, while seemingly counterintuitive (as the goal of entry-level certificates is to take low-skill students and quickly get them into employment), was, I believe, largely driven by the college’s explicit focus on equity. Faculty and administrators were concerned, as one interviewee put it,

⁷⁰ These are certificates that take only 1-2 quarters of full-time attendance and are designed to immediately boost a student’s job prospects.

“with providing real opportunities for disadvantaged students to secure a better future” through the earning of a college degree and subsequent (relatively) high-wage employment. Furthermore, these two-year degrees helped to facilitate the cohort bonds that occur both between students and between them and faculty. Administrators also believed workforce programs benefited from the college’s location in a large urban area with access to highly qualified industry experts and faculty, who in turn helped to create functional advisory board relationships with programs offered by the college, whereby boards focused equally on program curricula, student persistence and completion rates, and employment success.

Similarly, toward the end of the study period, and continuing to the present, the academic/transfer area at College L began examining many of the advising practices present in the workforce area and working to adapt them to the needs of academic/transfer students. The BAS programs implemented during this time appeared to work as a bridge and a catalyst between the two areas. Each BAS program hired (non-faculty) student development specialists focused on providing wrap-around support to BAS students, and although the initial intent was for the specialists to focus on third and fourth year students, it was quickly understood that student development specialists needed to spend significant, and potentially more, time with first and second year students to “get them up to speed” for college success. Because BAS programs, although focused on career degrees, incorporate general education courses at both the levels (first/second and third/fourth years) of the degree, there was a significant interaction that took place between the faculty and practices in the two areas something that had not happened previously at the institution. This exposure provided the impetus for the college to recruit and pay faculty to mentor students in some areas of transfer curriculum (such as STEM fields), with

preliminary college data indicating increased retention and completion rates for these pilot efforts in the academic/transfer area (personal correspondence, College L).

6.4 Case Study: College D

College D is a medium-sized comprehensive community college with an annual enrollment of just over 10,000 students located in a small town in an otherwise rural setting. The college was coded as a workforce oriented institution for this study: approximately 45% of institutional FTEs were generated in workforce courses, and 35%-38% of FTEs generated in academic transfer courses. Administrators interviewed for this study also clearly noted that the majority of students at the college were pursuing workforce degrees, and indeed 55%-60% of students in the study cohort had a goal of earning a workforce degree. Although located in a fairly diverse rural area, the college is less diverse than the state average, approximately 75% of its students are white and just under 30% of students in the study cohort identified as underrepresented minority students. Average student age is approximately 24 with a median age of 25. College D was identified by my HLM analysis as a high performing transfer completion institution, although the college also ranked near the top of both entry cohorts for better than predicted workforce completion rates as well.

Institutional Culture: Workforce and Transfer

Probably the most traditional comprehensive college interviewed in these studies, with separate administrative supervision for workforce and transfer faculty and programs, the college plays a large role in the economic planning and vitality of the surrounding area. As a comprehensive institution, however, College D also plays a large role in the community for students with an intent to transfer, as the it is located in a rural area relatively far from the nearest public four-year university.

Similar to several other colleges interviewed in these studies, college D described having a distinct separation between its workforce faculty and programs and the academic/transfer side during this time period, with each area believing that what they did was the most important mission of the college. Administrators interviewed for this case study pointed out the “boutique” and “well-respected” programs in the workforce area as being a strong reason why the two areas were gaining a healthy respect for each other. The relatively recent creation of a faculty senate has helped the two areas to interact on common issues, and provided some opportunities for faculty from these different areas to work together. However, these opportunities remain limited in the institution.

Interviewees described the workforce programs at the college as being highly responsive and integrated with the local community in the area. The college views itself, and the community views the college (in the view of the individuals interviewed for this study) as a driving force in the economy of the region. The college has a strong history of looking closely at what is needed in the community and providing programs that supported that need, but also with a focus on providing decent wages for the graduates. Administrators used the words “entrepreneurial,” “innovative,” and “strategically aligned with community needs” when describing the programs offered by the college. A large amount of the credit for these programs was given to the vision of the long serving president who was in place during the time of the study.

Interestingly, despite the fact that the college was being interviewed because of its better than expected transfer student completion rates, transfer programs were described as struggling in terms of both quality and ability to innovate. Informants described sections of the academic/transfer faculty as overly focused on “rigor,” and these faculty tended to use this focus as an excuse to not address systemic inequities in course outcomes. Another section of the

academic/transfer faculty, however, was described as strongly focused on “student success” and was keen to innovate classroom practices to improve student outcomes. One informant noted that these differences tended to fall along generational lines, with senior (baby boomer) faculty making up the majority of the “rigor” camp, and younger faculty making up the majority of the “student success” camp. However, informants also described a long history of strong institutional focus on serving students in the best way possible as permeating all aspects of the college, including instruction in both program areas.

Institutional Culture: Data

Although administrators indicated that data had always been important for senior level management, similar to other institutions interviewed for this study, data were not part of the widespread discussion on student success or completion at College D until around the beginning of the time period of this study. Informants described data as not being easily obtainable at the beginning of the study period, with a marked shift to more widespread data use that occurred during the time of this study. Credit for this shift was largely attributed to becoming an AtD college during the second year of the study period. By the end of the study period data use by middle and upper management was described as being, “as common as drinking a glass of water, before any decision we looked at the data.” Yet, interviewees noted that faculty still lagged behind in data use, especially in the transfer area and among older faculty, who were both described as not being as amenable to the shift to a data driven culture: one administrator said, “(many of these) faculty feel like it is their job to teach and don’t feel they need to rely on data to inform their practice.”

Institutional Culture: Equity

Administrators interviewed cited a fairly widespread lack of awareness about equity at the beginning of the study period, and noted that the institution still lags behind, “where it should be,” in terms of focus on equity. AtD was cited as the catalyst for understanding how far the institution was lagging behind in terms of addressing issues of equity in terms of differential outcomes for various populations (e.g., URM students, LGBT students, first generation students) in completion. In response the institution brought in an outside consultant to help create a strategic equity and inclusion plan, the only institution interviewed to have approached the issue in this manner. Currently (post study period), most informants noted that the institution seems to be fully embracing issues of equity in terms of completion and other student success measures.

Coordination

Although the College won the Aspen Prize for Community College Excellence during the time period of this study, administrators interviewed (surprisingly to this researcher) did not feel that the college was especially strategic during this time in terms of grant applications or adoption of completion initiatives, such as AtD. Unlike many institutions in the state during the time period of this study, the college did not have a full-time grant writer, although in response to becoming an AtD institution, the college did launch an institutional research department in 2011 that also worked to coordinate grant solicitation. However, in comparison with other community colleges in the state, individuals interviewed for this study felt the college had a long history of focusing on student success outcomes, and listed several initiatives launched in the 1990s centering on increasing student success and completion (but without the systemic data to evaluate them), well before the current national higher education focus on completion began. This focus on student success seems to have more fully permeated the institutional culture during the time period of the study and seemed to give faculty, staff, and administrators a lens through

which they interpreted the varied missions of a comprehensive community college. Indeed, in contrast with other institutions interviewed, joining AtD largely helped College D focus on data more as a means to *evaluate* initiatives aimed at increasing completion, whereas at other colleges AtD facilitated both the shift to a completion focus and the use of data to evaluate this focus. Interestingly, in contrast to the views of most informants at other case study institutions (who regarded their institution's approach to soliciting grants and initiatives aimed on completion as poor or haphazard), senior administrators at College D noted that the institution had an effective and comprehensive strategic plan in place long before the period of this study, and noted that the college's long serving president had acknowledged expertise in the area of institutional strategic planning.

Specific Practices Addressing Completion

College D took the fairly unusual step of hiring and implementing college success navigators (representing new staff at the college) for all transfer students during the time period of the study. In both interviews with other colleges and personal experience in the system, I notice that college success navigators, who often provide "wrap-around services" for students, tended to be implemented in either workforce programs or in adult basic education programs. The role of these navigators at College D, however, is to support and retain transfer students and to provide "wrap-around" support services, mimicking what I found in the workforce areas of other highly effective institutions. The college also developed and implemented several new structural alignments, including excellent on-line tools designed specifically to help students plan a two-year (or more if necessary) schedule of classes to complete the transfer degree and to easily find specific classes needed to satisfy distribution requirements for the degree.

