BRIDGING THE COLLEGE COMPLETION GAP WITH COMPREHENSIVE SUPPORT SYSTEMS: A MIXED-METHODS IMPACT EVALUATION OF THE DELL SCHOLARS PROGRAM

by

Stacy Song Kehoe

B.A., New York University, 2008

Submitted to the Graduate Faculty of the School of Education in partial fulfillment of the requirements for the degree of Doctor of Philosophy, Learning Sciences and Policy

University of Pittsburgh

2017

UNIVERSITY OF PITTSBURGH

SCHOOL OF EDUCATION

This dissertation was presented

by

Stacy Kehoe

It was defended on

May 17, 2017

and approved by

Dr. Lindsay Coleman Page, Assistant Professor, Research Methodology

Dr. Thomas Akiva, Assistant Professor, Applied Developmental Psychology

Dr. Christian Dieter Schunn, Professor, Psychology

Dissertation Advisor: Dr. Jennifer Lin Russell, Associate Professor, Learning Sciences &

Policy

Copyright © by Stacy S. Kehoe

2017

BRIDGING THE COLLEGE COMPLETION GAP WITH COMPREHENSIVE SUPPORT SYSTEMS: A MIXED-METHODS IMPACT EVALUATION OF THE DELL SCHOLARS PROGRAM

Stacy Song Kehoe, PhD

University of Pittsburgh, 2017

Despite widespread efforts to address barriers to college success, low-income and first-generation students continue to complete college at substantially lower rates that their more advantaged peers. A review of causal research to date has linked comprehensive interventions (e.g. programs that provide students with a combination of financial, academic and social support) to promising persistence and degree attainment outcomes for low-income and first-generation students. However, the body of causal research on the impact of these type of interventions remains nascent. This mixed-methods dissertation study contributes to this critical research area by using rigorous quasi-experimental methods to examine the impact of the Dell Scholars Program on the college persistence trajectories of its participants. An earlier regression-discontinuity study revealed large and significant impacts on degree attainment rates. Specifically, the study found that the program has a 9 percentage-point and 16 percentage-point impacts on four- and six-year bachelor's degree completion rates, respectively (Page, Castleman, Kehoe, & Sahadewo, 2017). This work builds off this prior investigation in two important ways. First, I couple difference-in-differences and matching analytic strategies to estimate program impacts for Dell Scholars beyond the selection threshold. I find significant impacts on persistence, degree attainment, stopout rates, and dropout

rates. To explore the mechanisms underlying these impacts, I estimate first-difference impact estimates on first-year loan borrowing behavior, academic progress, and academic achievement. I find significant program effects for all outcomes, with notably larger impacts for students enrolled in less selective institutions. In the second part of my study, I move beyond the question of whether the Dell Scholars Program impacts enrollment and degree completion outcomes to address the critical question of *how* the program achieves successful results. I conduct an explanatory case study that draws on interviews with program staff and students, program administrative data, observations and program artifacts. I identify four key program components that drive the observed causal impacts: the program's use of a proactive, data-informed support system that is highly responsive to persistence risk indicators; the program model's flexible, clientfocused practices; the program's work environment and staff background; and the implementation of continuous quality improvement strategies.

TABLE OF CONTENTS

DEI	DICA	TIONXIII
AC	KNO	WLEDGEMENTSXIV
1.0		INTRODUCTION1
	1.1	THE PRESENT RESEARCH 2
		1.1.1 Overview of the study
	1.2	SIGNIFICANCE OF THE RESEARCH AND LIMITATIONS 4
2.0		LITERATURE REVIEW7
	2.1	CONCEPTUAL MODELS EXPLAINING COLLEGE SUCCESS9
		2.1.1 Major theoretical perspectives 12
	2.2	BARRIERS TO COLLEGE SUCCESS AND IMPACT EVALUATIONS ON
	INT	ERVENTIONS DESIGNED TO PROMOTE PERSISTENCE
		2.2.1 Academic barriers 21
		2.2.1.1 Academic interventions
		2.2.2 Social and information barriers
		2.2.2.1 Social and informational interventions
		2.2.3 Financial barriers
		2.2.3.1 Financial interventions

2.3 COMPREHENSIVE APPROACHES TO PROMOTING COLLEGE			
SUCCESS 40			
2.3.1 Couple institutional aid with enhanced institution-based supports 40			
2.3.2 Provide privately funded aid and social support for students across			
many institutions			
2.4 SOCIAL CAPITAL THEORY AND THE ROLE OF ORGANIZATIONS IN			
PROMOTING WELL-BEING 43			
2.5 KEY TAKEAWAYS FOR THE CURRENT RESEARCH 44			
3.0 PART 1: ESTIMATING THE IMPACT OF THE DELL SCHOLARS			
PROGRAM BEYOND THE SELECTION THRESHOLD 47			
3.1 BACKGROUND			
3.1.1 The Dell Scholars Program			
3.1.1.1 Overview of the program's data collection process			
3.1.1.2 The Dell Scholars Program selection process			
3.1.1.3 Findings from the regression discontinuity study			
3.1.2 Estimating impacts beyond the selection threshold			
3.2 METHODS 55			
3.2.1 Data sources 55			
3.2.2 Outcome variables 57			
3.2.2.1 Enrollment and degree attainment outcomes			
3.2.2.2 College financing, academic progress, and academic achievement			
variables			
3.2.3 Coarsened exact matching procedure			

	3.2.4 Analytic sample	66
	3.2.5 Estimation strategy	68
3.3	RESULTS	69
	3.3.1 Difference-in-differences impact estimates on persistence and colle	ege
	completion	70
	3.3.2 Impact estimates on college financing, academic achievement and academ	nic
	progress	76
	3.3.2.1 College financing	77
	3.3.2.2 Academic progress and achievement	81
3.4	DISCUSSION	84
	PART 2: INVESTIGATING THE PROGRAM COMPONENTS UNDERLYIN	NG
E CA	USAL IMPACTS OF THE DELL SCHOLARS PROGRAM	88
11	THE PRESENT RESEARCH	66
4.1		00
4.1	METHODS	89
4.2	METHODS	89 90
4.2	METHODS	89 90 92
4.2	METHODS	89 90 92 94
4.2	METHODS	89 90 92 94 95
4.2	METHODS	88 89 90 92 94 95 95
4.2 4.3	METHODS 4.2.1 Data collection timeline 4.2.2 Data elements 4.2.2.1 The Dell Scholars Program administrative dataset 4.2.2.2 The Dell Scholars Program case study analytic sample 4.2.3 Analytic strategy FINDINGS	 88 89 90 92 94 95 95 97
4.2	METHODS 4.2.1 Data collection timeline 4.2.2 Data elements 4.2.2.1 The Dell Scholars Program administrative dataset 4.2.2.2 The Dell Scholars Program case study analytic sample 4.2.3 Analytic strategy FINDINGS 4.3.1 Key program component: A proactive, data-informed support system the strategy for the strategy f	88 89 90 92 94 95 95 97 hat
4.2	METHODS	88 89 90 92 94 95 95 97 hat
	3.3 3.4 E CA	 3.2.5 Estimation strategy

	4.3.1.2	Evidence of model responsiveness to indicators of academic risk 111
	4.3.2 Key	program component: Flexible, client-focused program practices 121
	4.3.2.1	The Dell Scholars rely on the program's financial award to support
	persist	ence
	4.3.2.2	The Dell Scholars Program opens doors to early completion and
	additio	onal education opportunities134
	4.3.2.3	The Dell Scholars Program is a critical source of financial and social
	suppor	rt 139
	4.3.2.4	Conclusion143
	4.3.3 Key	program component: The Dell Scholar's Program work environment
	and staff ba	ckground
	4.3.3.1	Collaborative case management146
	4.3.3.2	Work environment150
	4.3.3.3	Staff cultural competency151
	4.3.4 Key	program component: Implementation of a continuous quality
	improveme	nt strategy 155
4.4	DISCU	USSION
5.0	DISCUSSIO	ON AND IMPLICATIONS164
APPEND	IX	
BIBLIO	GRAPHY	

LIST OF TABLES

Table 1. Overview of data sources 56
Table 2. Descriptive statistics and means comparisons of Dell and BPS before matching
Table 3. Descriptive statistics and means comparisons of the matched analytic sample
Table 4. DID impacts of scholar selection on enrollment, persistence and completion
outcomes71
Table 5. DID impacts of scholar selection on enrollment, persistence and completion outcomes,
by institutional selectivity
Table 6. DID impacts of scholar selection on enrollment risk indicators 74
Table 7. DID impacts of scholar selection on enrollment risk indicators, by institutional selectivity
Table 8. First-difference impacts of scholar selection on first-year borrowing
Table 9. First-difference impacts of scholar selection on first-year working patterns 80
Table 10. First-difference impacts of scholar selection on course credit attainment
Table 11. First-difference impacts of scholar selection on postsecondary grade point average 83
Table 12. Overview of data sources for the explanatory case study
Table 13. Descriptive statistics for the Dell Scholars Program analytic sample,
Table 14. Overview of flags for the onboarding, check-in and renewal processes 104
Table 15. Summary statistics for program contact notes and interventions 115

Table 16. OLS estimates predicting more than 5 contact notes in the second year across second
year cumulative GPA 118
Table 17. OLS estimates predicting a program intervention across year 4 cumulative grade point
average
Table 18. Summary statistics for Dell Scholars Program award disbursement 124
Table 19. Summary statistics for Dell Scholars Program award disbursement across all Barron's
Selectivity Index categories

LIST OF FIGURES

Figure 1. Tinto's Student Integration Model
Figure 2. Tinto's Revised Student Integration Model 11
Figure 3. Tuition and fees (2016 dollars) across institutional selectivity categories
Figure 4. The Dell Scholars Program toolkit for college success
Figure 5. The Dell Scholars Program staffing structure as of October 2015 100
Figure 6. The Dell Scholars Program model with administrative tool check-in points 102
Figure 7. Boxplot of the distribution of contact notes across the GPA< 2.0 risk indicator 116
Figure 8. Scatterplot of predicted probability of scholars having a high number of contact notes
across cumulative grade point average in their second year, by institutional selectivity117
Figure 9. Scatterplot of the raw contact notes across cumulative GPA through year four 127
Figure 10. Screenshot from a slide deck from the Michael and Susan Dell Foundation about the
methodology of the administrative tool's Student Risk Indicator
Figure 11. Screenshot of a new feature in the administrative tool that allows the staff to review
cohort-level progress and target intervention points
Figure 12. Socioeconomic distribution at colleges by selectivity for 1982 and 2006. These graphs
were recreated from Carnevale & Strohl (2010)
Figure 13. Distribution of 2013 six-year graduation rates for institutions that enroll Dell Scholars
and their matched BPS counterparts

DEDICATION

This is for my mother, Sung Hui Yum Kehoe, who is my most treasured social resource, and for her mother, my helmohi, who exemplified strength, love, and kindness. I also dedicate this work to three brilliant women – Dr. Jennifer Russell, Dr. Lindsay Page, and Susan Knight – for guiding and supporting me in all the instrumental ways that they could not.

ACKNOWLEDGEMENTS

This work would not have been possible without the material and social support that I received from the community of academics, practitioners, graduate students, funders, young adults, family and friends that I have in my life. I am deeply and forever grateful to Dr. Jennifer Russell, my faculty advisor, for inviting me into the doctoral program. Dr. Russell was my funder, my advocate, and a critical source of support for me in graduate school. Dr. Russell was always available guide me through the politics and norms of academia, and she is the reason I could conduct personally meaningful work without sacrificing my well-being. I am also greatly indebted to Dr. Lindsay Page for offering me the opportunity to work on this personally and intellectually fulfilling impact evaluation. Dr. Page was a consistent source of enthusiasm and brilliant mentorship as we extended this work to build a dissertation. Both women were available to field my questions and doubts at all hours. They are exemplars of what graduate student advising can be.

This scope and depth of this impact evaluation was only possible because of the collaborative spirit and dedication to rigor exhibited by the staff of the Michael and Susan Dell Foundation. Oscar Sweeten-Lopez launched this partnership and paved the way for our access to the funding and information that was needed to conduct accurate and thorough work. I must thank the Dell Scholars Program team – Ninfa Murillo, Sonja Demps, Sana Meghani, Todd Penner and the Dell Scholars Program Ambassadors - who were so generous with their time, knowledge, stories, and thoughts. I owe thanks to Marita Kurian, Gunjan Gupta, John Ly and George Prevelige

for their generous assistance with data management and access. And, of course, I am thankful to the scholars who participated in the interviews with openness, honesty and strength.

This analytic design of this work was enriched by my participation in the IES-funded Northwestern Quasi-Experimental Workshop in 2016. I owe thanks to Dr. Tom Cook for giving me the opportunity to participate, and for the instruction, advice and encouragement that I received from Dr. Vivian Wong and Dr. Coady Wing as I grappled with the matching procedure. I also owe thanks to Dean Alan Lesgold for providing the financial support necessary for my attendance.

During my time in graduate school I was embedded in a remarkable learning community. I am grateful for Dr. Thomas Akiva and Dr. Christian Schunn, who provided generous feedback and encouragement throughout my five years in the program, and enthusiastically accepted the responsibilities associated with sitting on my dissertation committee. I owe great thanks to the current and past faculty of the Learning Sciences and Policy program: Dr. Rip Correnti, Dr. Kevin Crowley, Dr. Mary Kay Stein, Dr. Philip Herman, Dr. Lindsay Matsumura and Dr. Jim Greeno. Every faculty member in this program contributed to my training in a unique and meaningful way. In addition, I would like to thank the current and past graduate students in the LRDC for being an incredible community to learn with. I am eager to see what is ahead for Paulette, Ross, Laura, Maggie, Eben, Marijke, Sharon, Danielle and Katelynn. I am indebted to Dr. Lauren Allen, Dr. Kaleen Tison, Dr. Anita Schuchardt, Dr. Joshua Childs, Dr. Julie Meredith, Dr. Meghan Bathgate, Dr. Sherice Clarke and Dr. Aaron Kessler for their peer mentorship and friendships. I also owe thanks to the doctoral students of the F2016 Causal Inference course, who pushed me to be a better instructor.

I owe thanks to the administrative and support staff in the Learning Research and Development Center and the School of Education who are tasked with the often-thankless work of

XV

helping researchers keep in line with institutional policies and procedures. I especially want to thank Chris Mathis, Deanna Weber Prine, Anthony Taliani, Jeff Flotta, Mike Laughlin, Diane Fajbik, De Ivanhoe, Brad Hyland, Carol Capson, Lynne Welshons, Susan Sherlock, and George McClure. Thanks to Susan Dawkins for stepping in to help me get this formatting right.

I carried the experiences and observations from my prior work community with me throughout this journey. I owe thanks to the current and past staff of the Urban Assembly School of Law & Justice for supporting my development as a practitioner and trusting me to direct a program model that continues to be dear to my heart. Susan Knight, Elana Karopkin, Joseph Pinto, Suzette Dyer, Diana Moldavan, Amallia Orman, Shannon Lynch, Shannon Curran, Joshua Lupher, Aaron Shelby, Sarah Finucane and Sharhonda Bossier were my greatest teachers. I owe enormous thanks to the students and parents of that school community for trusting and challenging me, and for clearly demonstrating what is possible when there are opportunities and resources for learning.

Outside of my professional and academic spaces, I was also lucky enough to have a loving personal community. Thank you to my family and my friends for always rooting for me, and for understanding when I had to be absent to fulfill the responsibilities associated with this work. I must also acknowledge one of my dearest long-time friends, Justin Restauri, who died suddenly during my time in the program. His death brought to focus the great privilege it is to breathe easily, to have the strength to engage with the natural wonders around me, and to have the time and energy to conduct intellectually stimulating work. The fullness of his life and the magnitude of his absence in my own remind me to never take my time and health for granted, every day.

Finally, I thank my partner, Daniel, for growing alongside me and demonstrating how to balance meaningful work with the life we are building together. You are the protector of my solitude, and my best friend.

xvi

1.0 INTRODUCTION

While college access has increased across socio-demographic groups over time, the gap in degree attainment continues to widen (Braxton et al., 2013; Shapiro et al., 2015; Tinto, 2006; Ziol-Guest & Lee, 2016). The Pell Institute's analysis of six-year graduation rates for first-time beginning college students that initially enrolled in a four-year institution reveals alarming gaps in degree attainment across income groups. Just less than one-third of the low-income, first-generation students that initially enrolled in a four-year institution in 2003 attained a bachelor's degree within six-years, while approximately two-thirds of their peers who were not low-income or first-generation graduated (Pell Institute, 2011). The ongoing disparities in degree attainment rates underscore the pressing need to identify effective interventions that promote college success for students who are not sufficiently supported by current institutional and policy retention efforts.

Rigorous impact evaluations on initiatives to support college success have traditionally focused on interventions that target one domain of the college experience (i.e. financial aid or academic support). Yet, there is a profuse array of descriptive and qualitative research that reveals the extent to which low-income, first-generation students encounter a myriad of post-enrollment challenges that compromise persistence and degree attainment. Research on comprehensive support programs, which provide support in more than one domain of the college experience (e.g. providing a scholarship as well as access to intensive advising) are associated with substantially large impacts on the degree attainment rates of at-risk, first-time beginning college students.

Despite these findings, the body of rigorous research studies that examine these promising interventions remains nascent. This work contributes to this acute area of research by coupling rigorous quasi-experimental analytic methods with an explanatory case-study in its examination of a comprehensive college success initiative.

1.1 THE PRESENT RESEARCH

In this work, I delve deeply into understanding the impacts and underlying programmatic components of the Dell Scholars Program. The program is a comprehensive college success initiative that provides participants with a generous annual scholarship and ongoing social and informational support. The program model warrants deep investigation for several reasons. First, the program implements a proactive approach to providing students with social support in addition to financial assistance. Findings from this study will contribute to the budding area of research that uses rigorous quasi-experimental methods to estimate the impacts of programs that provide support across multiple domains of the college experience. Second, the operational core of the program model is a sophisticated web-based system that collects extensive, validated information on student progress to guide a proactive approach to social and informational support. This sophisticated tool allows for a large student to staff ratio and remarkable potential for scalability. Third, unlike other comprehensive support programs that are tied to rigorous evaluations, the program serves students attending a variety of colleges that span categories of institutional selectivity. Finally, using a regression- discontinuity design that capitalized on an arbitrary cutoff score in the program's scholar selection process, Page and colleagues found sizable effects of the program on degree attainment (Page, Castleman, Kehoe, & Sahadewo, 2017). Specifically, students who were just

above the threshold for selection were 9 percentage points more likely to earn a bachelor's degree within four years of initial college enrollment and 16 percentage points more likely to do so within six years compared to students just below the threshold.

1.1.1 Overview of the study

This study is a mixed-methods investigation that builds off and deepens the prior regressiondiscontinuity study in three primary ways. First, inference regarding the causal impact of the Dell Scholars Program was limited to the students at the margin of selection based on the regressiondiscontinuity analytic design. In the first part of this work, I present findings from an impact evaluation in which I use additional rigorous quasi-experimental methods to estimate program impacts beyond the selection threshold. Specifically, I use a coarsened exact matching strategy to generate counterfactuals. By matching both non-selected Dell finalists and Dell Scholars I can capitalize on the unique opportunity to check and account for potential selection biases that often undermine the validity of research when matching strategies are used to estimate causal impacts. I use a difference-in-differences estimation strategy to answer my first research question: What is the impact of the Dell Scholars Program on persistence and completion outcomes across all scholars?

Second, the Dell Scholars Program collects a rich set of longitudinal data on academic achievement, academic progress and college financing for their participants. The regression-discontinuity study was not able to estimate impacts on these variables because they are not observable for non-selected Dell finalists. The NCES Beginning Postsecondary Students 2009/2009 (BPS: 04/09) study does collect this information for their nationally representative sample of first-time beginning college students. Therefore, I utilize the restricted-use BPS: 04/09

dataset to generate counterfactuals and estimate causal impacts on these additional outcomes. This study's second research question focuses on this rich set of persistence and college experience data that were observable for both scholars and their matched counterparts: What is the impact of the Dell Scholars Program impact on college financing, academic progress and academic achievement, which are known drivers of college success?

Third, causal research often does not adequately link contextual information to impact estimates. Rich contextual information is critical for researcher, policymakers and practitioners who are interested in replicating program models. In the second part of this work, I present findings from an explanatory case-study that draws on multiple sources of data to identify the program components and contextual factors that drive and shape the reported impact estimates. Through these analyses I answer the following research question: What are the key programmatic components of the Dell Scholars Program that underlie and drive the observed causal impacts?

1.2 SIGNIFICANCE OF THE RESEARCH AND LIMITATIONS

A limitation of this work is that its findings cannot be generalized to the larger population of lowincome, first generation students. The Dell Scholars Program recruits a subsample of this population that must meet high school achievement benchmarks and have plans to complete a fouryear degree. In addition, the program only supports students that enroll in non-profit two- and fouryear institutions. Findings from this study cannot be generalized to a growing population of lowincome, first-generation students that enroll in technical or certificate programs or proprietary institutions. An additional limitation of the study is that I am only able to observe four- and sixyear degree attainment outcomes for earlier cohorts of the Dell Scholars Program, therefore limiting my sample sizes and subsequently statistical power for some outcomes of interest.

Despite these limitations, this work offers contributions to the field. I begin with the study's methodological contribution. Prior research that has estimated impacts beyond eligibility thresholds use the exact covariates that determine a subject's eligibility for and selection into an intervention. The Dell Scholars Program's selection process is more complex, drawing on multiple sources of information to determine applicant selection into the program. Therefore, their selection procedure cannot be replicated. This study is the first to use regression-discontinuity estimates to assess the validity of impact estimates from a matching procedure that uses covariates that are informed by theory and prior research.

Findings from this work has the potential to inform college success initiatives serving lowincome students at large, and will be of immediate interest to researchers and policymakers who study and design interventions that aim to support the growing number of low-income students entering college. First, the program serves a group of traditionally underserved students who enroll in a set of institutions that are diverse across geographic location and selectivity. Other well-known merit-scholarship programs, such as the Gates Millennium Scholars and QuestBridge, accept lowincome, first-generation students who primarily attend Elite or Highly Selective institutions.¹ The resources that these students have prior to enrolling in college and through their enrollment in college often confounds any potential effects that can be observed in an impact evaluation. The lack of heterogeneity of in the student samples and the types of institutions that they attend greatly limits the extent to which these evaluations can inform the design of initiatives at large. Second,

¹ I conduct analyses across institutional selectivity as defined by the Barron's Selectivity Index. I describe this index in the methods part of Chapter 3.

studies on college success rarely have access to detailed, longitudinal persistence data across treatment and comparison groups. In this study, I take full advantage of the rich, longitudinal data available for the Dell Scholars and the counterfactual I generate from a nationally representative dataset of first-time beginning college students. Third, this study moves beyond the program impacts to addressing the pressing question of *how* the program achieves successful results.

2.0 LITERATURE REVIEW

Despite widespread efforts to address barriers to college access and completion, traditionally underserved students continue to enroll in and complete college at significantly lower rates than their more advantaged peers (e.g. Bailey & Dynarski, 2011; Baum, Ma, & Payea, 2013). While college access has increased across all socio-demographic groups over time, college completion rates have declined, and the gap in degree attainment between these groups continues to widen (Braxton et al., 2013; Shapiro et al., 2015; Tinto, 2006). The postsecondary system is specifically failing to promote the success of underserved students (i.e. low-income, first-generation and/or ethnic minorities) whom, on average, overcome significant barriers to enroll in college. While reform initiatives have made substantial progress in increasing access to college through a variety of programs and policies (for a recent review see Page & Scott-Clayton, 2016), the literature on interventions that effectively promote college success after enrollment is incipient.

Findings from the most recent longitudinal study on a nationally representative sample of first-time beginning college students revealed that low-income, first-generation and ethnic minorities (i.e. Black and Hispanic students) had bachelor's degree attainment rates of 25 percent, 15 percent, and 16 percent respectively, six years after they first enrolled in college (Radford, Bernker, Wheeless & Shepherd, 2010). Attrition is costly on multiple levels. Students who drop out of college accrue debt without obtaining access to the personal, financial and life-long benefits associated with degree attainment. In addition, there are larger societal impacts, including lower

local, state and federal tax revenue, decreased civic participation, and higher rates of incarceration and public assistance expenditures (Baum et al., 2013; Jones, 2013; Schneider & Yin, 2011).