Administrators interviewed for this case study also spoke of trying to foster a culture of kindness at the college, and about efforts to create a more caring institution. One administrator put it like this, “academics are smart people and tend to be competitive and like to argue. That culture [of winning and being right] can be taken too far and needs to be strategically addressed.” In the view of senior administrators, the competitive culture that is inherent in much of academia (taken too far) stifled the faculty’s ability to work creatively with each other and with students. These administrators described a process by which the college tried to mimic a “culture of kindness” in relations among faculty, staff, and administrators, in the hope that these groups would, in turn, take on a similar approach when dealing with each other on difficult issues. Informants also cited the excellent working relationship between student services and instructional personnel as being crucial to the success of student completion efforts, and focused on strategically aligning the goals and efforts of the two areas during the time period of the study, something not mentioned by other colleges interviewed for this study. Finally, it should be noted again that serving students via a focus on student success, as well as a culture of putting student needs first, seemed to be a pervasive cultural element at the college and something embraced by all levels of the institution.

6.5 Case Study: College X (Representing Average Institutional Effectiveness)

College X is a large comprehensive community college located in a suburban city adjacent to a large city. The college had an average enrollment of approximately 19,000 students during the time of this study, with a relatively equal focus on workforce and transfer programs, with approximately 35% of institutional FTEs generated in workforce courses and approximately 40% generated in academic/transfer courses. Administrators interviewed for this study confirmed the institution’s balanced focus on the two areas. However, just over a third of students in the

study cohorts were pursuing a workforce degree, with just under two thirds pursuing a transfer degree. Similar to College L, the difference between these two percentages is due to the large Running Start program at the college, as well as (to a lesser extent) students from other institutions taking classes for credit to transfer back to their home institution. The college student population was slightly more diverse than the system average at the time of the study: approximately 56% of students identified as white,⁷¹ and the median age was approximately 27, close to the system median of 26. The mean age for the students was 23 years. College X was identified from the HLM analysis as an average performing institution for both workforce and transfer student completion, with institutional completion rates very close to those predicted by the quantitative model described in previous chapters.

Institutional Culture: Workforce and Transfer

Much like College L during the study period, College X described the relationship between the transfer and workforce areas at the college as one of separation. Administrators described a lack of understanding between the two areas as to what the “other side did,” and noted that opportunities to work together were almost non-existent during the study period. They also noted that both instructional areas were keenly aware of the differences between them in funding availability, with workforce programs and faculty at the college having access to far more funding opportunities, which in turn led to increased capacity for advising, faculty and student support, and a feeling of stability. Administrators also highlighted the fact that College X does not have “traditional” workforce programs (i.e., programs focused on skilled trade careers such as welding and diesel tech) and instead offers paralegal, engineering technology, allied health, construction management, and computer information systems, and accounting.

⁷¹ Washington’s two-year college system average during the time was just over 60% white.

Interviewees noted that the workforce area had a strong emphasis on hiring faculty with credentialed expertise, leading to faculty with many advanced degrees in the workforce area, thus potentially helping to alleviate some of tensions perceived by the informants to be felt in other colleges in the system between faculty with advanced degrees (in transfer fields) and faculty without them (in workforce areas). Interestingly, the isolation of the two areas has persisted even though the administration of them had been integrated since before the study period began: instructional deans had both transfer and workforce departments under their supervision, unlike the more traditional model of separating the two areas administratively. However, joint administration, mandated by senior administration, did not lead to integration of faculty and programs, rather deans continued to run workforce and transfer programs as completely separate. However, the creation of a faculty senate during this time was cited as a large contributor toward the process of beginning to break down the barriers between the two areas, which largely began to emerge after the time period of this study.

During the time period of the study, the college began to focus more deliberately on programs that were specifically focused on high-wage, high demand fields, such as engineering technology and computer information systems. Additionally, the college has intentionally been redesigning or eliminating programs that did not fit this profile, albeit slowly, and this process began during the time period of the study. Transfer programs were described by informants as being extremely competitive in terms of how they compared with what students would receive at a four-year institution, and administrators cited highly qualified faculty with appropriate educational levels to teach at four-year institutions, noting that many transfer faculty had done so at previous points in their careers.

Institutional Culture: Data

College X is an acknowledged leader among public two-year colleges in Washington State in its ability to solicit and execute grant funded programs. Because of this, informants reported that data were historically incorporated in certain areas of the institution, notably in administration and workforce programs. The college joined Achieving the Dream at the beginning of the study period, and AtD was cited as a catalyst in furthering data use, organization, and availability during the study period. However, the extent to which data had permeated the wider institutional culture was unclear. One administrator described the beginning of the study period as a time of being “data rich but information poor,” i.e., the institution had access to large amounts of data, but relatively few areas were aware of this or had the expertise to utilize it. During the time period of the study, an institutional research department was created, and institution-wide (rather than only program specific) data began to become more widely available, and data became more integral to institution-wide decision making. Administrators were able to cite several decisions during this time period, such as a mandatory college success course for students placing into pre-college math or English, math curriculum changes, and a focus on improving courses that were widely taken but had low pass rates.

As with other institutions interviewed for this study, it appears that the workforce area of College X adapted more quickly to the use of data in decision-making, and this was (again) attributed to the presence of outside accrediting bodies for programs that required tracking of students entering and completing programs, as well as data on pass rates for certification or licensure exams, especially in the health and information sciences areas. Interviewees noted that transfer faculty spent more time questioning the data and whether it was meaningful or useful to institutional decisions or teaching practices. Administrators interviewed noted that a great deal of time was spent discussing how to best utilize the data generated, i.e., how to meaningfully utilize

the data to increase success rates in courses, or deliver more effective advising models. One administrator described the state of the college by the end of the study period as “data informed, but not data *driven*.” Administrators also cited some difficult past decisions (such as where to grow an area and where to cut) as leading especially transfer faculty to be suspicious of data when used in decision making.

Institutional Culture: Equity

Individuals interviewed for this case study describe an institution that has been somewhat slow to come to the equity discussion, with much of the focus on “equality” rather than “equity” over the time period of the study. Interviewees noted that College X’s location in what has historically been a largely white, middle to upper middle class suburban area contributed to the lagging equity focus. Over the past decade and a half the surrounding area and corresponding student body have undergone a large demographic shift, whereby white students now make up just over half of the college’s students. Interviewees describe an institutional culture that is slowly but steadily responding to these changes, and describe that process as starting during the time period of the study.

Coordination

As noted earlier, college X is widely known for its ability to secure grants. However, administrators describe a shift during the time period of the study in the coordination of these efforts. Initially, the college focused on securing grant funding that could be used to improve outcomes in specific (mostly workforce) programs, although the college was also awarded grants for STEM transfer programs as well. Over the time period of the study, and in response to issues raised through AtD participation, the institution became more focused on institution-wide efforts, and shifted to a more coordinated approach. Basically the college began to look at completion

rates for all students, rather than only program by program. Incidentally, administrators also describe intense “initiative fatigue” during this time period.

Specific Practices Addressing Completion

Administrators at College X believed that strong instruction in the classroom, increasing the percentage of tenure-track faculty, as well as a better integration of part-time faculty into the operations of the college and building a strong “safety net” for marginalized students, were the key factors that would lead to increased completion rates in the institution. Informants universally acknowledged that the college had begun to address each of these issues during the time period of the study, but felt that the institution had not fully achieved any of these goals. Retention specialists were also cited as a *current* initiative with the potential to improve completion rates at the college, especially in the STEM and workforce areas. However, these specialists were largely not in place during the time period of the study. Interviewees noted that the college continued to struggle to find funding for these initiatives.

In general, I noted two main differences between College X and the relatively effective institutions interviewed for this study in terms of completion practices put in place. First, College X did not have the same strong focus on wrap-around advising models during the time period of the study, although it should be noted that the institution is currently pursuing the implementation of many of these models (post-study). Second, in contrast with relatively effective institutions (and potentially because of its strong history of securing grant funding that provided additional resources for programs), the college seemed less focused on reallocating existing resources and redesigning existing college structures (such as advising and registration) to support activities that have to been shown to have potential to improve completion rates

through pilot implementations, such as retention specialists, and more focused on simply finding additional funding to implement them.

6.6 Summarizing Policies, Practices, and Cultures across Case Studies

In a recent paper on redesigning community colleges for increased student completion, Davis Jenkins (2011) reviewed high performing organizations both within and external to higher education. His paper outlines seven practices of highly effective organizations relevant to creating highly effective community colleges designed for student completion including practices in the areas of: leadership, focus on the customer, functional alignment, employee involvement and professional development, process improvement, use of measurement, and external linkages. Although these four case studies are far too limited a sample to provide conclusive evidence, I employ Jenkins' (2011) model⁷² on highly effective institutions to organize the information gathered in these case studies and begin the analysis process.