Drawing on a comprehensive review of research, this inquiry is driven by theories that suggest that a large proportion of the completion gap can be explained by the academic, social and financial resources accessed by more advantaged students (e.g. Heller, 2013). Furthermore, this work is influenced by prior research that hypothesizes that the academic, social and financial supports that are common in higher-income homes and communities can be designed and embedded in organizational practices, and subsequently support the outcomes of underserved students. Ongoing disparities in degree attainment rates illuminate the need to unpack and understand the mechanisms that drive success. There is a substantial body of literature that analyzes the relationship between a student's individual characteristics and the likelihood of degree completion. There is also a rich body of research across multiple theoretical perspectives that shed light on the challenging maze of academic, psychological, social, cultural and financial barriers that underserved students encounter after the point of enrollment. Yet, despite this large and growing body of descriptive evidence, the most pressing question around what interventions improve postsecondary outcomes remains largely unanswered.

In the next sections I will provide an overview of the conceptual models and theoretical perspectives that have guided work on college persistence, specifically highlighting the model proposed by Goldrick-Rab (2010) in her recent review of research. I will then provide an overview of my review process and classification strategy. After reviewing studies, I will conclude with a discussion on implications for future research.

2.1 CONCEPTUAL MODELS EXPLAINING COLLEGE SUCCESS

An extensive amount of research has been conducted with the goal of understanding why our postsecondary system is hemorrhaging students, particularly those students that can arguably benefit the most from attaining a postsecondary degree. Since the 1970s, a number of conceptual models have emerged to account for the complex interplay of factors that together explain college persistence and degree completion. In their comprehensive review of factors that contribute to college success, Pascarella and Terenzini (2005) posit that there are two broad families of theories and models: developmental models and college impact models. They categorize models that address the nature, structure, and processes of individual human growth as *developmental* models, which focus primarily on the nature and content of *intra*individual change. These models draw on psychosocial theories, theories of developmental change, and cognitive structural theories and examine outcomes related to identity, intellectual, and socio-emotional development.

Pascarella and Terenzini label the second family of models and accompanying theories as *college impact models*, which focus less on individual student development and more on environmental and *inter*individual origins of student change. This family of models emphasizes student change as a function of the characteristics of the institutions students attend (between-college effects) and/or the experiences students encounter within the institutions they enroll in (within-college effects). They describe these models as being "eclectic", in that they often draw from a broad range of perspectives, and evaluate several sets of variables that are presumed to impact one or more drivers of change. The defining characteristic of these models, as opposed to developmental models, is that they attempt to account for the complex interplay of contextual factors, which occur on multiple levels, to explain the phenomenon of college persistence and degree attainment for various subgroups across a range of institutions.



Figure 1. Tinto's Student Integration Model

Since this work investigates the contextual factors that can be altered through programs and policies to impact college success, and the outcomes I examine are indicators of progress and attainment rather than development, I focus my attention here on college-impact models. Tinto's (1975) Student Integration Model (see Figure 1) has been described as paradigmatic due to its wide-reaching influence on college persistence and retention research. Tinto positioned academic and social integration as constructs that are critical to understanding student success. His model theorized that students who socially and academically integrate into a campus community increase their commitment to the institution and are subsequently more likely to graduate. Tinto hypothesized that students enter college with socio-demographic attributes, prior educational experiences and dispositions that interact with the academic and social systems of postsecondary institutions to varying degrees of success. He posited that negative experiences in the academic and social domains of the college experience weakens a student's commitment and enhances the likelihood of departure.

Tinto's conceptual model has evolved considerably since his original 1975 publication, and he has released adapted models such as the longitudinal model of student departure (Tinto, 1987; see Figure 2). Researchers continue to build on his original work and have appended additional constructs (e.g. institutional characteristics) and multiple layers (e.g. political-economic and family contexts) that are presented as important pieces to a comprehensive puzzle (see the five papers the National Postsecondary Education Cooperative (NPEC) commissioned in 2006). It is widely agreed that there are five sets of variables that are essential to comprehensive models of student success: 1) student background characteristics; 2) structural characteristics of the school; 3) student interactions with faculty and staff members; 4) student perceptions of the learning environment; and 5) the quality of effort students devote to educationally purposeful activities (Kuh et al., 2008).



Figure 2. Tinto's Revised Student Integration Model

2.1.1 Major theoretical perspectives

Comprehensive models are useful in illustrating the complex, multi-level factors that contribute to a student's experience. However, their breadth and scope make them unwieldy to fully operationalize in research. Researchers approach the college success puzzle from various theoretical perspectives that determine which factors and outcomes from these large conceptual models are put into focus. Prior reviews have identified five main theoretical perspectives that guide research on college success: economic, psychological, cultural, organizational, and sociological (for a thorough review see Braxton et al., 2014; Habley, Bloom, & Robbins, 2012; Kuh et al., 2008; Seidman, 2005). In this section I provide a brief overview of the outcomes of interest commonly associated with each perspective and the seminal theories that ground them.

The economic perspective focuses on the role of persistence and degree completion as markers that influence future labor market outcomes. Grounded in human capital theory, this perspective examines economic outcomes as a function of educational attainment. Human capital theory explores the productive capacity of an individual as an accumulation of investment in education, healthcare, professional development, and other services (Becker, 2009). A central assumption of human capital theory is that individuals implicitly calculate whether or not college attendance and completion is a worthwhile endeavor by comparing the expected benefits with the expected costs (Becker, 2009; Hossler, Braxton, & Coppersmith, 1989; Paulsen, 2001). Research grounded in this perspective has examined labor market outcomes (e.g. short- and long-term earnings) as a function of degree attainment, as well as the relationship between cost of attendance and enrollment trends.

The psychological perspective focuses on student motivation and engagement measures as key predictors of persistence and completion. Research from this perspective examines how an individual's psychology, specifically student perceptions of themselves and their environment, explains persistence outcomes. There are a number of theories that ground this perspective. Researchers have drawn from expectancy-value theory to examine achievement as a function of one's perceived self-efficacy, expectancies for success, and interest (Eccles, Wigfield, & Schiefle, 1998). More recently, measures have been developed around non-cognitive and social-psychological factors such as grit, social-belonging and mindset (Dweck, 2006; Yeager and Walton, 2011). While there is no one seminal theory that dominates research on college persistence, Bean and Eaton's (2001) conceptual model of the psychology underlying success retention practices speaks directly to researchers from psychological perspective. Their model highlights four key psychological theories as the basis for their recommendations on successful retention practices: attitude-behavior theory, coping behavioral (approach-avoidance theory), self-efficacy theory, and attribution (locus of control) theory (Bean and Eaton, 2001, pp. 74-75).

The cultural perspective is grounded in theories that examine cultural capital, defined by Bourdieu (1984) as the valued tastes and consumption patterns rewarded within certain settings and educational systems. Cultural capital theorists argue that students are often rewarded for the cultural knowledge that informs their dispositions and actions, and that "high-status" culture is often associated with perceptions of intelligence. Cultural capital that is deemed "sociallyvaluable" often reflects the interests and knowledge of middle- and upper-class families, which is transmitted to offspring over generations (Bourdieu, 1973). Unlike the other perspectives discussed here, the research on college persistence from a cultural perspective is not cleanly tied to predictor and outcomes variables. Rather, this perspective applies a critical lens to the assumptions underlying existing models that guide research on college success. For example, Tierney (1999) argued that traditional conceptualizations of social and academic integration are harmful to minority students in that they implicitly suggest that students must abandon their ethnic identities and ties to their communities in order to succeed on predominantly white campuses.

The organizational perspective focuses on the attributes, structure, and behavior of postsecondary institutions. This perspective is growing in importance as the higher education landscape continues to change in response to an influx of "non-traditional" students. Variables of interest include features such as institution size, location, and selectivity, as well as aggregate measure of student characteristics such as percent minority, percent low-income, and average standardized test scores. Institution features are usually included in statistical models as control variables, however, there is more recent research that suggests that college success is more a function of factors tied to organizational values and practices than a function of their structure (e.g. Engle & O'Brien, 2007; Psacarella & Terenzini, 2005). Researchers advocating for studies on organizational behavior have argued that internal organizational structures, practices and policies are more likely than organizational features to influence student outcomes.

This study is guided by a sociological perspective, which emphasizes the influence of external, structural forces on individual choices. This perspective positions the higher education system as a stratification mechanism that is a continuation of stratifying practices present throughout the formal education system. Sociological research on college persistence calls attention to the structural antecedents to postsecondary success. One example is Goldrick-Rab's (2010) proposed conceptual model in her review of the challenges and opportunities associated with the success of community college students. In her review she groups studies into one of three categories: a) the macro-level opportunity structure, which includes the exogenous policy-level

factors that constrain or facilitate the work of colleges and the success of their students; b) institutional practices, which include course sequence design, pedagogical practices, faculty recruitment and development, informational requires, and organizational learning; and c) the larger social inequalities that underserved students face throughout a lifetime that impact their access to learning opportunities and the extent to which they can take advantage of them. In her review, Goldrick-Rab provides extensive evidence on how each of these factors structurally constrains the ability of underserved students to successfully attain a degree.

While researchers from a sociological perspective position schooling as a mechanism that reproduces socioeconomic inequality, it has also sparked a thread of research that positions educational interventions as drivers for social mobility and reform. Researchers who strongly identify with the sociological perspective have responded to an urgent call to shift away from examining whether schools stratify opportunities for success (Perna & Thomas, 2006), to producing evidence of program and policy effectiveness within the system. These researchers (including Goldrick-Rab) have responded to this call by examining program and policy interventions with rigorous evaluation methods. My dissertation work is designed to contribute to this emerging body of literature.

2.2 BARRIERS TO COLLEGE SUCCESS AND IMPACT EVALUATIONS ON INTERVENTIONS DESIGNED TO PROMOTE PERSISTENCE

I shift away from discussing the multitude of factors that together shape the college persistence puzzle and instead focus on the key barriers that policies and interventions target to support student success. I urge readers who are interested in having a deeper understanding of the structural variables that constrain student success to read the Goldrick-Rab (2010) review, or the comprehensive reviews commissioned by the National Postsecondary Education Cooperative in 2006. Since I focus on interventions that are intended to directly support students after the point of college enrollment, I take a moment to describe the diversity of institutions in the postsecondary landscape and how students are distributed. A snapshot of today's postsecondary system clearly illustrates a socio-demographic divide and challenge for scalable reform. The longstanding image of the "traditional" college student—a high school graduate who immediately enrolls full-time, relies on parents for financial support, and is unlikely to work while enrolled—is now the exception to the rule in today's student population (Brock, 2010). At the turn of the century, only about a quarter of undergraduates had these characteristics.

Analysts and administrators often focus on the attributes of underserved students as the reason for poor system performance (Bailey, Jenkins, & Leinbach, 2005; Goldrick-Rab, 2010), but the argument that the attainment gap is solely attributable to intellectual ability has been repeated debunked by research. Students who are equally high achieving in primary and secondary education measures, and have the same odds of enrolling in college, face substantially different odds for degree completion. High-achieving, lower-class students who score in the top quartile of math assessments in 8th grade are 34 percentage points less likely to earn a bachelor's degree compared to peers from upper-class backgrounds (Heller, 2013). Analyses of graduation rates by socioeconomic status and SAT-equivalent scores reveal the same pattern. Students from the top SES quartile who scored between 1200 and 1600 on the SAT are 38 percentage points more likely than their low-income peers to graduate from college (Mattern, Shaw, & Marini, 2013).

One might still wonder if decreasing college completion rates are a product of the changing composition of the student body. In their analysis of declining degree attainment and rising time-

to-completion trends, Bound, Lovenheim and Turner (2009) found that essentially none of these outcomes were explained by the shift in the attributes of the student population. Rather, they found that negative outcomes were localized to those students who began their postsecondary education at public, less-selective two- and four-year institutions. Indeed, the influx of students with attributes that negatively correlate with degree completion have clustered in these types of schools. Non-traditional, at-risk students (i.e. students who have attributes that are negatively correlated with college success) are much more likely to be enrolled in community colleges, open admission four-year institutions, and for-profit proprietary colleges (Brock, 2010; Shapiro et al., 2015).

Conditional on academic achievement, the completion rate of a student's initial college explains a large fraction of the student's probability of attaining a degree. Under-served students who are "undermatched", a common phenomenon for students who have little to no access during the college application process, face daunting completion odds. Goodman, Hurwitz and Smith (2015) used a regression-discontinuity analytic technique to examine the outcomes of SAT test-takers in the state of Georgia in which public four-year universities had a undisclosed minimum SAT score requirement. Students above the threshold who attended four-year institutions had substantially higher bachelor's degree completion rates, particularly if they were from low-income backgrounds. Howell & Pender (2016) reached a similar conclusion: students who shift to an institution with a higher mean SAT score have a much higher probability of completing their degree.

However, there is promising evidence that student success is more a product of what an institution does and not a function of structural or study body characteristics. Studies conducted by the Pell Institute (Engle & O'Brien, 2007; Muraskin & Lee, 2004) examined the practices of institutions, all with a large proportion of underserved students, associated with both higher- and

lower-than expected graduation rates. They concluded that the policies and programs implemented at higher-performing institutions are what drive the success of their students.

This large body of quantitative and qualitative research supports the conclusion that a large proportion of the completion gap can be explained by the academic, social and financial resources accessed by more advantaged students (Heller, 2013). Many of the postsecondary institutions that serve a large proportion of underserved students have not been able to successfully meet the needs of students who have not had the ample opportunities to prepare for college-level work. In addition, there are a number of non-academic barriers that require access to resources and support that are not universally accessible.

In the next section I provide a review of studies that investigated the impact of interventions that are designed to help students overcome common barriers that have been identified in earlier descriptive research. I organize this review around the three domains of the college experience that have been identified by prior reviewers as ripe for reform efforts: academic achievement, social and informational barriers, and college financing (Brock, 2010; Karp, 2011). The direct-to-student interventions that I review are not designed to tackle the multiple layers of structural antecedents that Goldrick-Rab identified. Rather, these interventions focus on structuring supports for students as they are, in the institutions they are already attending. They are implemented with the shared belief that our policies and institutions are capable of doing much more to promote student success.

I present a review of evaluations of direct-to-student interventions that are designed to support the success of students in postsecondary institutions. By direct-to-student, I am referring to interventions that directly impact the student experience by altering their access to academic, social and financial resources. Programs and policies such as state-level performance-based funding for postsecondary institutions and faculty development initiatives are considered interventions that *indirectly* impact the college experiences of students and are therefore outside of the scope of this review. To be eligible for this review, a study must have focused on the outcomes of postsecondary students in the United States or Canada. I was particularly interested in analyses of heterogeneous effects for first-generation students, racial/ethnic minorities, and students from low-income backgrounds.

I review studies that include at least one of the following measures related to collegesuccess. These outcomes are defined following the guidelines of the What Works Clearinghouse postsecondary education evidence review protocol (IES, 2015): credit accumulation and persistence, which refers to progress toward the completion of a degree (e.g. number of collegelevel credits earned, number of terms of continuous enrollment, enrolled vs. did not enroll the next semester); academic achievement, which refers to the extent to which students adequately complete expected coursework (e.g. final grade in a single college level-course; grade point average in college-level course; ratio of college-level courses passed vs. failed); and attainment, which refers to the completion of a degree, certificate, or program. I stray from the What Works Clearinghouse review protocol by not including studies that solely examined outcomes related to access and enrollment, or labor market outcomes.

I restrict this review to research and evaluations that were published within the last fifteen years (2001-2016) using the following keywords individually and in combination in my search: college, postsecondary, persistence, completion, equity, inequity, degree, attainment, program, policy, low-income, minority, first-generation, intervention, causal, impact, experimental, and quasi-experimental. I limit my review of studies to this time period because the composition of students and organizations in the U.S. postsecondary system has changed significantly over time.

I wanted to review interventions and findings that would be most relevant to the pressing challenges that underserved students and the institutions that serve them are facing today.

Qualitative and descriptive quantitative studies were included to provide context and evidence of the barriers students face. However, this paper's primary research question about program and policy effectiveness strictly relies on experimental and quasi-experimental research studies that sufficiently rule out competing explanations and provides grounds for causal inference. Studies were included if they provided evidence of exogenous assignment to treatment and comparison groups. Randomized assignment and regression-discontinuity analysis were the most common analytic designs that met these criteria. I reviewed a number of studies that used propensity-score matching techniques, but excluded them from this review due to insufficient evidence of baseline equivalence and/or the presence selection bias.

There is a large body of research on suggested or tried reforms, many of which present conflicting or weak evidence of effects. Very few studies in this large corpus of work provide sufficient causal evidence of an intervention's impact on persistence or attainment outcomes. While I do not include non-experimental studies in this review, the majority of the studies that I do include in this review are causal evaluations of interventions that are implemented widely. The small number of causal studies also allows me to discuss each of the interventions in detail.

In his review of postsecondary interventions five years ago, Brock (2010) emphasized the need for evaluations using robust analytical techniques and causal evidence as necessary antecedents for system-wide reform. There have been a number of causal evaluations of postsecondary interventions since 2010. This paper attempts to exhaustively account for the causal evidence the field has linked to interventions that support underserved students as they overcome academic, social and informational, and financial barriers along their postsecondary pathways.

20
2.2.1 Academic barriers

A growing proportion of students enrolling in college did not have ample opportunities to prepare for college-level work during high school and subsequently struggle with the transition to the academic rigor on college-level coursework. Descriptive studies on longitudinal academic outcomes have repeatedly identified high school academic rigor, GPA and standardized test scores a consistent predictor of postsecondary academic success (e.g. Wyatt, Wiley, Wayne, & Proestler, 2012). More recent research has identified pressing post-enrollment factors that predict degree attainment. These factors include academic momentum, which refers to the speed with which undergraduates progress in college as measured by the credits a student accumulates in an academic term and academic year. Attewell, Heil & Reisel (2012) found that the number of credits attempted in the first semester of college were highly predictive of later degree completion. Postenrollment risk factors include incidents of a student earning a low GPA and/or earning a low proportion of the credits that they attempted within an academic term. These risk factors are common benchmarks for institutional policies on satisfactory academic progress, with consequences that are particularly damaging for low-income, first generation students. Schudde and Scott-Clayton (2011) found that a substantial proportion of Pell grant recipients are at risk for Pell grant ineligibility when they fail to meet the conditions for satisfactory academic progress. When a low-income student fails to meet these requirements, they compromise their access to federal funding and subsequently harm their chances for ongoing persistence and degree attainment.

Many postsecondary institutions, particularly those that are two-year or less-selective fouryear institutions, have structured remedial coursework (also commonly referred to as developmental courses) into the academic plans of students they determine are underprepared. Data from the most recent Beginning Postsecondary Students (BPS) survey (BPS:11/17) show that 22 percent of first-time beginning college students were enrolled in at least one remedial course. About 32 percent of students who attended a two-year institution enrolled in a remedial course, compared to only 15 percent of students who enrolled in a four-year institution. Students were more likely to enroll in a remedial course if they attended less-selective universities, were from lower-income homes, and had parents who did not have a college degree, and/or were ethnic minorities (NCES, 2015).

While remedial education is intended to help underserved students integrate into the academic landscape of higher education, it has primarily functioned as a gatekeeping mechanism to college-level coursework. Remedial education sequences have emerged as a major barrier that underserved students need to overcome on the path to degree attainment, and these course are associated with multiple costs. The vast majority of institutions require students to complete remedial sequences prior to enrolling in a college-level course. Students who are referred to multiple remedial courses can face a full academic year of coursework before they are even eligible to enroll in college-level coursework (Long & Boatman, 2013). Students who encounter remedial course sequences bear substantial opportunity costs and psychological discouragement that contributes to higher drop-out rates (Bailey, Jeong, & Cho, 2010; Diel-Amen & Rosenbaum, 2002)

While remedial education has become common practice, research on the effectiveness of remedial sequences has been sporadic, underfunded and inconclusive. Attewell et al. (2006) found that remedial coursework had modest negative effects on graduation outcomes for students enrolled in four-year institutions after controlling for prior academic skills and preparation. Bailey et al. (2010) conducted a study on a large sample of students (n=256,672) who were referred to developmental course sequences across 57 colleges. They found that just under one-third of

students referred to these sequences did not enroll in any development course within three years, and that those students who ignored their referral did reasonably well. Students who skipped remedial courses and immediately enrolled in a college-level course passed at a slightly lower rate than those students who completed their sequences prior to course enrollment. Bailey and colleagues concluded that developmental courses may create barriers to student progress that outweigh the benefits of the additional learning that might accrue to those who complete sequences.

Only a few studies have compared the success of students enrolled in remedial sequences to outcomes of comparable students enrolled in college-level coursework, and the results from these studies are mixed. Bettinger and Long (2005) used an instrumental variables strategy to account for variation in placement policies and proximity in college choice to track 28,000 fulltime, traditional-age freshmen at Ohio public colleges over six years. They found that students placed in remedial math courses were 15 percent more likely to transfer to a four-year college, and completed ten more credit hours than observationally similar students who were not placed in remediation. Students are typically placed into remedial courses based on a proficiency exam cutoff score. This common assignment mechanism allows for researchers to compare outcomes of observably similar students around this margin of selection. Calcagno and Long (2008) used a regression-discontinuity design strategy to analyze the causal effect of remediation on the outcomes of 100,000 community college students in Florida. They found that while remediation might promote early persistence, it did not help students who were on the margin of passing the placement cutoff with long-term persistence outcomes. Martorell and McFarlin (2007) also used a regression discontinuity design to examine longitudinal data for freshmen entering two- and fouryear colleges in Texas and found that remedial coursework had no effect on any college persistence outcome variable.

2.2.1.1 Academic interventions

Postsecondary institutions facing high attrition rates of students enrolled in remedial sequences have experimented with a number of interventions to better support students in their academic coursework. Despite an abundance of reform efforts and evaluations that are designed to offer academic support, there are a remarkably small number of causal studies on program effectiveness. I review these interventions below.

Assign students to learning communities

Learning communities are perhaps the most popular intervention implemented by postsecondary institutions to support the academic and social integration of students. While the design and implementation of learning communities vary across postsecondary institutions, there are two core tenets of this type of intervention. First, most learning communities strive to better link content, assignments, and discussions across courses (Brock, 2010). Second, learning communities strive to strengthen relationships between students, their peers, and faculty members by assigning groups of students into cohorts that move between the same sequences of courses. While learning communities are increasingly popular on campuses that serve a large proportion of traditionally underserved students, there is little rigorous evidence of their effects.

There is one experimental study of a learning community that was implemented as a part of the MDRC Opening Doors demonstration. I pause to provide an overview of the Opening Doors project since the studies produced from this initiative have led the charge in producing causal evidence for a number of the interventions I review in this paper. Opening Doors is a project managed by MDRC through which they collaborated with a number of two-year institutions across multiple states. The objective of the project was to design and implement new types of institutional programs to support underserved students with earning college credentials. Each demonstration project included a random assignment evaluation to isolate the impact of the intervention on student outcomes.

The Opening Doors learning community intervention took place the City University of New York's (CUNY) Kingsborough Community College. This community college is a large, urban school with a diverse student population that includes a large proportion of immigrant students. A sample of 1,534 incoming freshmen students was randomly assigned to either the learning community treatment group, or a control group that had access to the college's standard courses and support services. The intervention was implemented for one semester. The learning community treatment assigned students to cohorts of 25 students that together enrolled in three courses: an English class; a standard college course; and a student success course that covered skills required for academic success such as time-management. The program also provided program participants with enhanced academic counseling, tutoring and a voucher for textbooks. MDRC evaluators tracked student progress for two years. Scrivener et al. (2008) found that while the program provided an initial academic boost, the effects diminished over time. Students in the treatment group moved through developmental English requirements faster and more students passed the skills assessment test required for graduation, however there were mixed effects on persistence outcomes. The program did not have an impact on the rate at which students reenrolled.

Enroll students in supplemental college success courses

Another intervention model requires students to enroll in courses that focus on building academic and non-academic skills. These courses, referred to as student success courses or first-year seminars, aim to equip students with the knowledge, skills and abilities that are necessary to successfully transition to college-level coursework. It has been reported that college success courses are offered at almost 90% of postsecondary institutions (Padgett & Keup, 2011; Permzadian & Credé, 2016). However, in their meta-analysis of non-experimental evidence of first-year seminar effectiveness, Permzadian and Credé (2016) found that, on average, first-year seminars have almost no effect on the first-year GPA of students and only a small positive effect on one-year retention rates. There is a lot of variation in how first-year seminars are designed and the content and instruction that they deliver. When examining moderator effects, they found that first-year seminars are more effective when instructors are faculty rather than students, and when those seminars are extended to include all incoming first-year students rather than being restricted to those that are deemed as underprepared.

One example of a study on college success courses that randomly assigned students to a treatment condition is Rutschow, Cullinan and Welbeck's (2012) evaluation of a program implemented at Guilford Technical Community College in Greensboro, North Carolina. The college designed a course that aimed to improve the psychosocial awareness and academic achievement of students who were required to enroll in one or more remedial courses. The intervention was designed to have an intensive focus on helping students adjust their behavior and attitudes, improve time-management skills, and take responsibility for their own learning. A sample of 911 students were assigned to a either the treatment group, which was a required semester-long course, or a control group that was barred from taking the course but had access to

standard university services. While the study detected early effects on student engagement measures (outcomes which are outside of the scope of this review) there was no observed effect on academic achievement during the intervention or in post-program semesters.

Another example of a college success course was a program implemented at Chaffey College, a community college located in southern California. This intervention targeted students on probation status (that is, determined by the school as not maintaining satisfactory academic program). The program consisted of a college success course taught by a counselor, mandatory one-on-one counseling sessions, and required students to frequently use a success center that supplemented instruction. The first iteration of the program had low participation rates and the institution re-designed the program to be mandatory for qualifying students in the following year. In this review I only report effects for the second iteration of the program that required students to participate. In 2006, 444 students on probation were randomly assigned to the treatment group or a control group, which received standard university services. Evaluators tracked the academic progress of study participants over two semesters. Scrivener, Sommo, and Collado (2009) found significant effects on credit accumulation, GPA, and the proportion of students who shed their probationary status and returned to good academic standing. Specifically, the program almost doubled the proportion of student who moved off of probation.

Condense the remedial sequence timeline

Another intervention that has been widely implemented is the condensed remedial sequence. Institutions have been redesigning their developmental course sequence to be more efficient and therefore less of a burden for students to complete. The theory of action is that if students can complete the sequence quickly and become eligible for college-level coursework earlier in their pathway, they will be more likely to persist. There have been several models that have been innovative in combining college-level and remedial-skills coursework to promote student success. These models are well designed and implemented, and have produced very promising results, but I am unable to include them here because they do not meet review requirements. Specifically, these studies do not eliminate concerns around selection bias. I do, however, attend to these promising models in the discussion section of this paper.

Summer bridge programs have emerged as a popular alternative to traditional remedial sequences. These interventions provide condensed remedial sequences during summer months. There is one study that presents causal findings on the effect of summer bridge programs on academic achievement and persistence outcomes. In the summer of 2009, eight developmental summer bridge programs were offered at six community colleges and two open admission fouryear institutions across the state of Texas. Each campus tailored the summer program the meet the needs of the local community context, however all of the programs were designed to share four common features: 1) they included accelerated instruction in developmental math, reading and/or writing; 2) they offered academic support services; 3) each program had a "college knowledge" component with the goal of helping students develop non-cognitive skills that support academic success; 4) participating students were eligible to receive \$400. Recent high school graduates who intended to enroll in these colleges and were identified as students in need of remedial courses were invited to apply to participate in the summer bridge programs. Eligible students who applied were randomly assigned to either a treatment group that was offered a spot in a summer bridge program, or a control group that did not receive an offer but had access to standard university services. The program evaluators collected and analyzed academic outcome data through two academic years. Barnett et al. (2012) found no effect on the average number of credits attempted or earned. While the program had an impact on first college-level course completion, there were

no documented effects on course completion outcomes by the end of the two-year evaluation period. The evaluation also did not find evidence of the program having an effect on college persistence.

2.2.2 Social and information barriers

Vincent Tinto's (2006) longitudinal work on student departure argued that college is as much a social challenge as it is an academic one. While the term "social" is often associated with friendships or participation in clubs and extracurricular activities, in this section I focus on reviewing interventions that strive to either a) enhance an individual's social capital or b) decrease the need for social capital by embedding structure into a postsecondary pathway. Social capital theory posits that an individual's access to and use of resources embedded in their social networks can lead to upward mobility. The resource embedded in an individual's social network, which are accessed and/or mobilized in purposive actions, constitute their social capital (Lin, 1982; 2001). Studies on college access and persistence have illustrated that the amount, quality and stability of social resources from which students draw to assist with decision-making varies across socioeconomic groups. Underserved students often lack access to adequate (or even accurate) information and guidance around college-going processes that result in a gap between postsecondary aspirations, enrollment, and completion (Bell, Rowan-Kenyon, & Perna, 2009; Perna et al., 2008; Roderick, Coca & Nagaoka, 2011).

In their book After Admission, Rosenbaum, Deil-Amen and Person (2007) provide rich qualitative evidence that illustrates how underserved students face relentless challenges and barriers after the point of enrollment that compromise their chances of attaining a degree. They explain that colleges "demand a certain level of social know-how, a set of skills and knowledge

that help students understand school procedures and navigate these institutions" (Rosenbaum et al., 2007, p. 113). In order for students to progress through college, they need to be able to navigate the many course options and administrative procedures that are required for forward progress. Rosenbaum et al. (2007) highlight seven key obstacles that students with limited college knowledge face: bureaucratic hurdles, confusing choices, student-initiated guidance, limited counselor availability, poor advice from staff, slow detection of costly mistakes, and poor handling of conflicting demands (p. 114). In her review of student persistence theories and program evaluation literature, Karp (2011) identified four mechanisms of non-academic support that can improve college success outcomes for community college students: creating social relationships, clarifying aspirations and enhancing commitment, developing college know-how, and making college life feasible. This evidence suggests that institutions must adopt practices that support students who have limited access to the crucial information they need to make important decisions around their academic programs, financial aid, and career goals.

Guidance trends across the country's postsecondary system currently favor more advantaged students. The most selective institutions, which enroll more academically and socially prepared students, provide the most personalized guidance and structure (Brock, 2010). In community colleges, counselor-to-student ratios of 1 to 1,000 are not uncommon (Rosenbaum et al., 2007). A national survey of entering community college students found that less than a quarter of students were assigned a specific person they could contact for information or assistance, and less than half of the students reported that any college staff knew their names (Scott-Clayton, 2011).

Allard and Small (2013) make a compelling argument that the fewer the resources to which individuals have access in their personal networks, the more their outcomes depend on the

30

organizations with which they routinely interact. There is an ongoing debate of whether colleges that serve a high proportion of underserved students should be more or less structured (Rosenbaum et al., 2006; Scott-Clayton, 2011). Community colleges often have enormous course catalogs with no accompanying guidance. Scott-Clayton (2011) reviewed evidence that supports what she referred to as the "structure hypotheses": that students will be more likely to persistence and succeed in programs that are tightly and consciously structured, with relatively little room for individuals to unintentionally deviate from pathways toward completion, and with little bureaucratic obstacles to navigate.

2.2.2.1 Social and informational interventions

In this section I review studies on interventions that aim to enhance the social capital of students with the goal of better enabling them to navigate complex postsecondary environments. In addition, I also review an emerging line of exciting work around interventions that target common social-psychological barriers that are common to underserved students, specifically ethnic minorities. Social-psychological factors, such as mindset or a student's sense of social-belonging, have been shown to be strong predictors of academic achievement and persistence. Yeager and Walton (2011) make a compelling case for why these small interventions can and should be embedded in larger reform efforts, which I summarize below. These interventions take place in postsecondary contexts, and they are evaluated using random assignment methods, therefore meeting the requirements of this review.

Provide personalized guidance

As discussed above, students in community colleges and less-selective universities often have infrequent or zero access to an academic advisor. One intervention, that is perhaps an obvious solution, is to offer students access to personalized guidance that will help them keep on track. A personalized guidance intervention was designed as part of the Opening Doors demonstration and was implemented in two Ohio community colleges. The program targeted beginning freshmen and continuing education students who had fewer than thirteen credits, and offered regular, intensive and personalized guidance with a counselor-to-student ratio of 1 to 160. A sample of 1,139 eligible students were randomly assigned to the program group or a control group that had access to standard university services and counselors assigned to 1,000 students. Program participants were also eligible to receive a modest stipend of \$150 if they completed at least two counselor visits a semester. The intervention took place over one academic year. Scrivener and Weiss (2009) tracked student academic progress over three years and found that the program only improved academic outcomes during the second semester. Students in the program group were more likely to register for second semester classes and there was a modest impact on credit accumulation. They also found a small increase in registration rates during the first semester after the conclusion of the program, however credit accumulation effects disappeared.

Another personalized guidance intervention involved assigning students to professional coaches. InsideTrack is a for-profit organization that partners with colleges to provide student coaching services. Bettinger and Baker (2014) conducted a randomized assignment study of this service using data for a large sample of students enrolled in degree programs in public, private and proprietary colleges. The theory of action that drives InsideTrack is that coaches encourage persistence by helping students find ways to overcome both academic and non-academic barriers. Coaches and students interacted via phone, email, text-messages and social media sites over two semesters. In their evaluation, Bettinger and Baker (2014) found that students assigned to a coach were more likely to persist during the treatment period, with a 6-month retention rate of 63 percent

for coached students compared to 58 percent for students in the control group. They also observed persistence effects observed one year after coaching had ended, with a 14 percent increase in persistence for coached students after 18 months. They conclude that coaching may be a cost-effective method of improving completion outcomes.

Target social-psychological barriers

Social-psychological interventions target student self-perceptions of their abilities. Because these interventions are often simple and take place in a short amount of time, their documented effects have been discounted as "magic". Yeager and Walton (2011) eloquently dispute this claim in their review of social-psychological research, arguing that "even a seemingly small intervention but one that removes a critical barrier to learning can produce substantial effects on academic outcomes." (p. 275). Yeager and Walton (2011) argue that student self-doubt about abilities or susceptibility to negative stereotypes are real barriers to persistence that must be targeted, for there is evidence that they undermine academic performance. In this section I review findings from causal research that provides evidence of the impact of social-psychological interventions on postsecondary outcomes.

Aronson, Friend and Good (2002) designed a small intervention to combat stereotype threat. The basic notion behind stereotype threat is described as follows: "In situations where a stereotype about a group's intellectual abilities is relevant – taking an intellectually challenging test, being called upon to speak in class, and so on- Black students bear an extra cognitive and emotional burden not borne by people for whom the stereotype does not apply. This burden takes the form of a performance-disruptive apprehension, anxiety about the possibility of confirming a deeply negative racial inferiority..." (p. 114) Their intervention aimed to combat this treat by persuading students to adopt the view that intelligence is malleable and can be improved. A total

of 109 black and white undergraduates at Stanford University were recruited to participate in the study and assigned to one of three conditions. In the treatment condition, students wrote letters to younger students endorsing the belief that intelligence is malleable. In a control pen-pal condition, students wrote letters to younger students endorsing multiple intelligence theory. In a second control condition, students did not write letters. At the end of the academic year, both black and white students in the pen-pal treatment condition received higher grades than their counterparts in the other two conditions.

Walton and Cohen (2007, 2011) designed an intervention to combat the feelings of nonbelonging that black students commonly experience when they transition to college. Students participating the study were in their first year at a selective college and were randomly assigned to either a belonging-treatment condition or a control condition. Students in the treatment condition were exposed to a narrative that framed social adversity in school as common and short-lived, and encouraged students to attribute adversity to the college-adjustment process and not to fixed deficits unique to themselves or their ethnic group. After receiving exposure to this narrative, students were instructed to endorse this message by drafting speeches to be shared with future students. The effects of the treatment were striking. Students in the treatment group had substantially higher GPAs three years after the intervention, with students' sense of belonging from daily adversity mediating this effect.

Systematize reminders about administrative deadlines

Technology-based support services, which rely on technological tools to provide guidance, is an intervention area that is rapidly growing. While there is currently only one study that has evaluated a technology-based intervention designed to support persistence, there are likely to be many more within the next few years. Every year, students are required to register for classes and re-file their

Free Application for Federal Student Aid (FAFSA). Castleman and Page (2014) evaluated the impact of a "low-touch" intervention that sent college freshmen personalized text messages that provided information about FAFSA deadlines and information about where to find help on campus. Students in the study were randomly assigned to either a treatment group in which students received text message reminders about important steps in the FAFSA re-filing process, or to a control group that did not receive the text messages. They found large and positive effects on the continued college persistence of first-year students enrolled in community colleges. Students who received the treatment were 12 percentage points more likely to persistence into their sophomore year compared to community college students in the control group.

2.2.3 Financial barriers

A critical factor in enrollment and completion patterns is college affordability. Gaps in college persistence and degree attainment between social classes are pronounced, even after controlling for academic achievement and institution type. Over the past decade, college tuition at both private and public colleges has risen sharply, state budgets have trimmed allocations to postsecondary institutions, and family incomes for middle- and lower-class families have remained stagnant or declined in real terms (Baum et al., 2014; Hearn, Jones & Kurban, 2013; Page and Scott-Clayton, 2016). Unmet financial need, which is the gap between the cost of attendance and a students' financial aid package, has increased substantially between 1995 and 2003, with increases being highest for low-income students (Long & Riley, 2007). Several studies have revealed how high levels of unmet need may impact college completion trends by being linked to higher dropout rates, part-time enrollment, and students working too many hours while enrolled in classes (for a review see Welbeck et al., 2014). In his review of the role of finances in postsecondary access and

success, Heller (2013) concluded that lower-income students are more sensitive to rising tuition prices and are more likely to not enroll when faced with a higher cost compared to their wealthier peers. In addition, he notes that grant aid has been shown to be more effective in promoting participation compared to loans.

2.2.3.1 Financial interventions

There is an extensive body of research on the impact of different types of aid on access and enrollment decisions (for comprehensive reviews see Deming & Dynarksi, 2009; Dynarski & Scott-Clayton, 2013; Page & Scott-Clayton, 2016). This section reviews a small, but growing body research on the effects of need-, merit-, and performance-based aid on persistence and attainment outcomes.

Provide need-based aid

Need-based aid provides funding to students who demonstrate financial need. To examine the effects of federal need-based grants, researchers have capitalized on policy changes that create exogenous shocks and allow for causal inference. The federal Pell Grant program is perhaps the longest-standing, most widely recognized need-based grant program. Bettinger (2004) capitalized on small discontinuities in the Pell grant formula to study the causal effects of the voucher on student persistence in Ohio. He found that students whose Pell grants increase are less likely to dropout, but noted that his regression-discontinuity estimates were fragile.

Different types of non-federal, need-based aid programs have emerged to assist lowincome students with college financing. Causal research has been conducted on three state-based programs that distribute grants to students who meet income requirements and maintain satisfactory academic progress while enrolled in college. The Florida State Assistance grant program distributes small grants to Florida residents with household incomes less than \$30,000 attending postsecondary institutions within the state. Castleman and Long (2016) conducted a regression-discontinuity analysis that capitalized on the margin of eligibility to determine if the grant impacted the persistence and attainment outcomes of students attending public two- and four-year institutions. They found mixed-effects on credit accumulation, no effect on associates degree attainment, and large effects on bachelor's degree attainment within six and seven years, particularly for high-achieving students.

Goldrick-Rab et al. (2016) conducted an experimental analysis of the Wisconsin Scholars Grant, a privately funded program that offers students a \$3,500 grant per year for up to five years. Students were eligible if they were residents of the state, graduated from a state public high school, matriculated into one of thirteen public universities, enrolled full-time, completed the FAFSA and qualified for a Pell Grant, and possessed unmet need. Eligible students were entered into a lottery and randomly assigned to the treatment condition during their first semester of college. Goldrick-Rab and colleagues found that the offer of the grant increased on-time bachelor's degree completion rates for students by about five percentage points. There was a larger program effect on retention and earned credits among students with higher out-of-pocket costs. They found that the offer of the scholarship increased retention by 1.3 percentage points for each additional \$1,000 students faced in out-of-pocket costs when starting college. Larger impacts on second-year retention rates were observed among students who had an out-of-pocket cost that exceeded the size of the grant.

Angrist et al. (2014) conducted a randomized evaluation of the Buffet Scholars program, one of the largest private aid programs in the country. The Susan T. Buffett Foundation has offered college scholarships to Nebraska residents who attend Nebraska public colleges and universities

37

for over fifty years. Scholarships are awarded to first-time, entering freshmen who achieve at least a 2.5 GPA in a Nebraska high school and demonstrate financial need. Angrist et al. (2014) conducted a randomized evaluation of the program, awarding more than 2,000 scholarships via random assignment. They found substantial gains in sophomore enrollment, with an increase of 7.2 percentage points, and four-year enrollment gains of 14 percentage points. They found large effects on persistence for students that typically have low persistence rates, with a 20-plus point gain in four-year enrollment rates for nonwhite students.

Provide merit-based aid

States have played an important role in providing funding to make college affordable for lowincome students. Since the 1990's states have shifted away from appropriating state funds to public colleges, which could lower the sticker-price for all in-state students, to allocating merit-based scholarships to students who achieve a moderate GPA in high school (Dynarski, 2004; Toutkousian & Shafiq, 2009).

Merit-based scholarships that are issued to residents to attend in-state institutions have grown in popularity. Since the 1990's more than a dozen states have begun to implement meritbased aid programs for in-state residents (Dynarski, 2004). The program awards tuition and fees to young in-state residents who achieved a modest grade point average in high school (e.g. a GPA of 2.5 or 3.0). In her analysis of the effects of merit-based programs in Georgia and Arkansas, Dynarski (2008) found that the programs increased degree completion by 5-11 percent for those students who would have enrolled in college in the absence of the scholarship. She concluded that the positive effect on retention potentially outweighs any negative effect of enrolling marginally weak students with a higher probability of attrition. Scott-Clayton (2011) conducted analysis of the effect of the West Virginia PROMISE Scholarship on persistence and completion outcomes. She found that the program increased eventual graduation rates by four percentage points, and on-time graduation rates by seven percentage points. One notable design component of the PROMISE scholarship was its strict requirements for recipients to maintain full-time enrollment status with a minimum credit accumulation rate. Scott-Clayton concluded that this renewal requirement was a major driver of increased on-time completion rates. Her study is the first to disentangle the mechanisms underlying the observed effects of merit-based programs on persistence outcomes.

Provide performance-based aid

Performance-based scholarships are designed to reduce financial barriers while providing an incentive for academic progress. In 2008 MDRC launched a performance-based scholarship demonstration to evaluate the effectiveness of this type of aid across a variety of settings and incentive structures. The study included more than 12,000 students in postsecondary institutions across six states. Scholarships ranged from a few hundred dollars to \$1,500 a semester. Mayer et al. (2015) evaluated the program impact using a randomized control design. They found that the scholarship improved the academic progress of students during the program's duration as well as one year after program completion. Students in the program group enrolled in more classes and acquired more credits with effects consistent across socio-demographic groups. However, these effects diminished over time and there were no observed impacted on degree completion.

2.3 COMPREHENSIVE APPROACHES TO PROMOTING COLLEGE SUCCESS

I have reviewed program and policy evaluations that targeted one of the three domains of the college experience: academic, financial and situational. I limited my review to those studies that used exogenous assignment to produce evidence on program effectiveness. It is notable that causal evidence on program impacts, though rapidly emerging, remains thin. The most promising interventions, which have the largest documented effects on completion outcomes, are those that take a comprehensive approach to supporting students. I discuss the findings from impact evaluations for comprehensive interventions below.

2.3.1 Couple institutional aid with enhanced institution-based supports

Some institutions have designed internal programming that provides comprehensive support for students who are at risk for attrition. One example of this type of program is The Student Achievement and Retention Project (STAR), which combined academic services with financial incentives at the satellite campuses of a large Canadian university that is comparable to a large state school. In 2005, all first-year students in the bottom three GPA quartiles were randomly assigned to one of three treatment groups or a control group. One treatment group was offered an array of support services including access to mentoring by upper-class students and supplemental instruction. Another treatment group was offered cash awards, up to the equivalent of a full year's tuition, for students who met a target grade point average. A third treatment group was offered a combination of the two. A control group received standard university support. Angrist, Lang and Oreopousos (2009) found that the program had no effect on male students, and the effects were strongest for women offered both financial and academic support. Participants in the "combined" treatment group earned more credits and had a significantly lower rate of academic probation at

the end of the academic year. Women in this group also outperformed the other groups in their second year, in which the services of the treatment were not offered.

In 2007, the City University of New York launched the Accelerated Study in Associate Program (ASAP) across six community colleges. The ASAP program is comprehensive in that it targets the most at-risk population of community college students and provides them with substantial financial, academic and personal supports. Participants in the program attend full-time, receive personalized guidance from an advisor with a small caseload, attend a supplementary college success course throughout their first year, and attend college success seminars. In addition, the program provides a tuition waiver that covers the gap between financial need and cost of attendance. In 2010, MDRC conducted a random assignment study of students in ASAP across three of the six community colleges. The evaluation targeted new or continuing students with less than 12 credits who were eligible for a Pell Grant, needed more than one remedial course, and enrolled in an ASAP-eligible major. Scrivener et al. (2015) found that the program increased credit accumulation, increase transfer rates to four-year institutions, lowered the cost per degree, and doubled the graduate rates for program participants, the largest effects MDRC has found for a community college intervention (Scrivener et al., 2015). Recent replications studies of this intervention in Ohio community colleges have early promising results with substantial impacts on first-semester credit accumulation and persistence and full-time enrollment in the second semester (Hutchins & Robinson, 2016).

2.3.2 Provide privately funded aid and social support for students across many institutions

There are competitive private scholarship programs that offer a combination of financial and social support to cohorts of students who attend different universities. The Gates Millennium Scholarship provides financial and social support to high-achieving minority students. The program provides

funding to cover unmet need and self-help aid, funding for graduate education, and leadership development programs. DesJardins and McCall (2008) used a regression discontinuity strategy to examine the causal effect of the program on college success outcomes. They found limited evidence of a program effect on retention, but considerable empirical support of an effect on lowering loan debt, lowering work hours during college, lowering parental financial contributions to college, and increasing the proportion of students who aspire to a doctoral degree. Their findings are consistent with prior studies that also show a small effect on attainment, which is most likely a result of Gates Scholars being high-achieving students who attend very selective universities.

The Dell Scholars Program targets a student demographic that is quite different from the Gates Millenium Scholars cohorts. Participants in the Dell Scholars Program are students who maintained at least a 2.5 GPA in high school and demonstrate large financial need. Unlike Gates Millenium Scholars, participants in the Dell Scholars Program attend postsecondary institutions that vary widely across selectivity indicators. Page et al. (2017) used a regression discontinuity strategy to evaluate the impact of the program, which provides combined financial and social support to scholars primarily attending four-year institutions. They found sizable and significant effects on both on-time and six-year bachelor's degree attainment rates. Scholars who were just above the threshold for selection were 15 to 19 percentage points more likely to earn a bachelor's degree within six years compared to students just below the threshold.

2.4 SOCIAL CAPITAL THEORY AND THE ROLE OF ORGANIZATIONS IN PROMOTING WELL-BEING

The resources embedded in an individual's social network, which are accessed and/or mobilized in purposive actions, constitute their social capital (Lin, 2002). Social capital theory posits that an individual's access to and use of resources embedded in their social networks can lead to upward mobility. However, studies have illustrated that the amount, quality and stability of social resources from which learners draw to assist with college persistence varies across socioeconomic groups. Low-income students often lack access to adequate (or even accurate) information and guidance around college-going processes that result in a gap between postsecondary aspirations and actual enrollment and completion (Bell, Rowan-Kenyon, & Perna, 2009; Perna et al., 2008; Roderick, Coca & Nagaoka, 2011; Rosenbaum, Deil-Amen & Person, 2006; Scott-Clayton, 2011).