Leadership. I expected to find a strong theme of effective leadership emerging from my case study interviews, but this was not the case. Only two colleges' interviewees even mentioned the college president at all. Informants at College D described a president with a long tenure and excellent leadership skills, and cited his/her contributions as a key component in efforts to improve completion rates. The president was described as "an institution" and s/he seemed to be viewed differently than a "normal" president would be. It was fairly evident that the president's leadership was key to the effectiveness of the institution's reform efforts. Informants lauded the president's vision, ability to think outside the box, strong strategic vision and planning processes, and competence. They also described a strong leader that, while not universally liked, was universally respected. This respect was key to getting buy in from constituents that did not agree

⁷² For the purpose of this study, I will collapse some of the seven categories highlighted in the Jenkins (2011) paper.

and/or see the needs for many of the reforms put in place. In addition, one other effective college's interviewees briefly described the effectiveness of the president during the time period of the study, although they focused mainly on his/her ability to steer the college through a time of rapid change.

Focus on the customer. All the institutions interviewed mentioned creating student-centered institutions, institutions based around the needs of students, and “caring” institutions. It is fairly well accepted that community colleges are not set up in an especially intuitive or user friendly model (Cohen, Brawer, & Kisker, 2014) and prominent community college researchers (Bailey, Jaggars, & Jenkins, 2015) and community college policy makers⁷³ have recently endorsed radically redesigning institutions to better serve student needs and increase completion. While each of the effective institutions interviewed for this study had taken some steps during the time period of this study to address these structural issues (for example, mentor-style advising models), my sense is that the time period of this study represents a time of growing awareness of the need to restructure in order to effectively address completion rates that often show less than a third of students who enroll ever earn a credential. However, creating a strong and effective advising model based around some type of wrap-around service was one of the clearest themes to emerge from the case studies of effective institutions, although the models varied widely from college to college.

Functional alignment. I expected to see effective coordination efforts guiding the adoption of completion initiatives among highly effective institutions, but this theme did not emerge either. Two of the three highly effective colleges discussed the high degree of coordination between student services and instruction, which research has shown to be a key

⁷³ The Pathways Project (AACC, n.d.).

aspect of effective undergraduate institutions (Jenkins, 2007; Kuh et al., 2005). But in general, informants from all the case study institutions did not feel that the adoption of completion initiatives was well coordinated during the time period of the study.

Use of Data and Process Improvement. Use of data and performance measures were reported in all colleges interviewed for this study, as all had participated in the data-focused Achieving the Dream initiative, which is focused on increasing institution-wide completion rates, during the time period of the study. A review of individual colleges' Achieving the Dream goals showed that, at least for the individuals writing the application and annual reviews, baseline institutional data were clearly used to establish realistic goals and outcomes, and institutions had the capacity to generate data to inform performance measures. However, the degree to which data were incorporated into decision making processes, and contributed to the establishment of effective performance measures, remained unclear to the majority of the informants in these studies. Although all informants reported increased data awareness and use, none of those interviewed felt that the institution had been "data-driven" during the time period of the study. Interviewees used terms such as "data aware," "data informed," and mentioned the *post-hoc* use of explanatory data. My impression was that all institutions interviewed were at the beginning of a journey to incorporate data into institution-wide performance and decision making, and that process improvement was still in the concept phase for most institutions during this time period. However, all institutions reported 1) establishment and use of clear outcome measures, as well as intermediate measures, regarding student completion; 2) increased awareness, access to and use of institutional data regarding student retention and completion, as well as the creation of and/or greatly increased use and capacity of the institutional research department; and 3) participation in AtD as being catalytic in their use of data, intermediate measures, and focus on completion.

Employee involvement and professional development. All of the institutions interviewed for this study reported mixed employee involvement around completion initiatives. Jenkins (2011) remarks that higher educational institutions lag behind successful K-12 and non-educational institutions in efforts to ensure that all employees not only understand the goals of reforms but also the rationale behind them, which studies of successful organizational improvement efforts indicate is key to successful implementation. Unsurprisingly, I find this to be the case in my interviews. Most administrators demonstrated not only a clear understanding of reform goals, but also belief in the underlying principles upon which those reforms and goals are based. However, all institutions interviewed for these case studies indicated that, although most faculty, student services personnel, and other staff had adequate understanding of the reform goals by the end of the study period, there was substantially less buy-in surrounding the underlying principles supporting those goals.

External linkages. Studies of effective undergraduate institutions are mostly silent in regard to involvement of outside entities (such as industry), linkages to K-12 or four-year institutional partners, and/or parental involvement (Jenkins, 2011). In this study, highly effective workforce-oriented colleges clearly articulated effective working relationships with industry partners (via program advisory boards) as well as community partnerships as being key to the success of *programs*, although none reported those linkages that specifically addressed initiatives aimed at increasing completion. It is perhaps not surprising that colleges interviewed for this study did not discuss linkages to four-year institutional or K-12 partners, as the Washington SBCTC has established good working relationships with four-year institutions in the state, and coordinates not only the general transfer degree (AA/DTA) but also multiple major-specific two-year transfer degrees for all the community and technical colleges in the state (SBCTC, 2016).

6.7 Common Practices and Themes from Highly Effective Institutions

In his review of research on highly effective institutions, Jenkins (2011) suggests that reforms that only target one area of the institution are not enough to improve completion outcomes on a meaningful or sustainable level. Rather, research suggests that only reforms that connect all areas of the institution, i.e., a fundamental redesign, will enable institutions to become more effective in this regard. Individuals interviewed for these case studies reflect institutions that were in the beginning stages of tackling reform at the institutional level.

After asking a series of descriptive questions about the institution, the semi-structured interview protocol I used asked a series of questions regarding reform efforts and strategies employed for completion efforts. The first question asked the respondent to list the major reform initiatives and grants implemented or in place during the time period of the study. After this, I asked no specific questions about these initiatives, but noted when they were mentioned in context for the subsequent series of questions (Appendix A).

Achieving the Dream. For the colleges interviewed in this study, the national policy shift from access to completion discussed in a previous chapter was functionally brought into institutional practice via participation in the Achieving the Dream initiative. Although all institutions had a wide range of initiatives in place during the time of the study, the only initiative subsequently referenced throughout the interview process at effective institutions was participation in Achieving the Dream (AtD). All institutions interviewed had participated in AtD, although adoption points varied from before the study period (2010) to during the study period. Initial participation in AtD is a five-year commitment, and colleges can opt to continue if they wish and are accepted to do so. All institutions interviewed noted the catalytic impact of their college's participation in AtD on institutional culture, policy, and practices. Overall, informants'

responses identified three broad areas (during the time period of this study) influenced by participation in AtD: 1) data– especially concerning the generation and use of data, a focus on disaggregating data by different groups of students, and the creation and enhancement of institutional research departments; 2) completion– participation in AtD seemed catalytic in moving institutional focus toward the issue of student completion rates, as well as intermediate measures of completion, such as gateway course completion; and 3) development and implementation of student success strategies (focused on moving students toward completion), including advising models, and college success courses. These findings closely mirror initial research on the effect of AtD participation in Washington colleges, although that research also failed to find an overall effect of participation on completion rates for AtD institutions in Washington (Jenkins, Wachen, Kerrigan, & Mayer, 2012). However, AtD participation has clearly had a significant effect on the institutions included in these case studies, in terms of operations (e.g., use of data in decision making) and culture, and missions (e.g., a focus on completion).

I was struck by how strongly the AtD theme emerged. Institutions interviewed had a wide-range of initiatives in place during the time period of the study, including grants from the federal government (Department of Education, Department of Labor, Department of Health and Human Services, National Science Foundation), private foundations (College Spark Washington, Gates Foundation) and various state initiatives, mostly addressing acceleration of developmental education pathways (e.g., Integrated Basic Education and Skills Training (IBEST) programming and other acceleration models). AtD was the initiative most spoken about in terms of the effect it had on culture, practice, and awareness of the institution. Even colleges that chose to stop

participating in AtD during the time period of the study clearly acknowledged its influence on institutional approaches to data, course and degree success, and equity in outcomes.