College guidance and advising has emerged as a critical leverage point for low-income students with parents and family members who are limited in their ability to support progress in college due to lack of knowledge, time and financial resources (Perna & Titus, 2005). However, while we traditionally look to school counselors as the primary source of school-based college guidance, large student-to-counselor ratios and a lack of counselor expertise in key college-going processes have limited the ability of schools to assist low-income students in overcoming barriers (Deil-Amen & Rosenbaum, 2002; Page & Scott-Clayton, 2016; Perna et al., 2008; Scott-Clayton, 2011).

There is widespread agreement that social capital, or the access to resources that students gain through social networks, impacts educational outcomes (Coleman, 1988; for a review see Dika & Singh, 2002; Dufur, Parcel & Troutman, 2013). However, there is little insight into how organizations influence the accumulation of social capital (Borgatti & Foster, 2003; Coburn, Mata

& Choi, 2013). Organizations such as schools, after-school programs and community centers often broker access to resources and information that may be difficult for individuals to obtain through their own personal or familial networks. This is especially so for students growing up in poverty (Small, 2009; Stanton-Salazar, 2011). The evidence that organizations and institutional agents can impact differential access to social capital illuminates an opportunity to close opportunity gaps through organizational practices. The widening opportunity gap in degree completion has sparked the formation of programs in the broader education landscape that strive to support low-income students through college enrollment and degree attainment. These programs, including the Dell Scholars Program, aim to replicate access to resources commonly found in higher-income communities in their program models.

2.5 KEY TAKEAWAYS FOR THE CURRENT RESEARCH

New programs are emerging to comprehensively support students in reaching their postsecondary goals, but there is a critical gap in research that examines program support mechanisms and the impact these practices have on persistence outcomes. This review of the literature revealed three key takeaways. First, the corpus of current research is dominated by descriptive studies on college persistence and impact evaluations on interventions that only target one domain of the college experiences. Second, the review of literature revealed that comprehensive interventions, which provide a suite of support services across multiple domains of the college experience, are associated with impact estimates that are larger than those interventions that only target one domain of the college experience. Comprehensive programs are equipped to provide participants with a multidimensional set of resources to assist them as they encounter the diverse set of barriers

that clutter the landscape from the point of enrollment until degree attainment. Consequently, these programs are more likely to adequately support this vulnerable population of students to degree attainment. Third, the impact of interventions often fade shorty after subject exposure to that intervention has ended. Short-term interventions (e.g. support programs in which participants engage for only a semester or an academic year) do not usually have promising long-term impacts on degree attainment or labor outcomes. However, the comprehensive programs in my review, including the Dell Scholars Program, were designed to provide ongoing support from the point of enrollment until degree attainment. It is impossible to disentangle the individual causal effects of these features, however it is reasonable to assume that both the ongoing support and the suite of resources, together, drive long-run persistence and degree attainment impacts.

The review also explored an emerging literature that explores the extent to which the institutions and organizations with which we interact have the potential to function as critical resource brokers for individuals with few instrumental social ties in their immediate personal networks. Here I highlight a key distinction between the two categories of ties that are traditionally examined in social network research: expressive ties and instrumental ties (e.g. Nin, Cook & Burt, 2001). Expressive ties are indicators of social-emotional connections that are commonly found in relationships across trusted friends and family. Instrumental ties, on the other hand, are associated with tangible resources, information, and knowledge that assist individuals with fulfilling measurable goals such as obtaining a job or, in this case, degree completion. The underlying theory of action for programs like the Dell Scholars Program is that organizations and their staff can buffer the ongoing impacts of poverty on educational outcomes by equipping traditionally underserved students with the tools and resources they need to succeed. For students from higher-income homes, these instrumental resources are often easily accessible in their peer and family

networks. Organizations like the Dell Scholars Program aim to replicate the benefits that are typically embedded in social class structures with systematic practices that can support lowincome students at scale.

A major theoretical construct that drives this investigation is organizational embeddedness (Small, 2009). This construct posits that an individual's social capital depends substantially on the organizations with which that person routinely interacts. Further, if an individual is connected to the right organizations she can acquire connections and resources that yield measurable effects on their well-being (Small, 2009). This investigation is largely influenced by this construct and the accompanying assertion that the fewer the resources to which individuals have access in their personal networks, the more their outcomes depend on the organizations with which they routinely interact (Allard & Small, 2013). There is a pressing need to further understand how the organizations with which low-income learners interact shape their access to critical resource and consequently impact college persistence and completion outcomes. While the organizational embeddedness perspective has been used to understand the accumulation of social capital among low-income parents that engage with day care providers (Small, 2009), this study represents the first to use this perspective to guide a case study investigation of how a college success initiative, which is linked to large causal impacts on long-term outcomes, systematically brokers access to critical social and informational resources and subsequently promotes college success.

3.0 PART 1: ESTIMATING THE IMPACT OF THE DELL SCHOLARS PROGRAM BEYOND THE SELECTION THRESHOLD

To estimate the impacts of the Dell Scholars Program beyond the selection threshold I use quasiexperimental methods to generate impact estimates. The prior regression discontinuity study estimated impacts for subjects just above and below the selection cutoff, which restricted analyses to a small sample size and compromised the opportunity to investigate heterogeneous program impacts. I use two estimation strategies to generate program impact estimates. First, I use a difference-in-differences strategy to estimate enrollment (i.e. continuous enrollment and persistence) and degree attainment outcomes that I can observe for non-selected Dell finalists, Dell Scholars, and their matched comparison groups. In addition, I estimate impacts on two enrollment risk indicators: stopping out, which is an indicator set to one if a student is not enrolled in a term within the first four years after initial enrollment, and dropping out, which is an indicator set to one if a student stops out and does not return within the four years after initial enrollment.

To further unpack the impact of the program on college success, I draw from the full set of longitudinal academic data that are observable for scholars and BPS: 04/09 subjects. The second estimation strategy is a first-difference estimation of the impact of the Dell Scholars Program on known predictors of college success. I investigate multiple outcomes, including borrowing behavior and work hours in the first year of enrollment, credits accumulated over time, and cumulative grade point averages (GPA). In addition, I generate estimates for two academic risk

indicators: earning a term GPA below 2.0 and earning less than three-quarters of the credits attempted within a term.

3.1 BACKGROUND

I begin this chapter with an overview of the Dell Scholars Program recruitment process and program model. I only provide information that is necessary to interpret my analytic strategy and impact estimates and reserve detailed information about the model for the next chapter. I then summarize findings from the earlier regression-discontinuity study, provide an overview of the rationale driving my estimation of impacts for scholars beyond the selection threshold and the assumptions that must be met in matching procedures to generate causal estimates.

3.1.1 The Dell Scholars Program

The Dell Scholars Program is a college-success initiative that provides financial and social support to low-income students identified as having the potential to enroll and succeed in college. The Michael and Susan Dell Foundation launched the program in 2004 with a goal of supporting lowincome and first-generation students who have overcome a large degree of adversity to bachelor's degree completion. The program began with an inaugural class of 80 participants. During the time of this study, the program accepted 300 scholars a year. The program's key objective is to support 80% of each cohort to bachelor's degree completion within six years. To be eligible, applicants must maintain at least a 2.4 GPA in high school, participate in a partner college-readiness program,² be financially eligible to receive a Pell grant, and plan to enroll full-time in a four-year college.³ For the 2009 through 2012 cohorts, which are the cohorts that comprise analytic sample in this study, the program selected 300 scholars annually from a large, national applicant pool.

3.1.1.1 Overview of the program's data collection process

The Dell Scholars Program model is driven by a technological tool that was developed in-house at the Michael and Susan Dell Foundation. This tool, which is referred to as the *administrative tool* throughout this work, collects data from all scholars at key check-in points, including the summer before initial enrollment, after their first semester, and after every academic year. For each check-in process, scholars are required to enter in information about their academic achievement, financial aid packages, and situational information such as work hours, living circumstances and emotional well-being. In addition, scholars are required to upload supporting documentation to validate their entries. If a student does not enter information into their Connect site (the scholar-facing name of the administrative tool), they compromise their access to the scholarship award. The information and documents that students enter are reviewed closely by a contracted document review agency. A staff member at this document review agency is assigned to work specifically with Dell Scholars Program data, and therefore there is consistent communication between the program and the review agency to improve quality checks. I can generate impact estimates for academic outcomes that are known drivers of college success because the scholars enter validated

² Partner college readiness program vary in form and include charter school networks (e.g. YES Prep), summer programs (e.g. Upward Bound), and in-school college counseling programs (e.g. AVID).

³ Scholars must intend to enroll in a four-year program, however, 5.5% of scholars enrolled in a two-year college.

information about their college experiences into the system at key check-in points throughout their postsecondary trajectory.

3.1.1.2 The Dell Scholars Program selection process

The program implements a multi-stage selection process. On average, 8,000 applicants submit materials to the program in January of each year. Of that applicant pool, 600 applicants are identified as semi-finalists and are instructed to submit additional information for the second round of consideration. That pool of applications is reviewed by two separate reviewers and receive a finalist score in March. For the application cycles that took place between 2009 and 2012, the top 300 scores received the program offer. During the selection process, each applicant submits a rich set of information that includes socio-demographic data, high school course-taking and performance data, and situational information. In addition, each applicant signs a waiver that allows the program to observe persistence and degree attainment outcomes through the National Student Clearinghouse. The design of the program's selection process, coupled with evidence that rules out self-sorting or selection bias, allows for the use of rigorous quasi-experimental methods to estimate program impacts.

3.1.1.3 Findings from the regression discontinuity study

Page, Castleman, Kehoe, & Sahadewo (2017) evaluated the impact of the Dell Scholars Program using a regression discontinuity design that that capitalized on an arbitrary cutoff score in the program's scholar selection process, Page and colleagues found sizable effects of the program on degree attainment. Specifically, students who were just above the threshold for selection were 9 and 16 percentage points more likely to earn a bachelor's degree within four and six years of initial college enrollment, respectively.

Two key findings from this prior work inform the design of this study. First, the regressiondiscontinuity impact evaluation found no heterogeneous effects across demographic characteristics or institutional selectivity. This was likely due to the study's restriction to looking at impacts at the selection threshold, which subsequently restricted the sample size. Second, the impact evaluation found no evidence of the program having an impact on enrollment patterns. Since there is no evidence that the offer of the Dell Scholars Program alters enrollment patterns or the type of institution a scholar enrolls in, I am able to use institutional characteristics as pretreatment covariates in the matching procedure.

3.1.2 Estimating impacts beyond the selection threshold

I generate rigorous estimates of program impacts for all scholars by taking advantage of a rare opportunity to check the robustness of the estimates that I generate from matching strategies. The ability to estimate causal impacts using matching procedures hinges on meeting the *strong ignorability assumption* (Rosenbaum & Rubin, 1983), which is also commonly referred to as the *conditional independence assumption*. The Rubin Causal Model structures the counterfactual situations of subjects in treatment and control conditions and presents the following questions: what would the outcome of the treated subject be if she was in the untreated group, and what would the outcome of the untreated subject be if she was in the treated group (Rubin, 1974, 1978)? Since it is impossible to observe actual counterfactual conditions necessary to answer these questions. In the ideal situation, these simulated conditions produce evidence that the only difference between treatment and control subjects is exposure to treatment, and that the assignment mechanism is ignorable. Randomization is an ignorable assignment mechanism in its random assignment of

subjects into treatment and control conditions. If randomization is done correctly, subjects in the treatment condition and in the control condition should be arguably equal in expectation apart from exposure of treatment. In other words, one would expect both groups to have similar responses to the treatment and control conditions.

In the world of educational research, randomization is not often feasible, so researchers rely on quasi-experimental methods to get as close to the randomization process as possible. Social scientists seek out opportunities for regression-discontinuity studies because, at the point of a discontinuity, treatment assignment is accepted as being as good as random when a researcher can rule out evidence of self-sorting or assignment manipulation. Regression-discontinuity studies restrict study samples to subjects just above and just below the selection threshold to meet the critical assumption that subjects in the treatment and comparison groups are similar across observable and unobservable characteristics and therefore equal in expectation.

Within-study methodological papers that compare regression-discontinuity estimates to randomized experiment estimates have shown that regression-discontinuity studies, when done well, generate estimates that are as internally valid as those produced by randomized control trials (Steiner, Cook, Shadish, & Clark, 2010). However, the strength of the regression-discontinuity's estimation strategy comes with major limitations. First, limiting the sample to subjects around the threshold substantially reduces a study's sample size and statistical power. Second, the restrictions of the design eliminate the ability to estimate program effects for subjects that are meaningfully different from subjects near the threshold. An example will illustrate. Imagine an intervention program that has a firm income cutoff for eligibility. The income cutoff point functions as the discontinuity, with subjects just below the cutoff being observationally similar to subjects just above the cutoff but with discontinuous outcomes due to exposure to treatment. A regression-

discontinuity study would estimate programs impacts for these subjects just above and below the selection cutoff, with a key assumption being that both groups look the same across key covariates, including that income variable. But perhaps the program has an enormous impact for extremely low-income subjects who are way above that selection threshold. The regression-discontinuity design does not allow for marginal estimates of program impacts on different levels of that selection variable. Heterogeneous program effects provide critical information to practitioners, policy makers and designers of program interventions. Interventions may have larger and more meaningful impacts for some subgroups of subjects more than others, and the constraints of the regression-discontinuity study eliminate the opportunity to rigorously estimate those differential impacts.

To estimate differential impacts across all scholars, I use matching strategies to generate a counterfactual for non-selected Dell finalists as well as selected Dell Scholars. Matching strategies attempt to meet the strong ignorability assumption by matching on covariates that are associated with both treatment assignment and outcomes of interest, with the idea that matching on all confounding covariates will eliminate selection and estimation biases (Steiner et al., 2010). Matching studies, however, face a major and often insurmountable challenge. There are unobservable factors that may drive a subject's selection into a treatment condition that influence subsequent outcomes, including a diverse array psycho-social and historical factors that are difficult to measure and capture. Most matching studies cleanly illustrate that they successfully achieved balance across a set of covariates when comparing their treatment and comparison groups, and these studies lean on this balance to defend the validity of impact estimates. However, at best, these demonstrations only show that a study has matched on the observable covariates that may impact outcomes, and the covariates that drive selection remain glaringly *un*ignorable. This

work offers a methodological contribution by combining matching strategies with regression discontinuity estimates to further unpack the impact of a program intervention. I can defend the validity of my estimates produced by a matching procedure by taking advantage of the unique opportunity to compare estimates to those generated by the regression discontinuity study.

My analytic design is guided by prior methodological studies (Angrist & Rokkanen, 2015; Battistin & Rettore, 2008; Linden & Adams, 2012; Mealli & Rampichini, 2012) that capitalized on regression-discontinuity study designs and impact estimates to check the validity of estimates generated by matching strategies for subjects beyond selection thresholds. However, unlike these prior studies, I cannot replicate the Dell Scholars Program selection process with the covariates that are observable. For example, the Dell Scholars Program selection process assigns a scaled score to indicate the extent to which an applicant experienced adversity by drawing on information that is provided to them through essays and recommendation letters. Therefore, this study's procedure is unique in that it relies on matching across covariates that have been identified by prior research and theory as being related to degree attainment outcomes. I will check if the matching estimator meets the strong ignorability assumption by matching both non-selective Dell finalists and selected Dell Scholars to counterfactuals. If I fail to reject the null hypothesis that the degree attainment outcomes are the same between non-selected Dell finalists and their matched counterfactual, which are represented by the Dell coefficient in my difference-in-differences impact estimates, I can conclude that the selection mechanism using the rich set of covariates I have on hand meets the strong ignorability assumption and therefore presents a strong argument for the internal validity of the reported impact estimates.

3.2 METHODS

3.2.1 Data sources

To estimate the impact of the Dell Scholars Program on persistence, degree attainment, and known drivers and risk indicators of college success, I draw on data from multiple sources (see Table 1). Analysis of program impacts beyond the selection threshold requires a source of college experience data on a group of students that are observationally similar to Dell subjects. The NCES Beginning Postsecondary Students Longitudinal Study 2004/2009 (BPS: 04/09) provides a nearperfect source of information on the counterfactual. The nationally representative BPS: 04/09 sample consists of first-time beginning college students (n=16,680) that enrolled during the 2003-2004 academic year. A key feature of this dataset is that it includes transcript data from all institutions attended by BPS subjects (PETS files), as well as verified federal financial aid information. Therefore, this dataset is a critical source of detailed information on persistence absent the support provided by the Dell Scholars Program. I use three sources of data provided by the Michael and Susan Dell Foundation. First, the application dataset, which consists of data for six cohorts of applicants from 2009 to 2012. All program applicants submit detailed information on high school academic performance (i.e. GPA, course history, and standardized test scores), socioeconomic indicators (i.e. household income, enrollment in federal assistance programs, household size), and sociodemographic indicators (i.e. parent education, race/ethnicity and geographic data). This dataset also includes application scores that determined ultimate selection into the program. Following the structure of the prior regression-discontinuity study, the sample of applicants is limited to those subjects that made it to the finalist round of selection and received a finalist score (n=4,530). Second, I use the Dell Scholars Program administrative dataset, which

Data Source	Variables
Counterfactual Data Sources	
BPS 04/09 F9 Derived File	 Student demographic data (e.g. race, gender, household income, parent educational attainment) Secondary diploma type and grade point average
BPS 04/09 PETS Files	Postsecondary institution identification and enrollment patternsDegree attainment
	Credits accumulated/earned by termFederal loan borrowing
Dell Scholars Program Data Sources	
Applicant Dataset	 Student demographic information (e.g. race, gender, household income, parent educational attainment) High school performance date
	 Raw and standardized semi-finalist and finalist selection scores
National Student Clearinghouse	
Administrative Detect	 Persistence and degree attainment
Administrative Dataset	 Dell Scholar academic progress and financing data
Institutional Data Sources	
	Institutional selectivity
Barron's Selectivity Index	- Institutional selectivity

Table 1. Overview of Data Sources
contains rich, longitudinal information about postsecondary progress and experiences for all selected Dell Scholars (n=2,112).⁴ Finally, the program has obtained enrollment and completion records for all program applicants from the National Student Clearinghouse.

There are two data sources for institutional-level data for both BPS subjects and Dell subjects. First, data from the Integrated Postsecondary Education Data System (IPEDS), which captures an extensive set of information for accredited postsecondary institutions including student demographics, institution size, tuition and fees, enrollment patterns, etc. Second, the Barron's selectivity index is used to structure institutional subgroup analyses. The Barron's selectivity index is a categorical measure of college selectivity that is based on college admission rates and the competitiveness of each institution's student body as measured by high school ranking, GPA, and standardized test scores (Chetty et al., 2017; Reardon, Baker, and Kalsik, 2012).

3.2.2 Outcome variables

This section presents details about this study's outcome variables. First, I provide details about the enrollment and degree attainment outcomes that are examined with the difference-in-differences analytic strategy. Then, I present the academic and financing outcomes that are estimated with a first-difference analytic strategy, for they are only observable for scholars and their matched counterparts from the BPS: 04/09 sample. Appendix A details the construction of each variable, the data sources, and identifies the analytic strategy used to obtain impact estimates.

⁴ As explained in a prior section, continued scholarship support is contingent upon scholars reporting progress on a regular basis. Scholars provide transcripts and student aid reports that verify academic progress and financial need.

3.2.2.1 Enrollment and degree attainment outcomes

There are five measures of enrollment patterns that draw from data in the National Student Clearinghouse for subjects from the Dell sample, and data from the BPS: 04/09 PETS file for their matched counterparts. These measures include indicators for yearly persistence, stopping out, dropping out and degree attainment.

Persistence is a measure of sustained enrollment into the beginning of an academic school year. A student persists into the second year of college if she is enrolled in the fall and spring of her first year, and enrolls in the fall of her second year. In addition to generating impact estimates on variables related to forward progress, there are indicator variables for incidents of stopping out and dropping out. The stopout indicator variable is assigned a value of 1 if a student does not have an enrollment record for a term within the first four years of enrollment. If a subject is not enrolled in the spring of her first year and the fall of her second year, she is recorded as being stopped out within her first and second years of enrollment. The dropout indicator was coded to signal when a student stops out and does not return in any subsequent terms. A subject is assigned a value of 1 if she stops out and does not return in four years after initial enrollment.

Degree attainment is defined as attaining a bachelor's degree. On-time degree attainment refers to students who complete a degree within four years of enrollment. Six-year degree attainment outcomes count degree attainment within 6 years of enrollment. The indicators for degree enrollment were constructed by counting the number of months between enrollment in the fall semester after high school graduation until the recorded date for degree attainment. Students are on-time graduates if they graduated within 48 months and students are 6-year graduates if they graduated within 72 months. These timelines allowed for students who graduated in the summer after their final spring semester to count as on-time or within 6-year graduates.

3.2.2.2 College financing, academic progress, and academic achievement variables

The rich datasets available from the Michael and Susan Dell Foundation and the BPS: 04/09 study allow for analysis of outcomes variables that are known predictors of college success. This study presents first-difference impact estimates for outcomes related to college financing, academic progress and academic achievement. The college financing variables include first-year loan borrowing behavior, specifically for take-up of federal loans, Parent PLUS loans, and private loans. Private loans include any loans that were borrowed from a lending agency that is not linked to the federal financial aid office. The federal loans indicator is a variable that indicates whether a student borrowed money through a federal Perkins, unsubsidized Stafford or subsidized Stafford loan. The PLUS loan variable is an indicator for if a subject borrowed money through a PLUS loan. Parent PLUS loan borrowing is of interest because it is recognized as a more burdensome form of college financing. Compared to other federal loans, Parent PLUS loans have higher interest rates, require immediate repayment, and are more utilized by underrepresented students attending institutions with limited institutional aid (Rodriguez, 2015; U.S. Department of Education, 2014) In addition, first-year working patterns are observable for the 2012 Dell cohort and their matched BPS counterparts. Therefore, this study includes impact estimates for whether and to what extent Dell Scholars work in their first year of enrollment.

To estimate program impacts on academic progress, I constructed a variable that measures student progress to on-time degree attainment. Given that the subjects across both the Dell dataset and BPS datasets attend many institutions that have their own unique calendar and credit systems, the reported raw count of the credits a student earns within a term are adjusted (see Appendix A for details). These adjustments allowed for assessment of student progress across a common scale. Students were enrolled full-time and on-track if they had 32. 64, 96 and 128 adjusted cumulative

credits earned in their first, second, third and fourth years of enrollment, respectively. This study presents first-difference estimates on the cumulative number of adjusted credits earned for each of the first four years of enrollment.

For academic achievement, this study presents impact estimates for cumulative grade point average (GPA) for each of the first four years of enrollment. The cumulative GPA is the mean of the grade point averages a student earns across every semester of enrollment. This measure does not adjust for sample truncation due to stopping out or dropping out. If a student does not enroll in a term, their cumulative GPA for that year is carried over from the previous term.

Finally, this study reveals program impacts for two academic risk indicators: earning a GPA below 2.0 within a term and earning less than ³/₄ of the credits attempted within a term. These cutoffs were chosen as indicators for risk because they are commonly used by institutions to determine if a student should be assigned to academic probation and subsequently compromise access to federal financial aid (Schudde & Scott-Clayton, 2016).

3.2.3 Coarsened exact matching procedure

Dell Scholars and non-selected Dell finalists are matched to students in the BPS:04/09 dataset with the goal of approximating a fully blocked randomized experimental design. A coarsened exact matching (CEM) procedure (Iacus, King & Porro, 2009) is used to generate counterfactuals. Advocates for this alternative matching method have argued that propensity score matching may increase imbalance, inefficiency, model dependence, and bias (King et al., 2011; King & Nielsen, 2015). There are key benefits associated with the matching procedure. First, CEM does not depend on modeling assumptions. Given that the Dell Scholars Program specifically targets low-income, first-generation students and the BPS: 04/09 dataset is nationally representative, there was a

considerable lack of overlap and imbalance across many key covariates. The modeling strategy associated with propensity score matching called into question the integrity of the generated score. Second, CEM is a straightforward procedure that allows for transparency of the matching process and easy interpretability. This characteristic of the procedure was particularly important in considering the need to clearly communicate findings to practitioner partners and practitioners at large. Third, CEM allows for easy use-autonomy in coarsening and balancing continuous covariates and the procedure is designed to include observations with missing data, as opposed to dropping subjects that are missing data for some key covariates. The cost of these benefits is losing a significant proportion of the analytic sample; however, I conclude that the benefits of the procedure substantially outweighed the cost of a reduced sample size.

The CEM procedure has four steps. First the user identifies the covariates that will be used in the matching procedure. The user coarsens continuous covariates into distribution- and theoryinformed groups, however the variables are preserved as being continuous for future estimation models. The program then conducts an exact match across the combination of covariates included in the procedure. Matched treatment and comparison subjects are organized into CEM strata that represent each combination of the covariates. Finally, the procedure assigns each subject a weight. Subjects that are not matched are assigned a weight of zero. Treatment subjects that are matched are assigned a weight of 1. Each comparison group subject receives a weight that is the product of the total number of comparison group subjects divided by the total number of treatment groups in a stratum. For example, if a stratum has 10 Dell subjects and a 100 BPS subjects, each of the Dell subjects receive a weight of 1 and each of the BPS subjects receive a weight of 0.1.

Prior to implementing the matching procedure, I made decisions that restricted which subjects could be included in my analytic sample. The analytic sample is restricted to first-time beginning college students that enrolled in college the fall immediately after high school graduation. This allowed for a clean longitudinal timeline across academic years and eliminated concern for endogenous factors that drive delayed enrollment. The BPS sample is restricted to subjects that are United States citizens, attained a high school diploma, from households with a parental adjusted gross income below \$100,000, and were between the ages of 17 and 21. These cutoffs were informed by the minimum and maximum values observed for subjects in the Dell dataset. Finally, the BPS sample is restricted to students that indicated during their first year of enrollment that they intended to complete a bachelor's degree. The Dell Scholars Program allows participants to attend two-year institutions under the condition that they intend to transfer to a fouryear institution and obtain a bachelor's degree. This sampling restriction for BPS eliminated many subjects who begin in two-year institutions without intentions to complete a bachelor's degree. Keeping these subjects in the matching procedure would have certainly inflated impact estimated for bachelor's degree attainment. These sampling restrictions reduced the original BPS sample of more than 16,000 students to a pre-matching sample of 5,930 students. The Dell finalist sample of 4,530 was reduced to 4,131 students.

The procedure matched across both student and institutional characteristics, given the relationship between both types of variables and subsequent college success. It is reasonable to be concerned that the offer of the Dell Scholar Programs may have influenced student choices around which institution to enroll in, which would eliminate the possibility to include institutional covariates in the matching procedure. Page and colleagues found that selection into the Dell Scholars Program did not impact initial college enrollment (Page et al., 2017). Therefore, institutional variables are able to be used as baseline covariates in the matching procedure.

Subjects were matched across covariates that are observable for both Dell and BPS subjects that are likely to predict selection into the Dell applicant pool and predict degree attainment and persistence outcomes. I first examined a large set of covariates and narrowed the selection of matching covariates after examining correlations across variables and the extent to which severe imbalance across the datasets would drastically impact the sample size through the matching procedure. For example, the Dell Scholars Program accepts many Hispanic applicants because of the Michael and Susan Dell Foundation's location in Austin, Texas and longstanding partnerships with college-readiness programs throughout Texas. The BPS dataset, however, has a comparably small proportion of Hispanic students. If I would have kept both race categories in the matching procedure, the sample size would have been substantially reduced. The BPS dataset has a small number of students within both race categories that would fit into the different combinations of the matching covariates, which would result in a larger number of unmatched subjects. Therefore, I collapsed the Black and Hispanic race categories into one underrepresented group category. In addition, ACT scores are observable for a large part of both samples, however this variable strongly correlated with high school GPA and institutional selectivity.

Non-selected Dell finalists and selected Dell Scholars from the 2009 through 2012 cohorts were matched to students from the BPS 04/09 dataset. There was a separate matching procedure for each cohort year to account for any potential differences in covariates or outcomes across cohorts. Student socio-demographic and high school performance covariates included a binary variable for gender, a binary variable that indicated whether a student was Black or Hispanic, a binary variable that indicated whether English was the primary language at home,⁵ a coarsened

⁵ A large proportion of the Dell sample has students from home in which English is not the primary spoken language. I decided to include this variable to separate Hispanic students from immigrant families

parent adjusted gross income variable, and a categorical high school GPA variable. Institutional covariates included indicators for four-year institutions, public institutions, and a categorical variable for the Barron's Selectivity Index that sorted students into five institutional categories: Elite, Highly Selective, Very Selective, Selective, and Less Selective. The Elite category in the selectivity index includes Ivy League institutions as well as other colleges and universities with the most competitive admissions standards. Highly Selective and Very Selective schools include competitive public and private institutions that consider high school academic records in their admissions standards. Selective and Less Selective schools include institutions with less competitive admissions standards and open admissions policies. Table 2 presents information about the means and standard deviations for the pre-matched BPS 04/09 sample, non-selected Dell Applicants sample, and Dell Scholars sample. A t-test was conducted to estimate mean differences between the BPS group and each of the Dell samples. Prior to matching, there are significant differences between the BPS and Dell sample means across each of the matching covariates.

from other black and Hispanic students, as well as white and Asian students who are first-generation United States citizens.

	BI	PS	De Appli	ell icants		Do	ell olars	
	Mean	SD	Mean	SD	Diff.	Mean	SD	Diff.
Female	0.57	0.49	0.70	0.46	-0.13***	0.72	0.45	-0.15***
Black or Hispanic	0.15	0.36	0.73	0.45	-0.58***	0.66	0.47	-0.51***
Parent Income	75133.12	54677.44	20956.86	14320.13	54176.26***	18345.14	13544.44	56787.98***
First Generation Indicator	0.38	0.49	0.93	0.26	-0.54***	0.92	0.27	-0.54***
English is Primary Language	0.93	0.25	0.44	0.50	0.50^{***}	0.43	0.49	0.51^{***}
HSGPA 2.0 - 2.5	0.05	0.22	0.00	0.07	0.05^{***}	0.00	0.05	0.05^{***}
HSGPA 2.5 - 3.0	0.09	0.28	0.07	0.26	0.02^{*}	0.04	0.19	0.05^{***}
HSGPA 3.0 - 3.5	0.32	0.47	0.25	0.43	0.07^{***}	0.17	0.37	0.15^{***}
HSGPA > 3.5	0.54	0.50	0.67	0.47	-0.13***	0.79	0.41	-0.25***
Four Year Institution	0.96	0.19	0.92	0.27	0.04***	0.96	0.19	0.00
Public Institution	0.56	0.50	0.82	0.38	-0.26***	0.74	0.44	-0.18***
Elite	0.10	0.30	0.06	0.23	0.04^{***}	0.13	0.34	-0.04***
Highly Selective	0.13	0.34	0.20	0.40	-0.07***	0.26	0.44	-0.13***
Very Selective	0.27	0.45	0.16	0.37	0.11^{***}	0.19	0.39	0.08^{***}
Selective	0.36	0.48	0.33	0.47	0.03*	0.27	0.44	0.09^{***}
Less Selective	0.14	0.35	0.25	0.43	-0 .11***	0.15	0.35	-0.00
Observations	5930		2486			1645		

Table 2. Descriptive statistics and means comparisons of Dell and BPS before matching

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

Source: The Dell Scholars Program database, Michael and Susan Dell Foundation, and the BPS:04/09.

Notes: Standard deviations reported in parentheses for continuous variables. This table presents mean values of baseline characteristics for Dell applicants and Scholars and their matched BPS comparison students. For each set of students, the difference column presents differences in means. Significant differences in baseline characteristics are assessed with a t-test.

3.2.4 Analytic sample

The matching procedure described above identified a total of 3,244 BPS comparison students matched to 1,351 Dell Applicants, and a total of 2,378 BPS comparison students matched to 950 Dell Scholars. Most unmatched Dell subjects included male minorities in Elite and Highly Selective institutions and students enrolled in Less Selective institutions with high school grade point averages above 3.5. Table 3 presents descriptive statistics for each of the samples after matching. After the matching and weighting procedure, there are no significant differences in covariate means between the Dell samples and their matched BPS comparison groups.⁶ The analytic sample is predominantly first-generation, Black or Hispanic, and female. The mean parental adjusted gross income is noticeably low across every sample, ranging from \$18,00 to about \$20,500. Almost half of each matched sample consists of subjects who come from a home in which English is not the primary spoken language. Most subjects have high school GPAs above 3.0. Finally, subjects in the samples first enroll in institutions that are spread across the Barron's Selectivity Index, with a notable concentration of students in the Barron's Selective category.

⁶ In addition to testing mean differences and standardized mean differences, I examined variance ratios to test the overlap of each of the variables. There was nothing notable about the distributions of each covariate after the matching procedure.

	De	ll Applicant	s				D	ell Scholars		
	Bl	PS	D	ell		BI	PS	De	ell	
	Mean	SD	Mean	SD	Diff	Mean	SD	Mean	SD	Diff
Female	0.75	0.43	0.75	0.43	-0.00	0.75	0.43	0.76	0.43	-0.00
Black or Hispanic	0.70	0.46	0.70	0.46	0.00	0.65	0.48	0.64	0.48	0.00
Parental Income	20971.80	14706.51	20468.50	13832.26	-503	20158.10	13314.03	18257.34	12752.57	-1900
First Generation	0.93	0.25	0.93	0.25	0.00	0.93	0.25	0.93	0.25	-0.00
English	0.51	0.50	0.51	0.50	0.00	0.46	0.50	0.46	0.50	-0.00
HSGPA 2.0 - 2.5	0.00	0.07	0.00	0.07	-0.00	0.00	0.06	0.00	0.06	-0.00
HSGPA 2.5 - 3.0	0.06	0.24	0.06	0.24	0.00	0.05	0.21	0.05	0.21	0.00
HSGPA 3.0 - 3.5	0.28	0.45	0.28	0.45	0.00	0.15	0.36	0.15	0.36	0.00
HSGPA > 3.5	0.65	0.48	0.65	0.48	0.00	0.80	0.40	0.80	0.40	-0.00
Four Year Institution	0.95	0.21	0.95	0.21	0.00	0.97	0.17	0.97	0.17	-0.00
Public Institution	0.84	0.36	0.84	0.36	-0.00	0.76	0.43	0.76	0.43	0.00
Elite	0.04	0.19	0.04	0.19	0.00	0.13	0.34	0.13	0.33	0.00
Highly Selective	0.17	0.37	0.17	0.38	-0.00	0.24	0.43	0.24	0.43	-0.00
Very Selective	0.18	0.38	0.18	0.38	0.00	0.22	0.41	0.22	0.41	-0.00
Selective	0.39	0.49	0.39	0.49	0.00	0.28	0.45	0.28	0.45	0.00
Less Selective	0.23	0.42	0.23	0.42	0.00	0.13	0.34	0.13	0.34	0.00
Observations	3244		1351			2378		950		

Table 3. Descriptive statistics and means comparisons of the matched analytic sample

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

Source: The Dell Scholars Program database, Michael and Susan Dell Foundation, and the BPS:04/09.

Notes: Standard deviations reported in parentheses for continuous variables. This table presents mean values of baseline characteristics for Dell applicants and Scholars and their matched BPS comparison students. The means are weighted according to the weights created through the CEM procedure. For each set of students, the difference column presents differences in means. Significant differences in baseline characteristics are assessed with a t-test.

3.2.5 Estimation strategy

To estimate the impact of the Dell Scholars Program beyond the selection threshold, I use a difference-in-differences estimation strategy to estimate program impacts on enrollment outcomes. These outcomes are observable for both non-selected Dell Applicants and selected Dell Scholars through the BPS PETS dataset and the National Student Clearinghouse, respectively. The key estimating equation for analysis of persistence and degree attainment outcomes is the following:

(1)
$$Y_i = \alpha + \beta_1(Dell \ x \ Above_i) + \beta_2 Dell_i + \beta_3 Above_i + \theta X_i + \varepsilon_i$$

Here, Y_i represents outcomes that are observable for both Dell Scholars and non-selected Dell applicants. The spirit of the regression-discontinuity analysis is preserved with the use of the variable name *Above_i*, which is a binary variable that is set to one if a subject was selected as a Dell Scholar or if a subject from the BPS dataset was matched to a Dell Scholar. *Dell_i* is a binary variable that is set to one for finalists and scholars that applied to the Dell Scholars Program. Finally, X_i represents a vector of the individual covariates that are controlled for in the models. The reduced-form impact of the Dell Scholars Program is captured by β_1 . The difference-indifferences analytic strategy also allows for an assessment of this study's ability to derive causal inference. This analytic approach compares of the outcomes of non-scholar finalists and Dell Scholar to their respective matched BPS counterparts. To assess whether the BPS students function as an appropriate counterfactual, I will examine the estimates that are generated for β_2 . If β_2 is close to zero and statistically insignificant, indicating that there are no meaningful differences between non-scholar applicants and their matched BPS counterparts, I can conclude that the matched BPS samples are appropriate counterfactuals. Given that college financing and academic outcomes are only observable for Dell Scholars and students from the BPS dataset, I use a first-different estimating equation to generate impact estimates with the following reduced-form equation:

(2)
$$Y_i = \alpha + \beta_1 DellScholar_i + \theta X_i + \varepsilon_i$$

Here, Y_i is an outcome of college persistence or success, *DellScholar_i* is exposure to the Dell Scholars Program and X_i is a vector of individual covariates. The impact estimates of interest are captured by β_1 .

3.3 **RESULTS**

Findings from this study are presented in two sections. First, I examine the impacts of being selected as a Dell Scholar on persistence into the second and third years of college and bachelor's degree completion within four or six years. These impact estimates draw on enrollment data from the National Student Clearinghouse, which is observable for Dell Scholars, non-selected Dell finalists, and their matched BPS counterparts. To explore the mechanisms by which the program is impacting student outcomes, I then investigate the impact of the program on outcomes that are known predictors of college success. In the second part of this section, I present first-difference impact estimates on outcomes related to college financing, academic progress and academic achievement.⁷

⁷ I present estimates that were generated using ordinary least squares regression models. I estimated outcomes using logistic regression models to check the sensitivity of my impact estimates to model specifications. These models presented no notable differences in coefficients or statistical significance.

Each table contains models with the full set of control covariates used in the matching procedure. For the sake of space and ease of interpretability, the information listed is limited to the main impacts of interest and the baseline comparison group mean, which is the mean outcome for BPS subjects matched to non-selected Dell applicants.⁸ Furthermore, because there are consistent and meaningful differences in impact estimates across institutional selectivity, impact estimates are disaggregated across two institutional selectivity categories: a less selective institution category that includes subjects who first enrolled in Selective and Less Selective institutions, as determined by the Barron's selectivity index; and a more selective category that includes students in Elite, Highly Selective and Very Selective schools.

3.3.1 Difference-in-differences impact estimates on persistence and college completion

The difference-in-differences impact estimates presented in Table 4 indicate meaningful program impacts on persistence and degree attainment outcomes. Overall, Dell Scholars are approximately 4 percentage points and 9 percentage points more likely than their matched counterparts to persist into their second and third years of school, respectively. Scholars are 6 percentage points more likely to attain a Bachelor's degree within four years of enrollment and 13 percentage points more likely to complete their degree within six years.

⁸ Detailed tables with coefficients for the constant and the full set of controls are available by request.

	20	09 – 2012 coho	rts		2009 - 201	0 cohorts	
	2 nd year	3 rd year	BA	2 nd year	3 rd year	BA	BA
	persistence	persistence	attainment	persistence	persistence	attainment	attainment
			in 4 years			in 4 years	in 6 years
AbovexDell	0.041^{**}	0.086^{***}	0.056^{*}	0.014	0.083^{**}	0.074^*	0.132***
	(0.021)	(0.026)	(0.029)	(0.028)	(0.038)	(0.040)	(0.041)
Above	-0.006 (0.017)	-0.018 (0.021)	0.002 (0.022)	-0.002 (0.023)	-0.012 (0.029)	-0.007 (0.030)	-0.025 (0.031)
Dell	0.013 (0.014)	0.022 (0.018)	-0.017 (0.018)	0.028 (0.020)	0.016 (0.026)	-0.036 (0.025)	-0.074*** (0.029)
Average rate for BPS students matched to non-scholar finalists	0.871	0.764	0.260	0.869	0.761	0.254	0.656
N	7923	7923	7923	3933	3933	3933	3933
R ²	0.050	0.051	0.129	0.056	0.051	0.121	0.099

Table 4. DID impacts of scholar selection on enrollment, persistence and completion outcomes

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

Source: The Dell Scholars Program database, the National Student Clearinghouse, and the BPS:04/09.

Notes: Robust standard errors in parentheses. All models estimated using baseline covariate controls including gender, race / ethnicity, first-generation status, home language spoken, high school GPA, parental income, and indicators for institutional type, sector and selectivity.

	20	09 – 2012 coho	rts	2009 – 2010 cohorts				
	2 nd year	3 rd year	BA	2 nd year	3 rd year	BA	BA	
	persistence	persistence	attainment	persistence	persistence	attainment	attainment	
			in 4 years			in 4 years	in 6 years	
	Stu	idents attendin	g less-selective	institutions				
AbovexDell	0.055^{*}	0.111^{***}	0.089^{***}	-0.008	0.078	0.093**	0.180^{***}	
	(0.028)	(0.035)	(0.033)	(0.042)	(0.053)	(0.046)	(0.059)	
Above	0.006	-0.010	0.005	0.013	-0.000	-0.001	-0.034	
	(0.022)	(0.027)	(0.021)	(0.029)	(0.037)	(0.030)	(0.043)	
Dell	0.004	0.013	0.012	0.023	0.011	-0.016	-0.067*	
Den	(0.020)	(0.024)	(0.012)	(0.023)	(0.033)	(0.028)	(0.038)	
Average rate for BPS students	0.853	0.729	0.172	0.856	0.732	0.179	0.567	
matched to non-scholar finalists	~							
	Stu	dents attending	g more selective	e institutions				
AbovexDell	0.023	0.059	0.057	0.024	0.083	0.078	0.102^{*}	
	(0.029)	(0.038)	(0.048)	(0.040)	(0.055)	(0.069)	(0.058)	
Above	-0.018	-0.026	-0.012	-0.016	-0.023	0.028	-0.020	
	(0.025)	(0.032)	(0.038)	(0.035)	(0.046)	(0.054)	(0.046)	
Dall	0.027	0.037	0.061*	0.035	0.024	0.070	0.086**	
Dell	(0.027)	(0.037)	-0.001	(0.033)	(0.024)	-0.070	-0.080	
	(0.020)	(0.020)	(0.034)	(0.030)	(0.040)	(0.048)	(0.042)	
Average rate for BPS students	0.901	0.819	0.400	0.892	0.806	0.379	0.802	
matched to non-scholar finalists								
N	7923	7923	7923	3933	3933	3933	3933	
R ²	0.051	0.052	0.131	0.057	0.051	0.122	0.100	

Table 5. DID impacts of scholar selection on enrollment, persistence and completion outcomes, by institutional selectivity

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

Source: The Dell Scholars Program database, the National Student Clearinghouse, and the BPS:04/09.

Notes: Robust standard errors in parentheses. All models estimated using baseline covariate controls including gender, race / ethnicity, first-generation status, home language spoken, high school GPA, parental income, and indicators for institutional type, sector and selectivity.

The *Dell* coefficient, which allows for assessment of whether the matching strategy successfully generated appropriate counterfactuals, is statistically insignificant for the impact estimates for persistence and four-year degree attainment. Therefore, I can conclude that the matching procedure did indeed produce matched BPS groups that adequately function as counterfactual samples throughout this study. It is of note that this coefficient is statistically significant for six-year degree attainment estimates, however in a negative direction. Non-selected Dell applicants are 7.4 percentage points less likely than their matched BPS counterparts to complete a degree within six years. I explore possible explanations for this negative coefficient in the discussion section.

In Table 5, I present disaggregated estimates across institutional selectivity categories. The results reveal noticeably larger and statistically significant impacts on persistence and degree attainment rates for students enrolled in less selective institutions. Scholars in less selective institutions are 5.5 and 11 percentage points more likely to persistence into their second and third years of college. Further, scholars in less selective institutions are 9 percentage points more likely to attain a Bachelor's degree on time, and 18 percentage points more likely to attain a degree within six years after enrollment. For students enrolled in more selective institutions, there are no significant impacts on persistence or on-time degree attainment. However, an interesting pattern is observed for six-year degree attainment rates. Dell finalists who are not selected into the program and enroll in more selective schools are 9 percentage points *less* likely to attain a Bachelor's degree within six years. Dell Scholars, however, are 10 percentage points more likely than their matched counterparts to complete their degree, suggesting that the program mitigates this negative trend.

In addition to estimating impacts on forward progress and degree completion, I investigate the impact of the Dell Scholars Program on enrollment outcomes that are associated with a high

73

		2009-2	2012 cohorts		2009 – 2010 cohorts					
	2 nd year stopout	3 rd year stopout	Stopout, within vears	Drop out, within years	2 nd year stopout	3 rd year stopout	Stopout, within vears	Drop out, within years		
	F	····P····	1-4	1-4	···· F····	F	1-4	1-4		
AbovexDell	-0.063***	-0.071***	-0.098***	-0.043**	-0.039	-0.060*	-0.092**	-0.038		
	(0.022)	(0.023)	(0.028)	(0.019)	(0.030)	(0.033)	(0.039)	(0.027)		
Above	0.008	0.010	0.019	0.004	0.001	0.013	0.019	0.003		
	(0.018)	(0.018)	(0.022)	(0.016)	(0.025)	(0.026)	(0.031)	(0.022)		
Dell	-0.032**	-0.016	-0.028	-0.010	-0.050**	-0.016	-0.030	-0.005		
	(0.015)	(0.016)	(0.019)	(0.013)	(0.022)	(0.022)	(0.027)	(0.018)		
Average rate for BPS students matched to non- scholar finalists	0.165	0.195	0.310	0.109	0.169	0.193	0.318	0.106		
Ν	7923	7923	7923	7923	3933	3933	3933	3933		
\mathbb{R}^2	0.051	0.075	0.083	0.040	0.057	0.067	0.088	0.037		

Table 6. DID impacts of scholar selection on enrollment risk indicators

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

Source: The Dell Scholars Program database, the National Student Clearinghouse, and the BPS:04/09.

Notes: Robust standard errors in parentheses. All models estimated using baseline covariate controls including gender, race / ethnicity, first-generation status, home language spoken, high school GPA, parental income, and indicators for institutional type, sector and selectivity.