Wrap-around, Mentor-style, Student Advising Models. Having a strong and effective advising model based around some type of wrap-around service for students was one of the clearest themes to emerge from the case studies of effective institutions, although the models varied widely from college to college. For example, some colleges utilized faculty, others counselors, and others student services personnel, but all effective institutions had redesigned their advising models to position advisors as mentors with a mission and resources to provide some form of wrap-around services for students. Notably however, these changes took place during the time period of this study in the instructional areas in which each institution had been identified as highly effective, the transfer area for college D, and workforce areas for colleges L and G. In effective institutions the role of advising was altered in two significant ways from traditional community college approaches. First, advisors proactively reached out to students as soon as issues (or potential issues) arose, rather than waiting for the student to contact the advisor and ask for assistance. I was struck by how many individuals interviewed at effective institutions talked of having staff in these positions personally call students proactively to assess how they were doing. One administrator noted that, “every student who failed to enroll (from one term to next) was called (by the college success navigators) to figure out what had happened, and help them complete.” This active outreach and support was seen in all three of the effective colleges, and administrators at the average performing (comparison) college were currently discussing ways to launch a similar model at their institution. Second, advisors (and in some cases programs) provided wrap-around (i.e., multiple) services to students, an approach that allowed students to see the same individual for help with activities such as tutoring, registration,

counseling, academic support, and schedule planning. This is contrary to the traditional model where these services are housed separately and are disconnected. In some cases, this meant providing individualized orientations that took the place of (and were potentially more effective than) the general student orientation at the college. In other cases, advisors would actively help the student to navigate these services, rather than allowing the student to “deal” with them on their own.

Other Practices of Highly Effective Workforce Institutions. Focusing specifically on highly effective workforce-oriented institutions, the following practices and themes emerged in the case studies.⁷⁴ At each effective college the majority of workforce programs were offered in a highly structured cohort format, with limited enrollment points, block scheduling, and fairly pre-determined class schedules. In the views of interviewees, this format led to the development of strong social bonds among students in these programs, as well as between the faculty and the students. Structured cohort programs offered predictability in scheduling and often necessitated that students attend at full- or close to full-time. At all effective workforce institutions, the associated (workforce program) faculty served as mentors and advisors for their students, and had strong programmatic identities that associated the success of their students with the success of their programs. Course and exam failures were seen as issues to be addressed in terms of program completion. In other words, these failures were seen as indicators of program success (or failure) rather than as indicators of the *individual student's* success.⁷⁵ The majority of these institutions also reported focusing programs specifically on high-demand, high-wage fields, and reported strong and effective relationships with industry. All three highly effective workforce

⁷⁴ I include college D in this category as they also had significantly higher than predicted workforce completion rates.

⁷⁵ In programs that were not implemented in cohorts, workforce faculty were also reported to associate program success as being more important than course success.

colleges mentioned excellent industry participation and relationships, and strong advisory board participation. These colleges also reported a strong focus on two-year degrees over short-term, especially entry-level, certificates. Although several colleges did offer shorter-term certificates, these were clearly seen as part of the path to completing a degree. A current review of these programs on institutional websites shows this to be the case, the majority of certificates offered in workforce programs at these institutions were “stackable,” that is they were applicable toward an eventual degree, rather than terminal (although it is impossible to verify that this was the case during the time period of the study). Those institutions that still had more “traditional” vocational programs, such as College G, had clearly worked hard to focus those programs on cutting edge technology and emerging fields, and informants reported that program graduates were highly sought after, especially in the technical areas of these respective fields.

Sub-Missions as Coordinating Reforms. It has been widely documented that community colleges have a wide range of goals and missions, and that this can hamper institutional focus (Beach, 2011; Brint & Karabel, 1989; Cohen, Brower, & Kisker, 2014). Among the effective institutions in this study, however, a more focused “sub-mission” emerged as a guiding lens through which institutions viewed these multiple missions. I noticed this pattern when analyzing similarities and differences in effective institutions’ responses to the question about coordinating reform efforts. On the surface there seemed to be a wide-range of policies and practices regarding coordination of reforms: one institution had a strong strategic planning process and effective strategic plans in place, another lacked an institutional strategic plan during the time period of the study, and two institutions failed to mention strategic planning at all. Most of the effective colleges reported having no *formal* strategy in place that guided institutional decisions on which grants and initiatives to pursue during the time period of this study, although

all but one reported having that process in place currently. If there was a formal process in place, it is telling that the instructional leaders (deans and vice-presidents) interviewed in these studies were not aware of it.

However, despite the absence of formal strategy guiding institution-wide decisions, in effective institutions, a possible “sub-mission” theme became evident when responses to all the interview questions were analyzed. For example, as described earlier, at College M informants reported widespread agreement, based on the workforce mission of the college, on improving students’ lives through the acquisition of higher paying jobs, i.e., a workforce mission.⁷⁶ College D reported not only a strong strategic planning process, but clearly described an institutional focus on student success outcomes that had been in place for at least three decades, well before the current focus on student completion emerged in higher education.⁷⁷ College L had a well-articulated and widespread focus on equity, and interviewees tended to situate answers to my questions within an equity framework almost without thinking about it.⁷⁸ In fact, all three effective institutions tended to situate answers to (all of the) questions posed in the interview process within the sub-themes I have just described, again seemingly without being aware of it. In contrast, the average performing college explicitly described itself as a fairly “typical” comprehensive community college with a strong sense of mission on “serving students,” and described the three mission areas (academic/transfer, workforce, and basic skills) that are common to all community colleges in Washington State.

⁷⁶ “You have to understand that this is a workforce institution, everything we do is from that perspective” (Informant, College M).

⁷⁷ “Completion? Oh, we’ve been focused on student outcomes for at least as long as I’ve been here, and that’ll be 32 years this fall! Honestly, student outcomes are something that we have always been focused on, long before it was the thing to focus on” (Informant, College D).

⁷⁸ “Equity is a really big deal here; it’s part of our core mission” (Informant, College L).

In conclusion, all Washington community and technical colleges share (officially and programmatically) three broad missions as described in a previous chapter: workforce education, transfer education, and adult basic education. The four institutions included in these case studies all offered programming in these three areas, as well as offering a wide-range of other services, including access for high school students (Running Start), community (non-credit) education, and targeted contract training. However, in contrast to the comparison institution, which basically described the three main missions of (any) two-year college in Washington, the three more effective institutions had adopted, a common unifying theme, or sub-mission through which they filtered the various and sometimes conflicting missions of a community college. The conclusions described in this section are summarized in the following table.

Table 18. Common Practices and Themes from Highly Effective Institutions

<i>Theme</i>	<i>College M</i>	<i>College D</i>	<i>College L</i>	<i>College X</i>
Perceived Leadership	Strong	Medium	Low	Low
Perceived Use of Data	Medium	Medium	Medium	Medium
Perceived Funct. Alignment	Low	Low	Low	Low
Grants focused on Completion	Medium	Low	High	High
Achieving the Dream College	Yes	Yes	Yes	Yes
<i>Completion Strategies</i>				
Unifying Mission	Yes: Workforce	Yes: Outcomes	Yes: Equity	No
Wrap-Around Case Management Model	Yes	Yes	Yes	No
Highly Structured Workforce Cohorts	Yes	Yes	Yes	Medium

Chapter 7: Conclusions and Implications

7.1 Introduction

This research contributes to the literature in several ways. There is a large body of prior research investigating how individual characteristics contribute to post-secondary students' completion rates. However, considerably less is known about how institutional characteristics, particularly at the community college level, link with student outcomes. Extant research on community college institutional characteristics associated with student success tends to rely on older data from nationally representative samples of students, potentially missing effects based on the “noise” created by the wide range of variability in state community college systems. The present study fills this gap by 1) utilizing relatively recent rich student record data from a single state with a large two-year college system to quantitatively investigate how institutional variables contribute to community college students' likelihood of completing a college certificate, degree, or transfer, and 2) qualitatively investigating the practices and cultures of highly effective institutions in this system relative to “typical” institutions. The quantitative portion adds to the small but growing literature utilizing a single state system to examine input-adjusted college effects. In other words, it looks at institutional differences in completion, and particular institutional characteristics associated with these outcomes, after accounting for the differences in student characteristics. Similarly, the qualitative portion of the study adds to the nascent literature on what works in community colleges (Auguste, Cota, Jayaram, & Laboissière, 2010; Bailey, Jaggars, & Jenkins, 2015; Jenkins, 2011)

This dissertation employs a mixed methods approach to: quantitatively examine input-adjusted institutional contributions to a student's likelihood of completion and the fixed institutional characteristics that are associated with these contributions; and qualitatively

investigate highly effective institutions' practices and culture. The overarching goal of this study is to better understand how community colleges can influence students' likelihood of completion. Definitions of completion can vary widely in the literature examining community college student success, given the wide range of missions present in these institutions. For the purpose of this study, I include only those students seeking a two- or four-year degree. The qualitative strand of this research reports findings from three institutions identified in the quantitative portion of the study as highly effective and one average performing institution, and describes various institutional practices, policies, and approaches to student completion that may be contributing to the relative effectiveness of the identified institutions.