		2009-	-2012 cohorts		2009-2010 cohorts				
	2 nd year	3 rd year	Stopout,	Drop out,	2 nd year	3 rd year	Stopout,	Drop out,	
	stopout	stopout	within years	within	stopout	stopout	within years	within	
			1-4	years 1-4			1-4	years 1-4	
		Student	s attending less	selective instit	utions				
AbovexDell	-0.089***	-0.083***	-0.124***	-0.060**	-0.043	-0.036	-0.082	-0.048	
	(0.031)	(0.030)	(0.038)	(0.024)	(0.042)	(0.043)	(0.054)	(0.033)	
Above	0.010	0.006	0.018	0.001	0.008	0.003	0.006	0.001	
	(0.024)	(0.021)	(0.029)	(0.017)	(0.032)	(0.029)	(0.040)	(0.022)	
Dell	-0.030	0.004	-0.026	0.017	-0.051*	-0.010	-0.038	0.015	
	(0.021)	(0.020)	(0.025)	(0.017)	(0.029)	(0.028)	(0.036)	(0.022)	
Average rate for BPS students matched to non-scholar finalists	0.193	0.219	0.363	0.119	0.189	0.211	0.373	0.108	
		Students	attending more	e selective insti	itutions				
AbovexDell	-0.044	-0.045	-0.078^{**}	-0.006	-0.037	-0.073	-0.106*	-0.014	
	(0.031)	(0.035)	(0.039)	(0.028)	(0.043)	(0.052)	(0.057)	(0.043)	
Above	0.009	0.010	0.022	0.001	-0.007	0.021	0.034	0.000	
	(0.027)	(0.030)	(0.033)	(0.026)	(0.037)	(0.044)	(0.047)	(0.040)	
Dell	-0.036*	-0.048*	-0.033	-0.053**	-0.049	-0.026	-0.015	-0.037	
Don	(0.021)	(0.025)	(0.028)	(0.021)	(0.032)	(0.038)	(0.042)	(0.032)	
Average rate for BPS students matched to non-scholar finalists	0.120	0.156	0.224	0.094	0.137	0.162	0.230	0.103	
N	7923	7923	7923	7923	3933	3933	3933	3933	
R ²	0.051	0.076	0.084	0.041	0.051	0.122	0.088	0.038	

Table 7. DID impacts of scholar selection on enrollment risk indicators, by institutional selectivity

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

Source: The Dell Scholars Program database, the National Student Clearinghouse, and the BPS:04/09.

Notes: Robust standard errors in parentheses. All models estimated using baseline covariate controls including gender, race / ethnicity, first-generation status, home language spoken, high school GPA, parental income, and indicators for institutional type, sector and selectivity.

rate of postsecondary attrition. Tables 6 and 7 reveal the impact of the program on any incident of stopping out (i.e. not enrolling in an academic-year term) and dropping out (i.e. stopping out and not returning) within the first four years of enrollment. To further understand when incidents of stopping out takes place, I also present impact estimates for stop out incidents in the second and third years of enrollment. Scholars are 9.8 and 4.3 percentage points less likely to stop out and drop out, respectively, within the first four years.

Disaggregated estimates across institutional selectivity categories again reveals impacts that are larger in magnitude and statistically significant for scholars enrolled in less selective institutions. Dell Scholars in less selective institutions are 6 percentage points less likely to drop out within their first four years of enrollment, whereas there is no observable effect for their peers in more selective schools. However, there is a significant impact on stopout rates across both categories with an impact of 12.4 percentage points and 7.8 percentage points for students in less selective and more selective institutions, respectively.

3.3.2 Impact estimates on college financing, academic achievement and academic progress

This section presents results first-difference impact estimates for college financing, academic achievement and academic progress outcomes that are only observable for selected Dell Scholars and students from the BPS: 04/09 sample. Here, I take advantage of the rich, longitudinal datasets that are maintained for program participants beginning during the summer prior to their first year of enrollment. Analysis of these outcomes allow for rigorous consideration of the mechanisms through which the program achieves the observed impacts on degree completion. There are two

dimensions to consider by which the program may achieve successful results: college financing and academic progress. The remainder of this section is organized by these dimensions.

3.3.2.1 College financing

One potential mechanism by which the program may achieve successful persistence and degree completion outcomes is by reducing the college financing burden that may deter students from continued enrollment. This section presents impact estimates for loan borrowing and working behavior. Table 8 presents impact estimates for first-year federal and private loan borrowing. Overall, there are significant impacts across all loan categories with Dell Scholars being 26.5 percentage points less likely than their matched counterparts to take on a federal loan during their first year of enrollment, 3.4 percentage points less likely to take on a Parent PLUS loan, and 4.5 percentage points less likely to take on a private loan. These impacts are significant for students in both institutional selectivity categories, however, they are noticeably larger in magnitude for students enrolled in more selective institutions, where scholars may otherwise face larger gaps between the cost of attendance and their financial aid packages.

In addition to reducing loan debt, the program's award may enable scholars to allocate more of their time to studying and integrating into campus life instead of working to cover tuition and living expenses. Table 9 presents impact estimates for employment behavior in the first year of enrollment.⁹ Dell Scholars are 8 percentage points more likely to work at all and 7 percentage points more likely to work at least 10 hours a week. Yet they are less likely to work a high number of work hours. Specifically, Dell Scholars are 5 percentage points less likely to work at least 30 hours a week, with larger impacts for students enrolled in more selective institutions. Prior research

⁹ I am only able to observe first-year working patterns for the 2012 Dell Scholars cohort.

has shown that the number of hours a student works during the school year matters in predicting subsequent academic outcomes. Students who work more than 25 hours a week are more likely to experience negative academic consequences, as opposed to students who take on part-time employment, which his linked to positive impacts on persistence and degree attainment (Leppel, 2002; Scott-Clayton & Minaya, 2016).

The program impacts on loan borrowing and working behaviors are not solely attributable to the \$5,000 financial award that is allocated to each scholar for each academic year. During the program onboarding process, each Dell Scholar submits their Student Aid Report and institutional award packages for review. In addition, each scholar reports the number of work hours that they intend to work during the school year. This information is closely reviewed by a Dell Scholars Program team member prior to a scheduled one-hour welcome call with each scholar the summer prior to fall enrollment. Dell Scholars that report that they are borrowing private loans or a large loan amount and/or report an intention to work more than 20 hours a week are flagged and given detailed advising around financial aid and balancing work with academic demands. Therefore, the impacts for loan borrowing and working patterns are attributable to both the financial award and the robust counseling that the program team provides to scholars.

		2009 – 2012 cohorts			2009 – 2010 cohorts	
	Federal loan ^a	Parent PLUS loan ^a	Private loan	Federal loan ^a	Parent PLUS loan ^a	Private loan
Dell Scholar	-0.265***	-0.034***	-0.045***	-0.368***	-0.041**	-0.048***
	(0.021)	(0.009)	(0.009)	(0.035)	(0.016)	(0.012)
Baseline comparison	0.522	0.053	0.082	0.559	0.061	0.079
N	2465	2465	3326	828	828	1691
R^2	0.142	0.060	0.105	0.206	0.070	0.130
		Students attend	ding less-selective	institutions		
Dell Scholar	-0.209***	-0.026*	-0.030**	-0.351***	-0.031	-0.035*
	(0.032)	(0.014)	(0.014)	(0.053)	(0.025)	(0.019)
Baseline comparison	0.473	0.042	0.060	0.525	0.053	0.059
		Students attend	ing more selectiv	e institutions		
Dell Scholar	-0.304***	-0.040***	-0.057***	-0.381***	-0.048**	-0.058***
	(0.027)	(0.011)	(0.012)	(0.046)	(0.021)	(0.016)
Baseline comparison	0.556	0.060	0.097	0.584	0.066	0.093
N	2465	2465	3326	828	828	1691
R^2	0.144	0.060	0.105	0.206	0.070	0.131

Table 8. First-difference impacts of scholar selection on first-year borrowing

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

Source: The Dell Scholars Program database, the National Student Clearinghouse, and the BPS:04/09.

Notes: Robust standard errors in parentheses. All models estimated using baseline covariate controls including gender, race / ethnicity, first-generation status, home language spoken, high school GPA, parental income, and indicators for institutional type, sector and selectivity.

^a Data is not available for the 2009 Dell cohort.

	Any work hours	Work at least 10 hours/week	Work at least 20 hours/week	Work at least 30 hours/week	Work at least 40 hours/week
Dell Scholar	0.077**	0.066*	0.010	-0.054***	-0.049***
	(0.037)	(0.037)	(0.027)	(0.018)	(0.014)
Baseline comparison	0.591	0.432	0.153	0.074	0.052
Ν	853	853	853	853	853
R^2	0.053	0.087	0.080	0.064	0.079
		Students attendir	ng less-selective institutio	ns	
Dell Scholar	0.025	0.065	0.016	-0.043	-0.060**
	(0.059)	(0.060)	(0.044)	(0.029)	(0.023)
Baseline comparison	0.612	0.522	0.226	0.098	0.070
		Students attending	g more-selective institution	ons	
Dell Scholar	0.109** (0.047)	0.067 (0.047)	0.006 (0.035)	-0.061*** (0.023)	-0.042** (0.018)
Baseline comparison	0.578	0.377	0.107	0.059	0.041
N	853	853	853	853	853
R^2	0.054	0.087	0.081	0.064	0.079

Table 9. First-difference impacts of scholar selection on first-year working patterns

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

Source: The Dell Scholars Program database, the National Student Clearinghouse, and the BPS:04/09.

Notes: Robust standard errors in parentheses. All models estimated using baseline covariate controls including gender, race / ethnicity, first-generation status, home language spoken, high school GPA, parental income, and indicators for institutional type, sector and selectivity.

3.3.2.2 Academic progress and achievement

The second broad mechanism considered is the program's routines in gathering data on scholar's postsecondary experience sand the follow-up, feedback and support that is provided to scholars with the goal of promoting persistence and academic success. Scholars that struggle academically at any point of their postsecondary trajectory are provided with guidance, encouragement and direction to help them sustain satisfactory academic progress. In considering this mechanism, I present impacts on outcomes related to academic progress (i.e. credit accumulation and credit attainment rates) as well as academic achievement (i.e. cumulative grade point averages). Tables 10 and 11 presents first-difference impact estimates for academic progress and academic achievement, respectively, overall and across institutional selectivity categories.

Impact estimates for cumulative attainment of credits across the first four years of college are presented in Table 10. Although credit attainment rates were similar across Dell Scholars and their matched counterparts in the first year of enrollment, scholars accumulated a significantly greater number of credits in subsequent years. In addition, I examined incidents of students earning less than three-quarters of the credits that they attempted within any term in the first four years of enrollment. The Dell Scholars exhibit better degree progress over time, and are less likely to put their academic progress and financial aid at risk by earning less than three-quarters of the credits for courses that they enroll in.

In addition to having stronger academic momentum, Dell Scholars are more likely to have higher grade point averages. Table 11 presents cumulative grade point averages for the first four

			2009-2012 со	horts		2009-2010 cohorts					
		Credits ear	ned, cumulat	ive			Credits earne	ed, cumulativ	'e		
	Year 1	Year 2	Year 3	Year 4	Earned < ³ ⁄4 of credits attempted, years 1 - 4	Year 1	Year 2	Year 3	Year 4	Earned < ³ ⁄4 of credits attempted, years 1 - 4	
Dell Scholar	0.495	6.601***	10.827***	8.946***	-0.131***	4.574***	10.774***	14.428***	12.326***	-0.174***	
Deceline	(0.389)	(0.750)	(1.063)	(1.451)	(0.018)	(0.491)	(0.993)	(1.487)	(2.062)	(0.025)	
comparison	23.253	44.279	65.219	93.965	0.482	23.355	44.297	65.179	92.707	0.523	
N =2	3326	3326	3326	3326	3326	1689	1689	1689	1689	1689	
R^2	0.061	0.093	0.100	0.132	0.090	0.141	0.161	0.146	0.152	0.118	
				students atter	nding less-sele	ctive institu	tions				
Dell Scholar	0.743	7.262***	9.563***	10.503***	-0.169***	3.821***	9.714***	10.066***	10.297***	-0.208***	
	(0.681)	(1.280)	(1.865)	(2.545)	(0.028)	(0.845)	(1.711)	(2.559)	(3.551)	(0.039)	
Baseline comparison	22.382	42.790	63.046	85.722	0.599	22.405	42.683	63.047	84.893	0.646	
•			S	tudents atten	ding more sel	ective instit	utions				
Dell Scholar	0.377	6.285***	11.433***	8.199***	-0.104***	4.956***	11.312***	16.640***	13.356***	-0.149***	
	(0.472)	(0.888)	(1.293)	(1.764)	(0.024)	(0.602)	(1.219)	(1.823)	(2.530)	(0.034)	
Baseline comparison	23.872	45.335	66.762	99.819	0.399***	24.071	45.516	66.786	98.603	0.430	
Ν	3326	3326	3326	3326	3326	1689	1689	1689	1689	1689	
R^2	0.061	0.093	0.100	0.132	0.091	0.141	0.162	0.148	0.152	0.119	

Table 10. First-difference im	nacts of scholar selection	on course credit attainment
Table 10. Thist-uniterence in	pacto of scholar sciection	on course crean anannen

*p<.10 **p<.05 ***p<.01 Source: The Dell Scholars Program database, the National Student Clearinghouse, and the BPS:04/09.

Notes: Robust standard errors in parentheses. All models estimated using baseline covariate controls including gender, race / ethnicity, first-generation status, home language spoken, high school GPA, parental income, and indicators for institutional type, sector and selectivity.

	2009-2012 cohorts							2009-2010 cohorts				
		Cumulati	ve GPA				Cumulat	ive GPA				
	Year 1	Year 2	Year 3	Year 4	GPA < 2.0 during years 1 - 4	Year 1	Year 2	Year 3	Year 4	GPA < 2.0 during years 1 - 4		
Dell Scholar	0.090*** (0.028)	0.093*** (0.026)	0.115*** (0.026)	0.111*** (0.026)	-0.082*** (0.018)	0.047 (0.040)	0.049 (0.038)	0.071* (0.036)	0.079** (0.036)	-0.085*** (0.025)		
Baseline comparison	2.864	2.846	2.849	2.861	0.380	2.861	2.841	2.841	2.844	0.404		
Ν	3326	3326	3326	3326	3326	1689	1689	1689	1689	1689		
<i>R</i> 2	0.110	0.120	0.121	0.135	0.099	0.118	0.120	0.122	0.140	0.113		
			Studen	ts attending	less-selective	institution	s					
Dell Scholar	0.278***	0.338***	0.301***	0.304***	-0.145***	0.308** *	0.267***	0.226** *	0.252** *	-0.153***		
	(0.042)	(0.046)	(0.045)	(0.044)	(0.027)	(0.069)	(0.065)	(0.063)	(0.062)	(0.038)		
Baseline comparison	2.685	2.983	2.672	2.671	0.496	2.684	2.664	2.672	2.658	0.510		
			Student	s attending	more selective	institution	ns			I		
Dell Scholar	-0.049 (0.036)	-0.026 (0.032)	0.024 (0.031)	0.017 (0.031)	-0.038 (0.023)	-0.086* (0.049)	-0.062 (0.046)	-0.008 (0.045)	-0.008 (0.044)	-0.034 (0.033)		
Baseline comparison	2.995	2.658	2.979	3.000	0.297	2.997	2.979	2.972	2.990	0.324		
N	3326	3326	3326	3326	3326	1689	1689	1689	1689	1689		
<i>R</i> 2	0.122	0.132	0.128	0.142	0.101	0.129	0.129	0.127	0.146	0.116		

Table 11.	First-difference	impacts of	' scholar se	election on	postsecondary	grade	point	average
		1			1 2	0		

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

Source: The Dell Scholars Program database, the National Student Clearinghouse, and the BPS:04/09.

Notes: Robust standard errors in parentheses. All models estimated using baseline covariate controls including gender, race / ethnicity, first-generation status, home language spoken, high school GPA, parental income, and indicators for institutional type, sector and selectivity.

years of enrollment. Again, there are statistically significant impacts with Dell Scholars earning higher GPAs overall. These differences are particularly pronounced for students at less selective institutions and correspond to effect sizes on the order of half of a standard deviation. Finally, Dell Scholars are less likely to earn a term-level grade point average below2.0 during the first four years of college. Given that all Dell Scholars are recipients of federal Pell grants, and Pell grant eligibility often hinges on students maintaining satisfactory academic progress with a grade point average above 2.0, this suggests that the program may help students maintain access to critical sources of need-based aid that allow for continued enrollment.

3.4 DISCUSSION

In their earlier investigation of the Dell Scholars Program, Page and colleagues observed large impacts on four- and six-year degree attainment rates. In this study, I build on these prior findings and generate impact estimates for a set of enrollment outcomes for all Dell Scholars, including those beyond the selection threshold. The expansion of the analytic sample presented an opportunity to identify heterogeneous effects that the restrictions of the regression-discontinuity design did not allow for.

The increase in sample size and heterogeneity across demographic and institution characteristics allowed for important subgroup analyses and findings. Findings revealed that the Dell Scholars Program has large impacts on later persistence outcomes and four- and six-year degree attainment rates, which impacts that are larger in magnitude for scholars enrolled in less selective institutions. Dell Scholars in this category were 18 percentage points more likely to graduate within six years compared to their matched counterparts.

To understand the impact of the program on known predictors of postsecondary attrition, I estimated impacts on stopout and dropout rates within the first four years of enrollment. Scholars are 10 percentage points less likely to stop out and 4 percentage points less likely to drop out than their matched counterparts. These impacts are larger in magnitude for scholars in less selective institutions, with a 12 percentage point impact on stop out rates and 6 percentage point impact on drop out rates.

The matching procedure in this study and the rich set of outcomes observable for both Dell Scholars and subjects in the BPS sample offered a unique opportunity to generate causal impact estimates on indicators for college financial, academic progress, and academic achievement. These outcomes are long-known predictors of college success, and these estimates allow me to understand the extent to which the program impacts outcomes related to critical domains of the college experience. The findings revealed that Dell Scholars are less likely to take out a federal and private loans, therefore suggesting that the program may have significant impacts on debt accumulation and future education and earnings. Furthermore, the Dell Scholars accumulate more credits at a quicker pace than their matched counterparts and earn higher GPAs, on average. To assess the program's impact on academic risk-indicators, I examined the program's impact on the probability of a student earning a GPA below 2.0 or earning less than three-quarters of the credits attempted within any term within the first four years of enrollment. There were statistically significant impacts, with the Dell Scholars being less likely to experience these high-risk academic slumps. Again, the magnitude of these impacts were larger for students in less selective institutions.

The difference-in-differences estimates also allowed me the rare opportunity to check for unobserved selection bias in my matching procedure that may have undermined the validity of the impact estimates. The Dell coefficient across all findings was either consistently statistically not significant or suggested that my estimates would be biased in an unfavorable direction for the program. The estimates on six-year degree attainment rates also revealed a noticeable change in my second-difference coefficient. Non-selected Dell applicants in more selective institutions were 6 percentage points less likely to complete a bachelor's degree in six years. This finding was particularly puzzling. When first designing the study, I was initially concerned about biased estimates in the other direction. I was specifically worried about the inability of the matching procedure to account for the types of high schools that students and their matched counterparts attended prior to college enrollment given that the program only accepts applications from students enrolled in partner college-readiness programs, which range in structure from AVID and Upward Bound to intensive charter school networks that provide their students with extensive support systems. It is reasonable to be concerned that applicants to the Dell Scholars Program would have an unobservable advantage going into college. The finding that Dell finalists fall behind, rather than pull ahead, of their matched counterparts introduced the need to examine temporal effects that the matching procedure could not control for.

An investigation of temporal effects reveals remarkable difference in tuition price increases across institutional selectivity indicators. Figure 3 illustrates that, after adjusting tuition and fees to 2016 dollars across both datasets, the subjects attending more selective institutions in the Dell sample had a substantially larger tuition bill than their matched counterparts.



Figure 3. Tuition and fees (2016 dollars) across institutional selectivity categories

This finding opened a new line of questioning around differential impacts across institutional categories. Does the money offered by the Dell Scholars Program operate as the key support mechanism for students enrolled in more selective institutions? Does the academic and social support do more for those students enrolled in less selective institutions?

This additional line of questioning, coupled with the unresolved question of *how* the program achieves these impacts, reveals the importance of conducting descriptive analyses drawing on program administrative data that can be observed for Dell Scholars over time. In the next chapter, I present findings for an in-depth explanatory case study that identifies the program components that underlie the observed causal effects from this study.

4.0 PART 2: INVESTIGATING THE PROGRAM COMPONENTS UNDERLYING THE CAUSAL IMPACTS OF THE DELL SCHOLARS PROGRAM

The second part of this evaluation delves deeply into the program model to construct an explanatory narrative to couple with the causal impacts that were observed in the first part of this investigation. Drawing on program administrative data, in-person and virtual observations, and interviews with Dell Scholars Program staff members, I identify four key program components underlying the observed causal impacts discussed in the last chapter. First, the program's proactive and data-informed social support system that is highly responsible to persistence risk indicators. Second, the program's flexible and client-focused policies and practices. The third component is a combination of the program's work environment and staff background. Finally, I discuss the Dell Scholars Program's implementation of a continuous quality improvement strategy.

4.1 THE PRESENT RESEARCH

The analytic objective of the second part of this work is to generate a rich, explanatory narrative about the Dell Scholars Program to identify the programmatic components that underlie the causal impacts that were observed in the previous chapter. This chapter is divided into three sections. First, I present the analytic strategy and provide overview of the data collection timeline and data sources that are used to generate findings. Most of this chapter is in the second section, which is dedicated to a discussion about each of the four major program components and the supporting evidence that led to their identification. Finally, I conclude with a discussion of results and implications for future research.

4.2 METHODS

This is an explanatory, single-case study of the Dell Scholars Program that employs an embedded, single-case design to gain insight into the programmatic components underlying the observed causal effects that are reported in the previous chapter. A single-case study design is warranted when the case is extreme or unusual, or presents an opportunity to longitudinal analysis (Yin, 2013). The Dell Scholars Program meets these criteria given their large impacts on postsecondary outcomes for a population of students that are typically at risk for postsecondary attrition. In addition, the program maintains a database of valid academic and financial data for each student at key transition points, which presents a unique opportunity for rich descriptive analyses. Finally, the program's use of a digital tool to guide and inform their workflow coupled with the large student to staff ratio presents an important opportunity to intensively study an effective and potentially scalable model in detail. This case study has two primary units of analysis. The first unit is the program's operational model, which includes the program's theory of action, staffing structure, workflow and the design and role of the program's administrative tool. Second, is the student-level administrative data captured by program, which includes the frequencies of program interactions with participants and program scholarship distribution amounts for each academic year.

4.2.1 Data collection timeline

The impact evaluation of the Dell Scholars program was initiated in the summer of 2015. The first phase of the project drew on application data and enrollment data from the National Student Clearinghouse for non-selected finalists and selected scholars. In these analyses, Page and colleagues (2017) generated regression-discontinuity impact estimates that compared students just above and just below the selection threshold. In the fall of 2015, data collection was initiated for the second phase of the impact evaluation.

The second phase of the impact evaluation, which is the content of this dissertation, had two objectives: to generate impact estimates beyond the selection threshold by combining two quasi-experimental design strategies; and to construct a rich, explanatory narrative that drew on staff and student interviews as well as administrative data captured in the backend of the program. The data collection plan for phase two first prioritized generating a strong overview of the program's theory of action, workflow, and technological tools. This initial work was informed by participation in online meetings with the technology team at the Michael and Susan Dell Foundation to learn details about the development and management of the technological tool that they use to interact with their program participants. There were also meetings and interviews with program leadership to learn about the history and structure of contracted partnerships with the ACT—which provides the program with document-review services—and the Scholar Resource Network – which provides scholars and their families with a range of social services. All meetings and interviews were audio-recorded and transcribed. The program also shared slide decks that were used for earlier trainings or presentations of their program model and/or the administrative tool. These items were catalogued as program artifacts for the study.

Acquiring administrative datasets for analyses was an iterative and collaborative process with the technology team at the Michael and Susan Dell Foundation. The administrative tool captures a rich set of information that is stored and displayed in a manner that is ideal for operational, as opposed to research, purposes. Therefore, the technology team extracted data from their database in stages. They first created a dummy account that allowed me to access and complete each program check-in process as though I was an active scholar. After completing each stage, I submitted variables request lists to the technology team that identified items in each checkin process that were needed for analyses.

During the spring of 2016, the data collection process shifted focus from the program's systems to gathering information about the program's workflow cycles. Each full-time staff member participated in an interview, and the Retention Officer submitted "impact narratives" to highlight cases of students that reflect the activities and impact of the program. The Dell Scholars Program announces its selection of students in April of each year. This provided an opportunity to observe each workflow cycle beginning with the onboarding of a newly accepted cohort of students. After the selection announcement, I observed and cataloged recorded orientation webinars for new scholars.

The staff have access to a suite of technological tools to support their work, included WebEx which allowed for clear and recorded virtual observations of their meetings. This allowed for easy observations of webinars that scholars are required to participate in as well as trainings of the Dell Scholars Program Ambassadors, which is a group of Dell Scholars who are employed to work full-time during the summer and part-time during the school year. Furthermore, I observed weekly team meetings in which the team debriefed the status of scholars and planned their strategies to support them. Most of the meetings were recorded with the WebEx tool and stored. For one week in the summer, I traveled to the foundation to conduct in-person observations of the program's routines, staff collaborations and interactions with participants. Observations included shadowing program team members and attending routine meetings and training sessions. Interviews were conducted with new and former Dell Scholars Program Ambassadors, which were recorded and transcribed. In addition, there were a series of in-person meetings with members of the technology team to extract administrative data that was not previously exported for analysis. In-person observations with documented in detail in field notes and audio-recorded.

The in-person visit also resulted in the program providing full access to the Dell Scholars Program administrative tool. This account facilitated access to the full set of data embedded in the program's administrative tool, including detailed contact notes and historical academic, financial and situational data for each Dell Scholar. The Dell Scholars Program's willingness to share access to the administrative site demonstrated their commitment to the integrity of the evaluation's objectives as well as their trust in our research team.

4.2.2 Data elements

I present an overview of the sources of data that inform my findings in Table 12. I use the same application dataset, institutional datasets, and data from the National Student Clearinghouse that I utilized in the first part of this study. The new data elements used in this investigation include
Data Source	Variables
Dell Scholars Program Datasets	
Applicant Dataset	 Student demographic information (e.g. race, gender, household income, parent educational attainment) High school performance data
National Student Clearinghouse	 Raw and standardized semi-finalist and finalist selection scores Persistence and degree attainment
Administrative Dataset	 Dell Scholar academic progress and financing data Frequency of contact notes, student tasks and interventions by relative academic year
Institutional Datasets	
Barron's Selectivity Index	 Institutional selectivity
IPEDS	 Institution type, location, percent admitted
Interviews	 Two 90-minute semi-structured interviews with Team Lead 90-minute semi-structured interviews with three full-time staff members 90-minute semi-structured interviews with 16 active Dell Scholars 90-minute semi-structure interviews with 6 current and former Dell Scholars Ambassadors
Observations	 Virtual observations of Dell Scholar webinars Virtual and in-person observations of trainings for Dell Scholars Program ambassadors Virtual and in-person observations of weekly team meetings In-person observations of meeting with the technology team and ACT document reviewing agency
Artifacts	 Documentation of training materials and prior presentations on the program model Ongoing access to the Dell Scholars Program administrative portal that captures communication and check-in data for every Dell Scholar

Table 12. Overview of data sources for the explanatory case study

interviews with program staff, in-person and virtual observations, and analysis of program artifacts. In addition, I collaborated with the technology team at the Michael and Susan Dell Foundation to expand the administrative dataset. In the first part of my study, I used the administrative dataset to generate impact estimates on academic and financial factors that are known drivers of college success. For this case study, the administrative dataset also includes variables that function as indicators of program dosage. I describe those indicators in detail below.

4.2.2.1 The Dell Scholars Program administrative dataset

The program administrative tool captures academic, financial and situational data on scholars from the point of registration during their senior year in high school until they complete their degree. The system has also evolved to quantify program interactions with students. These data allow the program staff and leadership to reflect on program practices, better understand how staff time and program resources are allocated, and identify areas of program improvement. The data elements captured by the system continue to evolve based on staff feedback and technological advancements. For this study, I collaborated with the technology team to construct a dataset for two indicators of program interactions: program contact notes and program interventions.

A contact note is a summary of an interaction between a program staff member and a scholar. Each contact note is entered into the scholar's file by the staff member that offered assistance. The program contact notes are an imperfect indicator in that it does not capture the exact number of interactions between students and the program. However, the contact notes function as an appropriate proxy for program dosage. Dell Scholars that require more support consistently accumulate more contact notes in their files.

An intervention is the most intensive level of interaction offered by the Dell Scholars Program. A scholar is assigned to an intervention is she is at serious risk of attrition. Students assigned to interventions are given a list of goals to complete to fulfill the requirements of the intervention, and each intervention case is closely monitored by a retention officer. Therefore, the intervention indicator is an appropriate indicator of an intensive dosage of the program's resources.

4.2.2.2 The Dell Scholars Program case study analytic sample

This investigation of programmatic components draws on administrative data for the Dell Scholars Program 2009 – 2012 cohorts.¹⁰ Like the first part of this study, the analytic sample is restricted to scholars who enroll in a postsecondary institution immediately after their high school graduation. However, these descriptive analyses do not require a matched counterfactual. Therefore, I use the full sample of 2009-2012 Dell Scholars who enrolled in college the fall after their senior year of high school. Summary statistics for this analytic sample is presented in Table 13.

4.2.3 Analytic strategy

The analytic strategy that I employ is explanation building, with an objective to explain *how* the Dell Scholars Program impacts the postsecondary outcomes of its participants. I iteratively build this explanation by triangulating analysis across a diverse set of data sources. To build an explanatory narrative I employ a logic model technique that has become increasingly useful in recent years to study theories of change (Yin, 2014). This analytic technique has three steps.

¹⁰ I restrict the analytic sample to these cohorts of Dell Scholars to maintain consistency in the paper and to bound observations to four years after enrollment.

	Mean	SD
Plack or Hispania	0.67	
Diack of Hispanic	0.07	0.47
Female	0.71	0.45
Parental Income	19205.82	13781.24
First Generation	0.92	0.27
English	0.43	0.50
Four Year Institution	0.96	0.20
Public Institution	0.74	0.44
HS GPA 2.0 - 2.5	0.00	0.05
HS GPA 2.5 - 3.0	0.05	0.21
HS GPA 3.0 - 3.5	0.16	0.37
HS GPA 3.5 - 4.0	0.79	0.41
Elite	0.14	0.35
Highly Selective	0.25	0.43
Very Selective	0.20	0.40
Selective	0.25	0.44
Less Selective	0.15	0.36
Observations	1108	

Table 13. Descriptive statistics for the Dell Scholars Program analytic sample, Dell Scholars Program 2009-2012 cohorts

*p<.10 **p<.05 ***p<.01 Source: The Dell Scholars Program database

First, I model a series of expected or ideal events over an extended period of time. In this study, I model the ideal student pathway between enrollment and degree attainment as continuous, fulltime enrollment in semesters during the traditional academic-year with satisfactory academic progress and on-time Bachelor's degree attainment. Second, I identify the points at which the program is expected to intervene if the milestones of the ideal pathway are not fulfilled. Third, we interlace theoretically predicted events with empirical evidence. In short, this analytic technique aims to answer three main questions: What is the Dell Scholars Program's theory of change? How is the program designed to operationalize that theory of change? Are their systems intervening in the ways that they expect them to?

I first delved deeply into understanding the components of the program model drawing on interviews with program staff, observations and accompanying field notes. Data from these sources allow for identification of the program's theory of change, the driving components of the program's operational model and the program's workflow cycles. I conduct a series of descriptive quantitative analyses using the administrative dataset at my disposal to understand to what extent the program is responsive to Dell Scholars when they are at risk of attrition. The triangulation of these data sources allow for a rich, empirically-supported narrative to pair with the impact estimates presented in the prior chapter.

4.3 FINDINGS

There are four key program components of the Dell Scholars Program that together drive the reported causal impacts in the previous chapter. I first provide important contextual information about the Dell Scholars Program's theory of change and the staffing structure. I then dedicate a

section of this chapter to each key program component and present evidence to illustrate each component's meaningful role in the program model.

In short, the theory of change implemented by the Dell Scholars Program is to support selected scholars, who represent a population of students that are vulnerable to attrition, to degree attainment. The program openly markets itself as more than a scholarship program in its marketing materials. These materials state, "We'll work with you to ensure you have the tools you need to complete college with a degree in hand" (Dell Scholars Program website, 2017). The program model functions with the belief that providing ongoing financial, social and informational support will lead scholars to degree attainment. The program has remained consistently focused on achieving an 80% six-year degree attainment rate for each cohort. The tools that the program website refers to are a suite of services that scholars receive when they are accepted into the program. Figure 4 presents an overview of this toolkit.

Dell Scholars Program Toolkit for College Success

Baseline Award

- \$20,000 award for educational expenses
- Chegg textbook and tutoring credits
- Dell laptop

Additional Services

- Access to social and informational support from the Dell Scholars Program team
- Access to social services guidance from the Scholar Resource Network

Figure 4. The Dell Scholars Program toolkit for college success

Each scholar receives access to \$20,000 to support educational expenses, conditional on meeting program check-in requirements, which will be discussed in detail in the next section. In addition, participants receive a laptop and credits to use toward textbook and tutoring services

provided by Chegg.¹¹ The program also provides additional support services, though the rate of use varies according to each scholar's individual circumstances. Scholars have access to ongoing social and informational support from the Dell Scholars Program team. The program staff are equipped with the expertise to troubleshoot common challenges faced by low-income, first generation students, such as renewing a FAFSA or completing income verification, avoiding financial aid displacement, or assistance with identifying individuals to reach out to for support for academic assistance. In addition, students have access to a contracted service that is referred to as the Scholar Resource Network. The Scholar Resource Network provides a range of services to Dell Scholars and their families when they need supports that are outside of the scope of program resources. These services may include assistance with finding local affordable daycare providers, finding affordable legal assistance, finding psychiatric facilities, or finding other necessary social services (e.g. food pantries, shelters, etc.) within a scholar's geographic area.

The program model has evolved considerably since it first began in 2004, though the staffing has grown modestly compared to the number of students the program has expanded to serve. In the program's initial two years there were two full-time staff members for 80 scholars. During the first four years the 2009-2012 cohorts were enrolled in college, with 300 scholars per cohort, the program staffing structure was comprised of a Team Lead, one Retention Officer, one Retention Associate, and the Dell Scholars Program Ambassadors. Figure 5 presents an illustration of the Dell Scholars Program staffing structure.

¹¹ Chegg is a for-profit company that offers a range of web-based, for-fee services that are aimed to support college success. These services include online and used textbooks and online tutoring services. The Dell Scholars Program purchases Chegg credits to allocate to the Dell Scholars. See <u>www.chegg.com</u> for service details.

The Team Lead oversees the program's mission and performance and is the external face of the program. He manages the budget, staff and oversees the program's mission and performance. The Retention Officer is the persistence case manager. She oversees the day to day workflow around scholar case management, is the primary provider for persistence support, and she oversees the responsibilities of the Dell Scholars Program Ambassadors. The Retention Associate provides extensive logistical support to the program. She oversees the document review partnership with ACT, all scholar check requests, and collaborates closely with the Retention Officer to manage the Dell Scholars Program Ambassadors and money disbursement for Dell Scholars. During the summer, the program employs four full-time Dell Scholars Program Ambassadors to provide programmatic support. The Ambassadors are active scholars that attend college within the Austin metropolitan region. Those Ambassadors stay on as part-time employees during the academic school year. The program has remained loyal to its original mission to support scholars to degree attainment, and since its founding, has developed sophisticated technological tools and adopted workflow routines to achieve their objective while maintaining a lean staffing structure.



Figure 5. The Dell Scholars Program staffing structure as of October 2015

100

4.3.1 Key program component: A proactive, data-informed support system that is highly responsive to persistence risk indicators

The Dell Scholars Program's approach to their work has changed considerably since their launch in 2004, and much of this evolution was driven by technological advancements and staff observations of the challenges that derailed the progress of scholars in the earlier cohorts. The program has since developed a sophisticated technological tool that automates the identification of indicators of risk and prompts an individualized response from a staff member.

The Dell Scholars Program model is an exemplar of a data-driven support model. The program's practices are informed and enhanced by the information that is collected and stored in their technological tool. After observing high attrition rates in their earliest cohorts, the program model shifted from being reactive to the challenges reported by Dell Scholars at the end of their academic years to taking a more proactive and data-informed approach. The Team Lead explains:

When we first started we were taking it easy in terms of trying to identify where we were with our students and their major challenges. And over those first formative years we learned that we needed to be very proactive because what we were doing was reacting to issues that could have been avoided if we intervened sooner. We were having a much more difficult time helping students navigate out of those circumstances because these issues compounded on themselves. So that's the direction we've taken since – to gather the information and understand what's going on with our Dell Scholars sooner, and implementing our interventions in an earlier time frame. We are proactive from the minute that they are selected as scholars (Team Lead, Interview, 28 October 2015).

The operational core of the program model is the Dell Scholars Program *administrative tool*, which serves three critical functions. First, the administrative tool collects data from all scholars at several check-in points, from the point of program acceptance until degree attainment. Second, the administrative tool functions as the primary communication channel between participants and program staff. Third, the administrative tool is used by the staff to track student progress over time. Figure 6 presents an illustration of the program model, the role of the administrative tool, and a simple overview of the program model's workflow.



Figure 6. The Dell Scholars Program model with administrative tool check-in points

For each check-in process, which are represented by the circles in Figure 6, the scholars are prompted to log into their Dell Scholars Program Connect account.¹² For each check-in process, scholars spend approximately 30 minutes entering information about their academic achievement,

¹² The Connect website is the scholar-facing, web-based component of the administrative tool, and it is where the scholars log in to complete each check-in process, submit check requests, and access the suite of resources provided by the program.

financial aid packages, work hours, and emotional well-being. Each process contains multiple items that require scholars to select a single response (e.g. How many hours a week to plan to work during the next semester?). There are also opportunities for students to enter in open-ended responses to provide more detailed information about their selected answers. In addition to manually entering information about the courses they completed, their academic achievement, and financial aid packages, the scholars are required to upload official documentation including a most recent transcript and an official financial aid summary issued by their home institutions.

The Dell Scholars Program withholds the remaining award balance until each check-in process is complete, which incentivizes student engagement. Once the scholars complete a check-in process, their files are closely reviewed by a document review team that is contracted by the program. The document review team is trained by the program staff to take on two main roles. First, the document review team closely reviews and verifies the information entered by students. If a scholar entered incomplete or incorrect information, the document review team can communicate with the scholar through the administrative tool and provide them with instructions for completing the process. These next steps usually take the form of "tasks" that are assigned to scholars to complete. For example, if a participant did not upload an official Student Aid Report, a member of the document review team will post a "task" to the student's account, and the student is alerted that the must be completed before the program can release their award balance.

Second, the document review team is trained to escalate student files that are flagged for predetermined risk indicators. The program buckets these risks into three categories: academic, financial and situational. There are flags that are unique to the onboarding process and the checkin and renewal processes. Flags for these processes are listed in Table 14. In addition, there is an

Flags	Onboarding Process	Check-in and Renewal Processes
<u> </u>		
Academic	Enrolled part time or not enrolled	Failed or withdrawn from classes
	 Attending community college 	Enrolled less than full time
	Attending an out of state public college	Planning to enroll less than full time the next semester
	 Living off campus without reliable transportation 	
	Anticipates studying less than 20 hours per week	
	 Scholar concerns with academics or adjusting to campus 	
	 Enrolled in remedial classes 	
	College plans changed	
Financial	Excessive unmet need (>\$5,000)	Lost financial aid
	Excessive loans (>\$5000)	High unmet need
	 No Pell Grant 	-
	■ EFC > \$0	
Situational	 Excessive work hours (>20 hours/week) 	Serious situational issues discussed in scholar essays
	 Unsupportive family 	• Mindset below 5 ¹³
	Family or personal issues	
	 Has children or other dependents 	

Table 14. Overview of flags for the onboarding, check-in and renewal processes

¹³ During the 2015 academic year the administrative tool began to collect Dell Scholar responses to items that were designed to capture mindset. The mindset score is on a scale of 1-10, with 10 being the most positive response.

option for the document review team to mark a student record as an "Emergency Escalation" if there is an issue that requires immediate staff attention. Emergency escalations may occur if a scholar indicates that their immediate well-being is at risk. When a scholar's file is flagged and escalated, the program team receives notification of the escalation in the dashboard of the administrative tool. The escalations are then reviewed by the staff to determine the appropriate next steps. The Dell Scholars Program staff closely reviews every escalated case that comes across their dashboard. Each next step is determined by the retention officer who draws on the rich set of information that is stored for each Dell Scholar within the administrative tool. There are incidents when a file is escalated and, after a close review of the file, the retention officer will decide that it is not necessary to contact a Dell Scholar. For example, I observed the retention officer reviewing an escalated file after a renewal process for a Dell Scholar that withdrew from a course during the spring term. After reviewing that student's file, the retention officer decided that it wasn't necessary to reach out to the student because she had previously informed the staff of this decision during the academic term.

There are also escalated files that require additional data collection or clarification from scholars. These cases are often delegated to the Dell Scholars Program Ambassadors, who are trained to reach out to students and assist in the collection of additional documentation or contextual information. Escalations that involve more complex or dire scenarios are managed by the retention officers.

The Dell Scholars are not restricted to communicating with the program team during the check-in processes. Rather, they are encouraged to reach out any time an issue or a challenge arises that they do not know how to resolve. The program model is designed to facilitate easy communication pathways between scholars and staff. Students have the option of emailing,

texting, calling or Facebook messaging with the team at any time that they require assistance. All communication from the scholars go to staff accounts that are linked to the administrative tool. This ensures that all communication exchanges between a scholar and the team are stored in their file.

4.3.1.1 Escalation patterns for each check-in process

First-generation, low-income students face a variety of pressing challenges at different points on their persistence trajectories. The escalation patterns that are captured by the Dell Scholars Program administrative tool reflect the ebbs and flows of common challenges faced by lowincome, first- generation students at different points of their persistence pathways. In this section, I review the common challenges that scholar face during each check-in process.

Onboarding

During the onboarding process, the Dell Scholars Program allocates a large amount of staff resources to supporting new scholars with common financial aid issues faced by low-income and first-generation students. Two of the most pressing issues include the process of income verification and negotiating financial aid displacement at each scholar's postsecondary institution.

Many low-income students are flagged for income verification, which requires students to provide an extensive amount of additional financial paperwork to their colleges before their financial aid packages are released. This is a time-consuming and difficult process that often requires the support of informed adults and cooperation from parents. Once the process of income verification is learned, the routine of filing the paperwork every year for the FAFSA renewal can go smoothly. However, in the beginning, many students need additional support to complete this process. During the onboarding process, many scholars require support from the staff in negotiating this time-consuming and bureaucratic task.

Aid displacement is another common issue that requires support from the staff during the onboarding process. Students are required to report sources of outside aid to their institutions before their financial aid packages are finalized. When Dell Scholars report that they are receiving outside financial assistance, they are at risk for aid displacement. Aid displacement occurs when an institution deducts institutional merit- or need-based aid in response to the notice of additional outside aid. When this occurs, the net financial benefit of the Dell Scholars Program is compromised. During the onboarding check-in process, the Dell Scholars Program staff spends a substantial amount of their time supporting new scholars through the process of negotiating with their institutions to avoid aid displacement:

There are issues that are short-term and have to absolutely be addressed prior to enrollment. Financial aid is the biggest lift for us, and we will look to see how they report our scholarship and if we are going to cause any displacement. That is important because we want them to get a net gain from our scholarship. So, if they aren't reporting it correctly, or we do cause displacement, we are going to displace other institutional grants and scholarships and, in the end, they will still graduate with the same loan debt. Now, that probably won't impact enrollment, but it could impact the quality of persistence later (Retention Officer, Interview, 4 March 2016).

The Dell Scholars Program team works with each individual Dell Scholar and gives them detailed instructions about how to communicate with their institution if they are at risk for displacement. While this is a new and challenging situation for new scholars, it is a routine challenge that has been navigated by the program staff repeatedly, and so they are readily prepared with the resources to support students throughout the negotiation process:

A common displacement scenario is when we see that they were offered loans and then they accepted zero because they thought we'd come in and replace the loans. Then they anticipate other institutional aid coming in. So, we'll run through the data that they provide us and reach out to those students specifically to make sure that we don't displace their institutional aid. We know the colleges that are going to displace no matter what. So, we have our scholars look up the outside scholarship policy on their college's website, or we'll give them a detailed script to guide how they ask their college this question. We'll have them ask a question in a certain manner, and tell them what to say in response to a set of responses, and then instruct them to come back to us if they are confused and we'll lead them through the next step (Retention Officer, Interview, 4 March 2016).

In the interview, the Retention Officer goes on to explain that outcome varies depending on the institution. It is not unusual for a staff member to initiate direct contact with institutions that have a firm policy on aid displacement, and it is not uncommon for scholars to experience aid displacement in their first year despite having the support of the Dell Scholars Program team:

There are situations in which the institution has already re-worked the package and they refuse to give the original package back. So, some scholars take a hit the first year, and then it's a learning process for them. They'll know what happened the first year and then know it won't happen the second or third year because they will later defer our scholarship. Then there is the loan repayment education piece that this process gives them. They'll have to take out loans so we don't displace their other institutional aid, and the on the back end, when they graduate, they can use the award balance to pay back those loans (Retention Officer, Interview, 3 March 2016).

The program model has evolved to be proactive in helping the scholars avoid institutional aid displacement, which could compromise their persistence outcomes or contribute to later loan debt. The loan repayment option embedded in the model is an example of the program's flexible policies, which will be addressed in detail in the next section of this chapter.

108

Check-in and renewal processes

During the check-in and renewal processes, the common challenges shift away from financial aid to academic progress and achievement. During the check-in and first-year renewal processes, the Dell Scholars Program team receives their first glimpse into the academic performance of their new scholars, and it is not uncommon for first-generation, low-income students to have a tough time with transitioning to the postsecondary academic environment: In addition, this population of students may have a difficult time understanding common terms and status categories used across postsecondary institutions, such as Satisfactory Academic Progress and how this status relates to academic probation and subsequently student access to federal and institutional financial aid. The Dell Scholars Program has evolved to have scripts on hand to assist students who are in academic risk with understanding their circumstances, the potential consequences, and how to avoid derailment from their persistence pathways by getting back on track or self-advocating for alternative solutions:

There will be academic issues where they've failed courses, or withdrew from courses, or they are already on probation for not making Satisfactory Academic Progress. So, there is this common script that we use to help them understand why they are on probation. You know, a lot of the time they don't understand. They will get an email that says they didn't complete 76% of the coursework they were required to complete. We want them to understand why they are on probation as well as what they need to do that semester to get off of probation. We are very detailed in saying that, 'Hey, you were at a 1.8 and you need to get to a 2.0, what GPA do you need to have this term to be able to get a 2.0 cumulative?' That kind of stuff. And we'll explain to them that they can appeal. Was there something significant or extenuating that affected their academics – such as mental health or medical issues – that would justify an appeal and allow them to do a retroactive withdraw from some courses? (Retention Officer, Interview, 4 March 2016).

The Dell Scholars Program team has long-observed that the academic challenges faced by scholars are often intertwined with financial and situational circumstances. While academic performance is the common reason a scholar's file is flagged and escalated, the Dell Scholars Program team routinely approaches academic performance as a symptom of another underlying pressing issue. They refer to these issues as "triggers", which are challenges that a Dell Scholar is struggling with that are impacting their academic performance:

A student might have a lot of adversity and it's always something that triggers it, right? When we see them failing, we look into it and ask, 'Well, why are they failing?' Well, ok, they're dealing with this issue or they are working all of these extra hours because they're still responsible for supporting their families back home. So it wasn't just academics. It was the situation issue that triggered the academic problem. And we dig deep into it. We don't just say, 'Oh, they are just failing and it's an academic issue'. There is depression and stress. Some of them have death in the family. A lot of students come from an adverse background and are dealing with that and it carries over. Or it could be something new that came up. They are stressed out because they are working a bunch of hours to send money back home. It's a lot of different areas. You could be struggling academically and it could be the financial and situational issues that caused you to struggle academically (Retention Associate, Interview, 23 March 2016).

The Dell Scholars Program recruitment process favors applicants who overcome a substantial amount of adversity, and the program team understands that this adversity does not end at the point of postsecondary enrollment. The challenges in the home lives of the scholars often follow them when they first step onto a campus and permeate their postsecondary experiences. The program initiated a mid-term check-in process more recently, during the 2014-2015 school year, once they realized that scholars were experiencing early academic distress and not reaching out for support:

We have these students who dig themselves so far into a hole and we don't know if they will be able to turn it around. They could have a 0.7 GPA after their first semester! And so what we started to do, once we noticed this trend, we started to reach out to students for mid-term check-ins. Instead of waiting for the fall check-in to report issues, we started reaching out to them in the middle of the term with bulk text and email messages that say, 'Hey, how is your fall term going? Can you reach out to us if you're struggling?' And we'll get messages back that say, 'Oh thank you for checking in. I'm failing! What do I do?', and it's clear that they wouldn't have reached out to us if we didn't reach out first (Retention Associate, Interview, 23 March 2016).