7.2 Findings

Research Question 1. The multilevel modeling (quantitative portion) results based on two recent cohorts ($N=58,492$ combined) of first time, degree seeking students enrolled in all of Washington's community and technical colleges ($N=34$) indicate that, *after controlling for incoming student characteristics*, colleges show significant input-adjusted variation in completion rates, as measured by any of the following: completion of a two-year degree or certificate of at least 45 college level credits, or successful transfer to a four-year institution.

Research Question 2. Similarly, when both student and institutional characteristics were entered in the model, results for fixed institutional characteristics indicate that, all other factors being equal, location of the college (i.e., urban, rural, suburban), and focal orientation of the college (e.g., workforce vs. transfer) were the only consistent predictors of student outcomes, once student-level characteristics were accounted for. Specifically, students were more likely to complete their degree/certificate and/or transfer to a 4-year college when attending an institution with a focus that matched their own, and transfer students were more likely to complete at urban

institutions whereas workforce students were more likely to complete in colleges situated in non-urban locations. There was also some evidence to indicate that students attending larger institutions have lower completion rates, with some evidence indicating that this effect is largely driven by transfer students in these cohorts being more likely to attend institutions that were “overenrolled” relative to their state-supported capacity.

Research Question 3. Standardized (z -scores) of empirical Bayes residuals for each participant from the multi-level model were averaged by institution and used to identify three *relatively* effective institutions, i.e., institutions with aggregate completion rates significantly higher than what was predicted by the model, and one typical institution, i.e., an institution with aggregate completion rates that were nearly the same as what was predicted by the model.

Case study results representing qualitative examinations of these institutions’ policies, practices, and cultures showed that there is wide variation in selected institutions’ leadership, reform coordination, and use of data to enhance student completion. However, a commonality of all highly effective institutions is the use of strong, wrap-around, mentor-style advising models. Moreover, highly effective workforce-oriented institutions showed a high degree of similarity in program structure and approach, these programs were overwhelmingly offered in a structured cohort format with limited admission points, a relatively fixed schedule of courses, a high degree of interaction between faculty and students, apparently excellent relationships with industry partners, and a focus on high wage, high-demand programs. Additionally, effective colleges have found a strong “sub-mission”, such as focus on equity or workforce education, to navigate among the traditionally broad, multi-faceted community college mission, as a focal point for completion efforts. Finally, although national research has yet to show a strong completion result for Achieving the Dream (AtD) colleges, all highly effective institutions included in this study

cited participation in AtD as transformational for institutional practice and culture, especially in terms of focusing on data, completion, and intermediate measures of completion.

7.3 Discussion

Adjusted Institutional Variation. Results indicating that, even after accounting for student variation captured in the model, there remained significant variation in aggregate institutional completion rates are consistent with other recent state-level studies in other states (Clotfelter, Ladd, Muschkin, & Vigdor, 2013; Kurlaender, Carrell, & Jackson, 2016) and with national studies of two- (e.g. Calcagno, Bailey, Jenkins, Kienzl, & Leinbach, 2008) and four- year institutions (e.g., Bowen, Chingos, & McPherson, 2009). Although each of these studies and my own captures student variation through slightly different variables, both policy makers and administrators should take note that institutions do appear to be able to influence student outcomes,⁷⁹ thus discovering and appropriating effective practices remains an important quest to be further explored and refined.

Student characteristics. Student characteristics accounted for the majority of the explained variance in the HLM model in this study (see Table 10), which is similar to other studies examining institutional effects on completion (Calcagno et al., 2008; Bowen, Chingos, & McPherson, 2009). My dataset was slightly unusual in that only 22% of students were classified as attending part time and the dataset only accounts for students' attendance pattern during the first quarter of enrollment. An analysis of credits earned (as opposed to attempted which would be a more accurate measure of part time attendance) shows that a mere 20% of students were *earning* the equivalent of full time credits during terms when they were earning credits.

Nationally, reports indicate that more than 60% of community college students enrolled for

⁷⁹ Note: neither this nor the previous studies are causal in nature, so I am hypothesizing that the differences in student outcomes are actually attributable to institutional variation of some kind.

credit are attending part-time (AACC, 2016), although these statistics do not differentiate between students seeking credit only and students seeking a degree. Similarly, the Washington SBCTC reports that approximately 49% of students during the time period covered in this study were enrolled part-time, although these numbers do not distinguish between degree and non-degree-seeking students (SBCTC, 2013). Being a female and having a high school diploma or GED, positively predicted completion, which is in line with previous studies (Calcagno et al., 2008). Also, under-represented minority students, students enrolled in developmental education (i.e., indicative of low academic preparation), single parents, and students with a self-reported disability all negatively predicted completion, again in line with previous studies (Crisp & Mina, 2012). Receipt of need-based financial aid was not as strongly (negatively) predictive of completion as were other student level characteristics. While there is some disagreement as to how important SES is for community college completion (Attewell et al., 2011), most studies show that lower SES is significantly predictive of lower completion and transfer likelihood (Dougherty & Kienzl, 2006; Melguizo & Dowd, 2009; Prince & Jenkins, 2005), and recent research on community college students indicates that lower SES students have significantly decreased likelihood of earning a transfer degree and/or successfully transferring to a four-year institution, even with controlling for other variables (e.g., Clotfelter et al, 2013; Jenkins and Fink, 2016). This study employed receipt of need based financial aid as a proxy for family income and parental education (SES), and probably captured less variation than would variables directly measuring these factors. Some of the attenuated effect of SES is no doubt accounted for by the effects of other variables, but still this measurement limitation probably lowered the overall student variation accounted for in the model.

Finally, my results indicated differential effects on student age. Overall, previous research suggests that older students are less likely to persist and complete a certificate or degree (Adelman, 2006; McIntosh & Rouse, 2009; Moore, Shulock, & Offenstien 2009; Radford et al., 2010), and age has been found to be a significant unique factor in predicting transfer (and completion) likelihood, with older students at a significant disadvantage (Adelman, 2006; Attewell et al., 2011; Dougherty & Kienzl, 2006). However, Calcagno et al. (2006) found that, after controlling for academic ability and attendance patterns, older students attending Florida community colleges actually had a higher probability of completing a degree. In addition, Calcagno et al. (2006) found that, contrary to other studies, older students who enrolled in remedial math were less negatively affected than younger students. Similarly, when examining factors associated with transfer student success (successful transfer), Dougherty and Kienzl (2006) found that other demographic variables, such as family status and work experience, accounted for more than 90% of the variance directly predicted by age.

The current study also shows a differential effect of age based on the degree intent of the student. For students seeking a transfer degree, increased age negatively predicts completion, all other factors being held constant at average values. However, when examining all students and the most comprehensive of completion measures, age positively predicted completion. This relationship appears largely driven by older students seeking a workforce degree who, after accounting for all other variables in the model, were significantly *more* likely to complete. There are several potential factors at play here. First, older students pursuing a workforce degree are potentially more focused on their career goals, as workforce programs align tightly with potential career fields post-degree. This focus, along with a relatively short time to employment (minimum of two years for a workforce degree versus minimum of four years for a Bachelor's

degree) may give these students an increased motivation to persist through potential roadblocks in order to finish the degree. Similarly, as is discussed in subsequent chapters, workforce programs tend to be more structured, have fewer choices in courses and schedule options, and potentially more consistent faculty-student interactions over a longer period than transfer degree programs.

Institutional Characteristics. Institutional characteristics accounted for a much smaller proportion than student characteristics of the explained variance in the model, which is also consistent with previous research on two- (Bailey et al., 2005; Calcagno et al., 2008) and four-year (Bowen, Chingos, & McPherson, 2009; Titus, 2004) institutional contributions toward a student's likelihood of completion.

Institutional spending was not included as a predictor in this model given that exploratory analysis showed little sign of any effect on completion outcomes. Similarly, while some previous studies of community college institutional effects have found contradictory⁸⁰ (Calcagno et al., 2008) evidence, most studies have failed to find an association between measures of institutional spending and community college student completion (Bailey et al., 2005; Bailey et al., 2006; Clotfelter et al., 2013; Stange, 2012).

Results from this study indicate that students attending larger institutions have lower completion rates, with some evidence indicating that this effect is driven by transfer students and, in this time period, by transfer students in institutions that were "overenrolled" relative to their state-funded capacity. Institutional size was directly and uniquely predictive of lower completion, especially for degree-seeking students before accounting for student variation. After controlling for student variation, institutional size remained negatively predictive for the (larger)

⁸⁰ Calcagno et al. (2008) found that increased per-student academic support expenditures negatively predicted completion rates.

2010 cohort, but became only marginally (negatively) predictive for transfer students in the 2011 cohort. Given the large overlap between institutional size and overenrolled institutions, it is likely that some of the unique effect of size is lost because of the inclusion of tuition as a percent of revenues (the overenrolled indicator) as an institutional predictor. Most previous studies of community college effects have found a negative effect for students attending larger institutions (Bailey et al., 2005; Bailey et al., 2006; Calcagno et al., 2008), although in a recent state-level study of North Carolina Community Colleges, Clotfelter et al. (2013) found no effect of institutional size. Similar to previous national studies, my results show a negative effect on predicted completion rates of institutions with relatively larger enrollments, holding all other factors in the model constant at average values. That effect was most significant for the 2010-2014 cohort, potentially due to the over-enrolled nature of the system at that time. However, for the 2011-2015 cohort the unique effect of institutional size was only marginally significant for students with an intent to transfer. Interestingly, unlike many other institutional variables, there were no interaction effects between students' degree intent (workforce versus transfer) and institutional size, i.e., attending institutions with larger enrollments negatively predicts completion rates for all degree-seeking students in the study.

An interesting contribution to the literature in this study is the institutional variable tuition revenues as a percent of total institution revenue. As described earlier, I have employed this variable as a proxy measure for how “over-enrolled” an institution was during the time periods studied for the two cohorts examined. As described earlier, in Washington State, institutions receive FTE appropriations from the state *up to* the “target” FTE of the institution. When institutions generate FTEs beyond their state target, there are no matching state FTE

appropriations. Since tuition and state appropriations⁸¹ should represent the large majority of revenues for two-year institutions (Kirshstein & Hurlburt, 2012), the percentage of tuition revenue as a share of total revenue is increased in proportion to the excess FTEs and thus acts as a proxy for institutional over-enrollment. Results from this study indicate that over-enrollment can negatively predict average institutional completion rates, even after accounting for student characteristics and highly correlated institutional predictors such as college size. This effect was only significant for the 2010 cohort, where institutions were significantly more likely to be overenrolled due to the enrollment boom following the Great Recession. Because of the large overlap with institutional size, as well as the small institutional sample size of this study, it is probably more difficult to detect a unique effect of overenrolled institutions as overall cohort enrollment shrinks, as was the case for the 2011 cohort. Results from the full models indicate that transfer students may be harmed the most from attending overenrolled institutions. This is potentially due to the less structured nature of transfer degrees, as opposed to workforce degrees where courses needed for programs (degrees) tend to be specific and sequential, in addition to the fact that many workforce programs are cohort-based by design.

Most previous studies of community college institutional characteristics have found that attending an urban college negatively predicts student completion rates (e.g., Calcagno et al., 2006; Bailey et al., 2005) net of other variables, although studies of four year institutions show mixed results with researchers finding both positive (Scott et al., 2006; Hamrick et al., 2004) and negative (Goenner & Snaith, 2004) effects of institutions located in urban areas. I found that, in Washington, transfer students are more likely to complete at urban institutions and workforce students at non-urban locations. This effect seems to be largely driven by transfer students

⁸¹ State appropriations include FTE-based funds and other operating costs generating support from Washington State. State appropriations do not include grants, contracts and capital appropriations (Kirshstein & Hurlburt, 2012).

attending urban institutions where successful students are significantly more likely to “complete” by transferring to a four-year institution but do not complete an associate’s degree (which is not required for successful transfer to a four-year institution in Washington State), whereas there is some evidence that students in rural institutions are more likely to complete a degree (prior to transferring). Some previous research on two-year institution location has reported a negative association between urban location and completion rates (Bailey et al., 2005; Bailey et al., 2006) or when institutions are located near a four-year college (Clotfelter et al., 2013), while other research has not found an association between institutional location and completion (Calcagno et al., 2008; Stange, 2012). Zero order correlations in this study (see Appendix B) show some degree of overlap between urban location and proximity to four-year institutions, but not a great deal ($r = .37$). It has been hypothesized that community colleges in close proximity to relatively open access four year institutions tend to draw on less academically prepared and motivated students who instead choose to attend the four-year institution, while community colleges in rural areas tend to draw the opposite student pool, as place bound students decide to stay and earn an associate’s degree prior to transferring (Smith & Stange, 2015). One constant in the model was the propensity for transfer students attending institutions in urban locations to transfer before completing a degree. My results indicate that disaggregating by a student’s intent may help to explain some of the confusion in the literature. Moreover, research has shown that community college students overwhelmingly “sort” into institutions based on location (i.e., proximity to home), rather than by perceived quality or other factors associated with four-year college student sorting (Stange, 2012).

Although high faculty-to-student-ratios have been strongly associated with increased four-year institution completion rates, the same effect has not been seen for community college

completion rates (Bailey et al. 2006; Bound et al., 2010; Stange 2012). Some studies examining the percentage of tenured (full-time) faculty on community college performance have found that a lower percentage of part-time faculty predicts increased student completion (Calcagno et al. 2008; Jacoby 2006), while other studies have been unable to detect a negative effect associated with increased part-time faculty percentages (Ehrenburg & Zhang, 2005). The results of the present study showed that students enrolled in institutions with a relatively higher percentage of full-time (tenured or tenure-track) faculty have *lower* completion rates, an unexpected finding. This effect was marginally significant ($p < .10$) but consistent across both cohorts of students. The model showed no significant direct effects of faculty-student ratio, it became apparent once student characteristics were accounted for in the model. This is similar to Meza's (2013) finding that, after accounting for student characteristics, institutions with slightly higher student faculty (the inverse of faculty-student ratios) ratios had significantly better developmental math completion and transition rates. It is possible that institutions with greater percentages of full-time faculty have proportionally older faculty, who may be less in tune with the rapidly changing community college environment in Washington and nationally, although this is speculative at this point.

This study finds a significant effect of an institution's focal orientation. Previous research has suggested that institutional focus and/or programming mix can influence likelihood of student completion (Armstrong & Mellissimos, 1994; Auguste, Cota, Jayaram, & Laboissière, 2010; Roksa, 2006), with studies suggesting that students do better when attending institutions with orientations more similar to their own goal. Similarly, results from this study show a consistent relationship of institutional orientation with the likelihood of predicted student completion: students are more likely to complete when attending an institution with a focus that

is similar to their own. When all other factors are controlled, workforce students are more likely to complete at a workforce-oriented institution and transfer students are more likely to complete at a transfer-oriented institution. This corroborates and expands on recent research by Scott-Clayton and Weiss (2011), who found that students enrolled in Washington State's technical colleges were more likely to complete certificates (but not degrees) than students enrolled in Washington community colleges (Scott-Clayton & Weiss, 2011). Indeed the results of the present study indicate that a workforce student's increased likelihood of completion at a workforce-oriented institution is driven largely by completion of certificates (rather than degrees) at workforce-oriented institutions. The results of this study also suggest that transfer students may do worse at workforce-oriented institutions, similar to previous findings (Roksa, 2006).

Case Studies

The HLM model here also utilized student characteristic adjusted completion rates to identify highly effective institutions. Diving deeper into these institutions to qualitatively examine colleges' policies, practices, and cultures, I found significant variation in selected institutions' leadership, reform coordination, and use of data. However, a commonality of all highly effective institutions was the use of strong, wrap-around mentor style advising models. Moreover, highly effective workforce-oriented institutions showed a high degree of similarity in program structure and approach, these programs were overwhelmingly offered in a structured cohort format with limited admission points, a relatively fixed schedule of courses, a high degree of interaction between faculty and students, excellent relationships with industry partners, and a focus on high-wage, high-demand programs. Additionally, effective colleges appear to have developed a strong unifying theme, which I call a "sub-mission" that helps to coordinate

activities and reforms within the traditionally broad community college mission, and seems to act as a focal point for completion efforts. Finally, although research to date has yet to show a strong completion result for Achieving the Dream Colleges, all highly effective institutions included in this study cited participation in Achieving the Dream as transformational for their institutional practices and culture, especially in terms of focusing on data, student completion, and intermediate measures of completion.

7.4 Policy Implications

The results of this study can inform strategies for improving college completion efforts for two-year institutions. First, by establishing empirically the differential effectiveness of institutions, two-year colleges in Washington can begin to examine the practice of highly effective institutions and seek to incorporate lessons learned into their own reform efforts, as has been recently advocated in the literature on community college effectiveness reform (Auguste, Cota, Jayaram, & Laboissière, 2010; Bailey, Jaggars, & Jenkins, 2015; Jenkins, 2011). Furthermore, understanding how relatively fixed institutional characteristics (such as institutional orientation or size) can help inform future statewide policy reforms targeted at redesigning community colleges to be more specifically focused on student completion.

The Student Achievement Initiative is the performance funding mechanism for public two-year colleges in Washington and the SBCTC worked closely with researchers from the Community College Research Center at Columbia University to design a system for this that would specifically reward colleges that move students through key progress points to completion of educational goals. Thus, Washington is seen as a leader in the performance funding movement ((Hillman, Kelchen, & Goldrick-Rab, 2013). However, as this study (and several others associated with the CCRC) has shown, taking into account incoming student differences is

critical when attempting to appropriately evaluate and/or reward institutional effectiveness in student progress and completion. The growing popularity of performance funding for community colleges (Hillman, Kelchen, & Goldrick-Rab, 2013), as well as renewed Department of Education interest in evaluating all institutions of higher education (Kreighbaum, 2017), means that developing some valid way to measure “input-adjusted” student achievement will be key in future efforts to fairly evaluate and reward effective community colleges.

Overall, highly effective institutions interviewed for this study reported success strategies similar to those advocated in the “Guided Pathways” reform (AACCC, n.d.) movement and in research recently published on redesigning community colleges for increased effectiveness in student retention and completion (Bailey, Jaggars, & Jenkins, 2015; Wang, 2017). These studies suggest that two-year colleges would better serve students by increasing wrap-around case management approaches to student advising, decreasing choice in course offerings, and increasing the structure of programs to promote natural student cohorts and to provide clearer “pathways” to a degree and career, especially for students intent on transfer, as many workforce programs already utilize many of these structures.

The finding that institutional focus is directly associated with a student’s likelihood of completion has important implications for policy. It may be that state systems such as Washington’s may want to consciously dedicate institutions toward a specific goal, especially when there are multiple institutions within a single geographic area, as is the case in all major (and several smaller cities and towns) urban areas in the state. For institutions that provide the only access to a two-year college in the area, creating more of a structured “college within a college” for each focus area is also a viable option. Similarly, the finding that transfer students are more likely to complete at urban institutions is potentially driven largely by the reader

ability of students in urban areas to transfer to four-year institutions prior to completing a degree. It suggests that colleges located near relatively open access four-year institutions should ensure the direct transferability of their courses, since four-year institutions are able to evaluate transferability course by course for students who transfer before completing an AA/DTA. Conversely, community colleges located further from relatively open access four-year institutions may want to create more structured transfer programs that look similar to the workforce programs offered at highly effective institutions, including highly structured degree pathways with limited course options, schedules that encourage both student cohort formation and increased faculty-student interactions, and contextualization of courses.⁸²

Research on higher education students has traditionally indicated that older students are less likely to persist and complete. What this study and others are indicating is that there is something qualitatively different about older students seeking a workforce degree versus a transfer degree. It may be that some combination of the structured nature of workforce programs, along with the (relatively) more immediate payoff of degree completion in them, and their generally more contextualized nature seem to be helping workforce students. It would be interesting to examine the potential interaction of age and institutional focus, to see if attending college at a workforce oriented institution was more beneficial for older workforce students.

Similarly, transfer programs seem more traditionally geared toward younger students, are less structured, less contextualized, and the payoff is farther in the future (at least 4 years versus 2 years or less for workforce programs), all of which may be affecting older students seeking a transfer degree. More research is needed to tease apart these effects. It is also another potential

⁸² Indeed these are also the goals of the current Pathways Project The Pathways Project (<http://www.aacc.nche.edu/Resources/aaccprograms/pathways/Pages/default.aspx>) and are supported by the WSBCCTC for state-wide adoption (<https://www.sbctc.edu/colleges-staff/programs-services/student-success-center/guided-pathways.aspx>)

argument for the growing number of BAS degrees offered in Washington, as they are situated in workforce programs and structured more like workforce degrees than traditional four-year Bachelor's degrees.

7.5 Limitations & Future Research

There are several limitations to the current study. First, it should be noted again that multi-level modeling of secondary data does not support direct causal claims on the differential effectiveness of particular two-year institutions in Washington State on student completion, nor does it support causal claims about the institutional variables predictive of student completion. Causality can only be established with experimental and certain quasi-experimental research designs not available to be employed here (Shadish, Cook, & Campbell, 2002). However, it should be noted that education researchers must often make (non-causal) policy relevant inferences from secondary data analyses, as experimental studies in education are extremely rare and often logistically impractical. Researchers can feel somewhat comfortable doing so if the selection mechanisms (i.e., how students sort into institutions) are fairly well understood and the researcher has a rich set of variables in the dataset to take them into account (Altonji & Masfield, 2014; Clarke, Crawford, Steele, & Vignoles, 2010).

Second, while this study covers two complete recent entry cohorts representing all first time degree-seeking students enrolled in Washington's 34 community and technical colleges, care should be taken in generalizing these findings to other states or future cohorts of students in Washington State. One of the strengths of single-state studies for community colleges is their ability to control for the wide range of variations across state systems. However, this also means that these findings are reliably generalizable only to Washington State. As additional state-level studies of institutional characteristics predictive of community college student success and of

differential community college effectiveness are conducted, common findings across multiple studies should potentially lead to a greater national understanding of these effects.

Third, the strength of utilizing student input-adjusted measures lies in the richness of the student-level covariates employed to control for the variability students bring with them to college. Although the dataset used in this study is recent and fairly comprehensive, several additional variables (that are incomplete in the current dataset) would have more fully captured student variability. Because of sizeable amounts of missing data, I was not able to use measures of family income or parental education as direct measures of a student's SES. Nor was I able to utilize the geo-coding system set up in Washington State to approximate these variables from a student's address.⁸³ Instead I used students' need-based financial aid status as a proxy for SES. Although this is fairly standard in educational research, additional variables to code for SES would provide a more complete measure of students' SES and thus (potentially) better account for my (student-level) variation in outcomes. These data are available from Washington State's Education Research and Data Center (ERDC) and future studies should incorporate these data to more fully account for variability accounted for by SES.

Similarly, prior academic preparation is also a key covariate when attempting to control for student level characteristics predictive of completion. For the purposes of this study, I employed a student's placement into developmental education (either Math or English) as indicating that the student was below college level in one or both of those areas. For future studies, limiting the cohort of students studied to recent high school graduates (rather than the current study which includes all first-time college students)⁸⁴ would allow a researcher to utilize

⁸³ The current two cohorts of SAI student data do not have these data, however beginning in 2013 SES data based on this method are available.

⁸⁴ Currently 19% of Washington community college students are under age 20 (WSBCTC, 2016).

both high school grades and standardized test scores from Washington's High School Proficiency Exam (HSPE), a potentially more accurate measure of academic preparation. Again, these data are available from the Washington State ERDC.

Moreover, in the current dataset, a student's intent code, indicating pursuit of a workforce or transfer degree, and attendance status (part-time versus full-time) were both generated during the first quarter of attendance. However, these can change over time, and a more valid measure of intent and attendance status would be some form of an average over a student's time in the cohort. Because of time constraints, I was not able to access these data from the WSBCTC, but will be able to do so in future studies.

Fourth, because the sample size for institutions in Washington State is inherently relatively small ($N = 33$ in this study), my ability to both include potentially important institutional characteristics, as well as to detect an effect of those characteristics, is limited. Sample size presents a trade off when utilizing state-level versus national data for institution-level variable studies. Future studies may decide to include other variables (such as institutional financial characteristics) that were left out of this study based on considerations of power and potential to find an effect.

The qualitative case studies reported in this analysis represent just the first step in understanding differences between more and less effective two-year institutions with respect to student completion. Further interviews with college presidents, faculty, and student services personnel, at a wide range of highly effective, average, and less effective institutions would give a much more complete picture of the similarities and difference across these institutions that might provide good ideas for diffusion. This research is especially important as the broad institutional characteristics measured quantitatively in this study (and most others) cannot

adequately capture the differences in policy and practice, institutional organization, culture, and the nature of instruction that are most probably at the root of differences in institutional effectiveness in getting students to completion. Furthermore, the kinds of characteristics included in the multi-level model, in this and other quantitative studies, are relatively fixed, and less amenable to the types of policy interventions that will be needed to improve completion rates for the next generation of community college students.

Finally, this study assumes, based on current research in WA and nationally, that students who transfer to a four-year institution will have the same approximate likelihood of completing a Bachelor's degree as similar students who begin higher education at a four-year institution. However, the question as to whether a student should complete an associate's degree prior to transferring remains complex and requires further exploration (Jenkins & Fink, 2016), especially given that difference in state policies will surely affect this outcome, as well as examining how various subgroups (e.g., older students, males, minority students, first generation students) will fare when transferring before versus after earning a two-year degree. Future studies examining whether (or not) earning an associate's degree prior to transferring to a four-year institution increases a student's likelihood of Bachelor's degree completion are now possible in Washington State, and they are relevant not just from an academic research perspective but also have important policy implications. For example, the state is currently considering whether Washington's performance funding system for community and technical colleges, the Student Achievement Initiative (SAI), should reward colleges for student transfers, and whether or not this should be based on previous degree completion.

Mixed-methods studies such as this one are rare, and offer methodologically complementary information to community colleges leaders, state policy makers, and researchers

interested in strategies for improving successful transfer to four-year institutions, as well as for boosting two-year degree completion rates. Qualitative case studies offer a grounded, practice-rich understanding of potentially effective (as well as emerging and less effective) strategies, cultures, and policies that cannot be obtained from quantitative analyses. The quantitative models here add to the growing number of state-level studies examining institutional variation in two-year colleges' completion rates, and the institutional characteristics associated with those outcomes. Both study strands offer insight regarding structural and policy decisions that can influence student pathways toward completion.

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Appendix A

Institutional administrator interview (Vice President of Instruction, Vice-President of Student Services, College President, Instructional Deans, and other knowledgeable personnel).

Thank you very much in advance for taking the time to meet with me and share your expertise. As you may know, I am currently the Dean of Arts & Sciences at X college and have been working in the CTC system for about 9 years now. I'm currently completing my PhD at the UW and writing a dissertation on institutional effects on community college completion rates. The statistical model I created (explain in detail) helped to identify colleges that seem to be especially effective at contributing toward student completion. This interview is to help me get a better picture of the policies and practices that college X had in place during the 2010-2015 period.

1. Tell me about your role in student completion initiatives that took place during the 2010-2015 time period.
2. Tell me about institutional culture at your college. Are people of are of completion rates at your college? How do faculty see student success, and specifically completion? How do student service staff/leaders view the issue? Senior administrations?
3. How are workforce faculty viewed at your college in comparison to academic transfer faculty? What about workforce programs versus programs specifically focused on transfer? Do you have programs that allow for both transfer and career placement?
4. Would you describe your workforce programs as focused on high wage/livable wage careers or more "traditional" vocational/trade programs?
5. How would you describe your transfer programs in comparison with four-year institutions?
6. Can you tell me about specific student success initiatives that were in place in this time period?
Probe: Which of these efforts would you say were specifically targeted on student completion versus other measures of success (such as course completion, credits earned, and retention)?
7. How coordinated has your institution been on focusing on student success and completion?
8. How important is equity at your institution? How would you define equity? How have completion efforts been specifically focused on issues of equity (if at all)?
9. How important are data at your institution? How were data used during this time period? Probe: Can you give me some examples of how decisions were made based on data during that time period? Can you disaggregate data to focus on specifics groups of students?
10. In your view what are the most effective ways institutions can positively influence student completion rates in community colleges? How specifically have you addressed these at your institution during the 2010-2015 time period?
11. Compared with other community colleges in the state, why do you think the initiatives at your college have been relatively more (for average college "more or less") successful than those at other colleges?
Follow-up: Do you these issues are unique to your institution or could it be "scaled-up" to other schools?
12. How did budgets and budgeting play into your completion initiatives during this time?
13. Have there been political costs to implementing student success initiatives and focus at the institution? If so what ramifications do you think these costs may have had on initiatives and efforts regarding completion?
14. What documents do you have describing the initiatives during this time period? Examples include: strategic and operational planning, grants, and specific policies or procedures.
15. What else do you think I should know and/or be asking about in this in-depth investigation?

Appendix B

Table B1. *Zero-order Correlations among Variables (2010 Cohort)*

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. Any Award (1=yes)	--														
2. Cert/Degree (1=yes)	.85 **	--													
3. Degree/Transfer (1=yes)	.80 **	.57 **	--												
4. Degree (1=yes)	.63 **	.75 **	.79	--											
5. Workforce Deg Intent (1=yes)	.00	.10 **	-.13 **	-.04 **	--										
6. Gender (1=Female)	.03 **	.04 **	.01	.01 *	.05 **	--									
7. Part-Time (1=yes)	-.08 **	-.14 **	-.08 **	-.14 **	.03 **	.03 **	--								
8. Under-Rep Minority (1=yes)	-.04 **	-.03 **	-.06 **	-.05 **	.00	.01 *	-.01	--							
9. DevEd Math + Engl (1=yes)	-.07 **	-.05 **	-.04 **	-.02 **	-.02 **	.05 **	-.13 **	.09 **	--						
10. DevEd Math or Engl (1=yes)	-.03 **	-.05 **	.06 **	.05 **	-.15 **	.07 **	-.11 **	.02 **	.41 **	--					
11. Graduated High School (1=yes)	.01 *	-.01 *	.05 **	.03 **	-.10 **	.00	-.01 *	-.03 **	.02 **	.07 **	--				
12. Disability (1=yes)	-.02 **	-.01	-.03 **	-.01	.05 **	-.01	-.01	-.02 **	.08 **	.05 **	-.01 *	--			
13. Has Children/Depend (1=yes)	.00	.03 **	-.06 **	-.04 **	.21 **	.13 **	.00	.07 **	.04 **	-.01	-.05 **	.00	--		
14. Single Parent (1=yes)	-.04 **	-.02 **	-.07 **	-.05 **	.13 **	.16 **	-.02 **	.07 **	.04 **	.01	-.04 **	.00	.64 **	--	
15. Need-based Fin Aid (1=yes)	-.02 **	.03 **	-.04 **	.02 **	.12 **	.10 **	-.21 **	.10 **	.15 **	.13 **	-.02 **	.04 **	.19 **	.20 **	--
16. Age (Years)	.02 **	.09 **	-.07 **	-.01 *	.34 **	.02 **	.06 **	-.02 **	-.05 **	-.11 **	-.08 **	.10 **	.31 **	.17 **	.10 **

Note. $N = 31,423$ first-time, degree-seeking students. All variables dummy coded except age dummy coded; age is measured in years. Pearson's r shown.

* $p < .05$, ** $p < .01$.

Table B2. Zero-order Correlations among Variables (2011 Cohort)

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. Any Award (1=yes)	--														
2. Cert/Degree (1=yes)	.87**	--													
3. Degree/Transfer (1=yes)	.82**	.62**	--												
4. Degree (1=yes)	.67**	.78**	.83**	--											
5. Workforce Deg Intent (1=yes)	-.01	.06**	-.13**	-.06**	--										
6. Gender (1=Female)	.02**	.03**	.00	.01*	.04**	--									
7. Part-Time (1=yes)	-.13**	-.12**	-.13**	-.12**	.07**	.02**	--								
8. Under-Rep Minority (1=yes)	-.05**	-.04**	-.07**	-.06**	.01	.02**	.00	--							
9. DevEd Math + Engl (1=yes)	-.06**	-.05**	-.04**	-.03**	-.03**	.03**	-.12**	.09**	--						
10. DevEd Math or Engl (1=yes)	-.05**	-.04**	.02**	.04**	-.16**	.06**	-.16**	.03**	.42**	--					
11. Graduated High School (1=yes)	.02**	.01	.05**	.04**	-.10**	.00	-.04**	-.02**	.03**	.08**	--				
12. Disability (1=yes)	-.03**	-.02*	-.03**	-.02**	.03**	-.01	.00	-.01	.07**	.05**	.00	--			
13. Has Children/Depend (1=yes)	-.01*	.01*	-.06**	-.04**	.19**	.13**	.02**	.05**	.02**	.00	-.05**	-.01	--		
14. Single Parent (1=yes)	-.04**	-.02**	-.06**	-.05**	.14**	.17**	.00	.05**	.02**	.01	-.03**	.00	.66**	--	
15. Need-based Fin Aid (1=yes)	-.02**	.01*	-.03**	.01	.09**	.09**	-.20**	.10**	.16**	.16**	.00	.03**	.17**	.18**	--
16. Age (Years)	.00	.05**	-.09**	-.05**	.31**	.01	.11**	-.03**	-.04**	-.11**	-.11**	.10**	.31**	.16**	.09**

Note. $N = 27,069$ first-time, degree-seeking students. All variables dummy coded except age dummy coded; age is measured in years. Pearson's r shown.

* $p < .05$, ** $p < .01$.