This statement speaks directly to the proactive approach of the program model. The program model is designed to get ahead of common challenges by prompting their students to provide information that allows the program to assess their risk and intervene as soon as possible. The program has adopted more formalized routines of "checking-in" with their Dell Scholars as the program model as evolved in response to the program learning that many of their scholars do not initiate communication for support.

4.3.1.2 Evidence of model responsiveness to indicators of academic risk

This section investigates the extent to which the program model is responsive to indicators of risk of attrition, such as learning a low GPA during a semester or withdrawing from multiple courses. Observations of program practices and descriptive analyses of administrative data show that such indicators drive program engagement with scholars. Interactions between program staff and scholars are routinely documented when a student reaches out for support, or if the student submits information during a check-in period that triggers outreach from the program. For example, if a student reports that he failed courses during his first year of enrollment, a Dell Scholars Program team member will schedule a phone call with the student to discuss what happened and devise an academic plan for the following semester. The content of this conversation, agreed-upon next steps, and any related follow up via email, text or phone, for example, are archived in that scholar's file as a *contact note*. If a Dell Scholar is in a dire or more complex situation, the staff member will work with the student to construct a long-term action plan, complete with milestones and tasks for the student to meet over time. This long-term action plan is called a program *intervention*.

The program's workflow and record keeping is comparable to the recordkeeping process of a family medicine practitioner. When a new patient is admitted, the physician's team is required to take extensive history and physical notes, which include past and present medications, risk factors, social and family history and a detailed review of health systems. In the Dell Scholars Program, these extensive history notes come in the form of the scholar's application data, which is also easily accessible in their online file, and their onboarding call. The program staff often refer to this information to have a rich understanding of the academic, economic and social factors that inevitably impact educational outcomes. For each subsequent visit, the physician's team documents interactions with patients in the form of progress notes, which involve updating patient health information and addressing pressing issues. In the Dell Scholars Program, these progress notes are generated by the information student import into the system during each check-in process and in subsequent interactions with the program staff. Just as physicians rely on their own notes or notes of prior healthcare providers in patient files, the Dell Scholars Program team relies on their detailed documentation of scholar interactions to address the pressing issues that often arise along their persistence trajectories.

In interviews, the Dell Scholars Program team members repeatedly attributed the success of the program model, given their relatively small staff size, to the administrative tool:

The biggest feature of our program is our technology. We cannot do what we do without the technology that we have. It allows us to see the students who are

struggling. It allows us to reach out to them right away. There is just so much that we can capture, like the data that we capture, within our tools that allows us to help students persist and complete their degree. That is so key-. without the technology, with the small team that we have, there is no way that we would be able to help the students in the way that we do, and help them persist the way that we do (Retention Associate, Interview, 23 March 2016).

The administrative tool emerged as the key component of the program model early in this research. It was referred to in almost every conversation and in response to any question that I had about individual or group-level persistence patterns. And the administrative tool is constantly evolving; it looks slightly different from the tool that I first observed when this investigation began. These changes are made in response to requests from the staff who are constantly striving to see individual- and cohort-level patterns and needs in a clearer way. The program model is firmly grounded in the assertion that access to more, better and well-organized information about the experiences of their Dell Scholars will lead to more efficient and well-informed services, which will subsequently lead to better outcomes for their Dell Scholars:

We definitely have everything as automated as possible in our system. And so that is where we spend a lot in terms of resources – building out a very comprehensive student management system, which has allowed us to maintain a much leaner staffing model. We aim to provide high-touch support for our Dell Scholars without having to replicate the traditional case management model where you would assign a certain number of students to a particular staff person that would then be responsible for them (Team Lead, Interview, 28 October 2015).

This rejection of a traditional case management model, yet commitment to providing "hightouch" services is a unique approach to this type of work. And the entire structure of the program's workflow hinges on the strength and adaptability of the administrative tool. After a Dell Scholar's file is escalated, the program response becomes highly individualized, which is a key mechanism that I'll explore in detail in the next section. However, I conclude this section by presenting

113

evidence of how the administrative tool, and subsequently the program model as a whole, is designed to be responsive to indicators of risk.

I observed three distinct levels of program dosage, and these levels are reassessed for each scholar during each mandatory check-in point that is illustrated in Figure 6. On the base level are scholars who are importing information into the system that suggests that they are progressing smoothly. These Dell Scholars are not flagged for escalations and their check requests are processed quickly after they finish each check-in process. The escalated level includes scholars who entered information into the system that signaled their file required a close review by a staff member. Some of these escalations are cancelled if, after review, the retention officer decides that a scholar is still on track to persist and graduate. Some of the escalations require a low level of support, like assistance in filing paperwork with the institution or finding accurate documentation. Other escalations require a more in-depth conversation with the scholar about their progress and an informal plan to stay on track. The third level is the intervention level. Scholars are assigned to an intervention when they trigger one or multiple flags that signal that they are in serious risk of attrition. The Dell Scholars who are assigned to an intervention require an extensive amount of staff time and resources. A staff member explains:

We wouldn't open an intervention unless it required a lot of work for us. When things just require a few steps, we wouldn't require an intervention. Most of the intervention cases are very challenging and time intensive (Retention Associate, Interview, 23 March 2016).

To investigate the Dell Scholars Program's proactive behavior around academic indicators of risk, I conducted simple analyses of program interactions and the probability of receiving an

114

			Less Selective & Selective		Elite, High Selec	lly & Very ctive
	Mean	SD	Mean	SD	Mean	SD
Total contact notes	9.50	9.97	9.71	10.31	9.36	9.74
Contact notes, year 1	2.31	3.15	2.34	3.30	2.29	3.04
Contact notes, year 2	2.10	3.17	2.24	3.33	2.01	3.06
Contact notes, year 3	2.60	3.79	2.58	3.71	2.61	3.85
Contact notes, year 4	2.50	3.40	2.56	3.47	2.45	3.36
Total contact notes > 10	0.35	0.48	0.36	0.48	0.35	0.48
Any intervention	0.04	0.20	0.05	0.22	0.03	0.18
Observations	1108		446		662	

Table 15. Summary statistics for program contact notes and interventions

Source: The Dell Scholars Program database

intervention across subgroups organized by a risk indicator. I specifically compared Dell Scholars who had incidents of earning a GPA below 2.0 those that did not. This is a widely accepted risk indicator due to this GPA cutoff's common association with policies for Satisfactory Academic Progress. When a student is on academic probation due to compromising their satisfactory standing, she is more likely to compromise access to federal aid and therefore at a higher risk of attrition (Shudde & Scott-Clayton, 2016).

This study's analysis of the program's proactive and risk-driven design focuses on two units of program interactions: the number of contact notes in each scholar's record and whether a scholar was assigned to an intervention. Table 15 provides a summary of descriptive statistics for the two indicators. The average Dell Scholar has approximately 2.26 contact notes annually, but this ranges substantially from 0 to 35 and has a standard deviation of 3.32. Nearly 4 percent of scholars have no contact notes in an academic year. Very few scholars are assigned to an intervention, reflecting the program's practice or reserving that level of interaction for students who are in complex situations or in severe risk of attrition.



Figure 7. Boxplot of the distribution of contact notes across the GPA < 2.0 risk indicator

There is a relationship between scholars' number of contact notes and indicators of risk, which is illustrated in Figure 7. Dell Scholars who experience a GPA below 2.0 had an average of 11 contact notes over the first four years of college, compared to an average of 9 contact notes for those who do not experience a GPA level that might threaten their Satisfactory Academic Progress standing. To further investigate the relationship between academic risk and program interactions, I estimated the likelihood of a scholar having a high number of contact notes (i.e. at least 5) in their second year of enrollment across their year second year cumulative grade point average. If the Dell Scholars Program is designed to be responsive to indicators of academic risk, one would expect a statistically significant negative relationship between scholars' grade point average and the probability of being associated with a high number of contact notes. Table 16 presents two models, one without control covariates and the other controlling for all pre-treatment covariates.



Figure 8. Scatterplot of predicted probability of scholars having a high number of contact notes across cumulative grade point average in their second year, by institutional selectivity

	Total year 2	Total year 2
	contact notes > 5	contact notes > 5
Y2 Cumulative GPA	-0.11***	-0.09***
	(0.02)	(0.02)
Black or Hispanic		0.04
		(0.02)
1 if Female		0.01
		(0.02)
Parental Income		0.00
		(0.00)
First Generation Indicator		-0.09*
		(0.05)
English is Primary Language		0.01
		(0.02)
Four Year Institution		-0.13
		(0.08)
1 for Public Institution		0.02
		(0.03)
HS GPA 2.0 - 2.5		0.11
		(0.34)
HS GPA 2.5 - 3.0		0.00
		(.)
HS GPA 3.0 - 3.5		-0.11
		(0.07)
HS GPA 3.5 - 4.0		-0.15**
		(0.07)
Barron's Elite		0.00
		(.)
Barron's Highly Selective		0.01
		(0.04)
Barron's Very Selective		-0.03
		(0.04)
Barron's Selective		-0.01
		(0.04)
Barron's Less Selective		0.01
		(0.05)
Constant	0.47^{***}	0.71^{***}
	(0.06)	(0.13)
Observations	1075	1075
R^2	0.032	0.059

Table 16. OLS estimates predicting more than 5 contact notes in the second year across second year

cumulative GPA

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

Source: The Dell Scholars Program database

In addition, I present a scatterplot of predicted outcomes across the second-year cumulative grade point average, controlling for all pre-treatment covariates and across institutional selectivity categories in Figure 8. The regression results and accompanying scatterplot show a clear and statistically significant relationship between a high level of program interaction and academic risk. Dell Scholars are 9 percentage points less likely to be associated with many contact notes for each 1.0 increase in the second-year cumulative GPA. Overall predictive margins estimate that scholars with a cumulative GPA of 2.0 have a 24 percent likelihood of engaging with the program frequently during their second year of enrollment, compared to scholars with a 3.0 GPA who have a 14 percent likelihood. The disaggregation of the predicted probabilities across institutional selectivity reveal an interesting difference in these patterns. The relationship between grade point average and contact notes is tight for students enrolled in more selective institutions, whereas there are a large proportion of scholars in less selective institutions with high grade point averages and a high likelihood of having frequent interactions with the program. The loose nature of the scatterplot for scholars in less selective institutions suggests that scholars in these types of schools interact with the program for a diverse set of supports outside of the academic domain.

In addition to exploring the relationship between contact notes and academic risk, I examined the relationship between the likelihood of a scholar being assigned to an intervention and cumulative GPA. Given that program practices only assign interventions to scholars who need long-term support, I look at the probability of a scholar being assigned to an intervention within the first four years of enrollment across their fourth-year cumulative GPA. Table 17 presents estimates from two estimation models, one without controls and the other with the full set of control covariates.

	Intervention, within	Intervention, within
	years 1 -4	years 1 - 4
Y4 Cumulative GPA	-0.06***	-0.06***
	(0.02)	(0.01)
Black or Hispanic		0.01
		(0.01)
1 if Female		-0.00
		(0.01)
Parental Income		-0.00
		(0.00)
First Generation Indicator		-0.01
		(0.02)
English is Primary Language		0.01
		(0.01)
Four Year Institution		-0.07
		(0.05)
1 for Public Institution		0.01
		(0.01)
HS GPA 2.0 - 2.5		-0.11**
		(0.04)
HS GPA 2.5 - 3.0		0.00
		(.)
HS GPA 3.0 - 3.5		0.01
		(0.05)
HS GPA 3.5 - 4.0		-0.03
		(0.04)
Barron's Elite		-0.01
		(0.02)
Barron's Highly Selective		-0.02
		(0.02)
Barron's Very Selective		0.01
		(0.03)
Barron's Selective		-0.02
		(0.02)
Barron's Less Selective		0.00
		(.)
Constant	0.23^{***}	0.31***
	(0.05)	(0.09)
Observations	1082	1082
R^2	0.044	0.062

 Table 17. OLS estimates predicting a program intervention across year 4 cumulative grade point average

*p<.10 **p<.05 ***p<.01 Source: The Dell Scholars Program database

Again, there is a statistically significant relationship between the likelihood of a scholar receiving an intensive level of program support and academic performance. For each 1.0 increase in cumulative GPA, scholars are 6.6 percentage points less likely to be assigned to a program intervention. Predictive margins reveal that scholars with a 2.0 GPA have a 9 percent probability of being assigned to a program intervention, compared to their peers with a 3.0 GPA who are associated with a 3 percent probability.

Although there is a clear relationship between program interactions with scholars and their academic performance, the program is not designed to be solely responsive to risk. Displaying this relationship comes with the risk of misrepresenting the program model as being disciplinary in nature. Observations of the program and interviews with staff and students reveal that the program's intentions are far from being rigid or punitive. The strict program requirements around scholar data reporting are not in place to target disciplinary action, but are in place to guide the allocation of social resources and time embedded in the program's lean staffing structure:

We show them the data and say, 'Students like you – only 20% complete their degree. But our students are much more successful. You won \$20,000 with us, but there is much more to it. We want you to succeed. And this is why. Because we're going to be asking a lot from you. You're going to be doing these check-ins and we're going to ask for a lot of data. But this is what we do with the data. And you're going to have support and we're going to be here for you and you're not the only one. We are more than a check. You are not alone' (Retention Officer, Interview, 4 March 2016).

4.3.2 Key program component: Flexible, client-focused program practices

The previous section walked through the most common escalations in each check-in cycle's workflow and presented evidence of how the program model is designed to be highly responsive

to academic risk. That narrative, however, falls short of illustrating the extent to which the program model is designed to provide thoughtful, personalized support to their participants. Observations of program practices and a review of the program's administrative data revealed flexible program polices that were intentionally designed to meet the individualized needs of each scholar and optimize the allocation of program resources. This flexibility and client-focused approach in the program's design allows the program's financial and social resources to bend thoughtfully in the direction that is most beneficial for the scholar. In addition to maintaining routines to respond to risk indicators, the program is positioned to offer personalized support that boost persistence rates as well as impact long-term educational and labor outcomes that are outside of the scope of this study.

This flexibility is first and foremost evident in the program's policies for distributing the scholarship award. Every scholar is entitled to \$20,000 to be allocated to their educational expenses. Unlike last-dollar scholarships that only cover the amount of tuition and fees that are not met by institutional and federal aid packages, the Dell Scholars Program sets aside \$20,000 for each participant and makes it clear that, conditional on meeting check-in requirements, they are entitled to every dollar. There is a firm policy in place that requires the award to be disbursed only for education-related expenses. Therefore, a scholar cannot request money from their balance to be used for expenses like buying a car or traveling home. However, there is remarkable flexibility in how the program defines an educational expense.

An educational expense traditionally refers to the billable expenses that a student must pay in order to continue their enrollment in college.¹⁴ If there is a gap between a scholar's aid package and billable expenses, the scholarship award is disbursed to a scholar's institution to close that

¹⁴ These expenses commonly include tuition and fees, room and board, and health insurance.

gap. If a scholar's award comes with the risk of displacing other sources of aid, the program staff will advise the scholar to first negotiate with their financial aid office, and if the institution does not budge, advise the scholar to allocate their award balance to loan repayment. Loan repayment is also an option for those scholars who do not have unmet need, but have accepted a financial aid package with student loans. Dell Scholars who do not have loans or unmet need, which is not unusual for low-income students attending more selective institutions with hefty endowments and generous financial aid packages, have the option of using their award balance to pay for summer credits, study abroad credits, and summer internship stipends if they are on track to degree completion. In addition, scholars may use their award allotment for graduate school tuition after they attain a bachelor's degree.

Table 18 presents summary statistics of the disbursement patterns of the Dell Scholars Program award money for the 2009-2012 cohorts. School-year expenses (i.e. billable expenses during the traditional academic year) are the most common use of the award balance. On average, the Dell Scholars Program disbursed \$12,596 per scholar toward school-year expenses. Disaggregation of summary statistics across institutional selectivity categories reveals that this average is higher for students enrolled in less selective institutions at \$13,400. The second most common expenditure is summer term tuition and fees, with the program disbursing \$1,533 per scholar, on average. These two categories are followed by loan repayment, graduate school tuition, and internship and study abroad support. Scholars enrolled in more selective institutions, on average, draw more from these alternative expenditure options.

To further understand the relationship between the program's disbursement packages and institutional selectivity, I further disaggregate summary statistics across the larger set of Barron's

	All		Less Selectiv	e & Selective	Elite, Highly & Very Selective		
	Mean	SD	Mean	SD	Mean	SD	
School Year Fees	\$12595.78	8581.17	\$13400.47	8094.718	\$12053.65	8858.77	
Loan Repayment	\$1259.03	3630.63	\$774.38	2700.77	\$1585.55	4110.92	
Graduate School	\$891.02	3266.33	\$662.00	2829.12	\$1045.33	3524.20	
Summer Courses	\$1533.75	2664.55	\$1272.91	2039.44	\$1709.47	3002.22	
Internship	\$407.73	1725.34	\$46.77	535.57	\$72.66	499.95	
Study Abroad Fees	\$62.24	514.50	\$165.98	990.58	\$570.59	2063.68	
Observations	1108		446		662		

Table 18. Summary statistics for Dell Scholars Program award disbursement

Source: The Dell Scholars Program database

selectivity categories. It would be reasonable to expect financial aid packages to look very different in an Elite institution compared to a Selective or Very Selective institution, therefore I hypothesize that this variation in financial aid packages drives the variation in the program's disbursement patterns. Table 19 presents summary statistics across all categories in the Barron's selectivity index. The Dell Scholars Program spends only \$8,209 toward school-year fees, on average, for scholars enrolled in Elite institutions compared to an average expenditure of \$14,494 for scholars enrolled in institutions categorized as Selective. The program pays out more money toward loan repayment, summer credits, study abroad, internship, and graduate school costs for scholars enrolled in Elite and Most Selective institutions. Given that Elite and Most Selective institutions are typically associated with larger endowments and more generous financial aid packages, the Dell Scholars Program award allotment is commonly used for these alternative expenditures. These award disbursement patterns illustrate how the Dell Scholars Program is not a fixed award; rather, program policies allow scholars to draw on the financial resources offered by the program to meet their individualized needs.

This flexibility also extends to program practices around social interactions with scholars. The program pushes an open-access message to all participants and emphasize that the program staff are there to offer support and guidance for any scholar no matter what challenge or barrier they are facing. Scholars are encouraged to communicate with program staff about all situations that may compromise their persistence, and every message from a scholar is considered and responded to in a prompt and professional manner. Over time, the program has evolved to have routines and expertise in place to help their participants grapple with hurdles beyond academics including the complex bureaucratic, financial and life challenges that can lead to attrition.

	Elite		Highly Selective		Very Selective		Selective		Not Selective	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
School Year Fees	8219.85	8759.36	12587.29	8726.41	14084.11	8272.31	14494.04	7732.29	11538.09	8377.26
Loan Repayment	2310.59	5109.29	1725.47	4184.80	902.90	2995.77	869.75	2736.36	611.96	2639.32
Graduate School	1787.55	4914.15	1138.01	3541.52	409.20	1830.98	769.84	3156.07	478.35	2158.23
Summer Courses	1518.06	2992.94	1903.16	3033.21	1603.71	2969.31	1181.55	1993.17	1428.51	2112.97
Internship	168.35	802.00	62.72	441.35	17.78	188.14	74.24	673.65	0	0
Ν	158		279		225		281		165	

Table 19. Summary statistics for Dell Scholars Program award disbursement across all Barron's Selectivity Index categories

Source: The Dell Scholars Program database

Indeed, qualitative and descriptive evidence in the administrative dataset reveals variation in how scholars draw support from the program. Figure 9 presents a scatterplot of the raw number of program contact notes and cumulative grade point average acquired over the first four years of enrollment. In the previous section of this chapter, I presented a predictive and statistically significant relationship between GPA and the probability of a scholar having a high number of contact notes. The key difference in this plot is that it shows the *raw* number of contact notes across the cumulative grade point average. This plot shows that there is a substantial number of scholars who are performing well academically with a high number of program contact notes. In other words, there are Dell Scholars who do exceptionally well in school that still find themselves in situations that require support and guidance from the Dell Scholars Program team.



Figure 9. Scatterplot of the raw contact notes across cumulative GPA through year four

This variation in how students experience the program makes it impossible to pinpoint the causal mechanisms underlying the reported persistence and degree attainment outcomes. For some scholars, the funding is the primary component of the program on which they rely. For others, the program serves as their only source of stable support through their undergraduate career. Even with the rich data available in the administrative dataset, it is difficult to settle on a firm set of scenarios in which the Dell Scholars Program is most likely to have the largest impact, given the unique and complex circumstances of scholar cases. To further understand how the scholars experience the program within their individual contexts, I draw on the administrative data and interviews with scholars to identify and describe three common scenarios through which participants interact with the program.

4.3.2.1 The Dell Scholars rely on the program's financial award to support persistence

The figures in the previous section illustrate that the clear majority of Dell Scholars progress through school with very few contact notes from the program. Approximately 40% of scholars are associated with zero contact notes during a given academic year. Although a small proportion of these scholars are cases in which a student has stopped out and are therefore inactive in the program, most of these cases involve students that complete each check-in process without raising flags that require an extensive or ongoing conversation with the program. These students progress without little to no contact notes entered into their file.

Although the contact notes serve as a suitable proxy for measuring program interactions with participants, they can also be deceiving in how they underestimate the role of the program in supporting the persistence of scholars. Indeed, the majority of the scholars progress through the program without intensive interactions with program staff. Yet, simple analyses of contact notes can promote two faulty assumptions: first, that students without contact notes are progressing
through college smoothly; and second, that the program is solely a college financing mechanism. A close read of the administrative data (i.e. text message exchanges with scholars and detailed longitudinal information about academic performance and emotional well-being) coupled with interviews with the scholars reveal a very different story.

Dell Scholars, like other first-generation and low-income students, face a relentless set of challenges after the point of enrollment. In addition, because the program prioritizes students who have overcome adversity, there are many participants that enroll in college in the aftermath of traumatizing youth experiences and therefore have immediate social and emotional hurdles to overcome. During the interviews, I listed to stories of scholars who lost parents during formative years and were subsequently raised by family members as wards of the state, as well as young mothers who had children in high school that were conceived from acts of sexual assault. The postsecondary challenges faced by Dell Scholars are distinctly different from those experiences by their well-resourced peers, and the small number of contact notes is most likely a reflection of the self-determination and will of the scholars themselves or their access to resources in their institutions. It is not uncommon for scholars with a small number of contact notes to weather academic, financial, and social challenges by seeking out support from peers or college staff that are closer in proximity than the Dell Scholars Program team.

Antonio,¹⁵ for example, recently graduated from a less selective large, four-year university in Nevada. Antonio's mother died when he was very young, and he was raised by his sister and declared a ward of the state after his father was sentenced to prison because of his drinking problems and subsequent hit and run incidents. Antonio's sister worked hard to support him, but with three other children in the household and only one income after the death of her husband,

¹⁵ Pseudonyms are used for scholar names throughout this report to protect their identities.

Antonio was tasked with being financially independent at a young age. When he enrolled in college, he immediately built a strong network of friends through his fraternity and established firm connections to campus as a student employee in the college advising center. He had a strong start as a chemical engineering major, but found himself derailed by crippling depression and anxiety before the start of his junior year:

Last fall I was on and off four different medications for the anxiety and the depression, and at that time it was just really, really weird. I just could not get out of bed. I'd try to schedule my work in the morning so I would go to class. But I would go to work and then come back home and just pass out and sleep all day (Antonio, Interview, 18 May 2017).

Antonio stopped attending his classes and his GPA fell below 2.0. Although Antonio's low GPA raised a flag in the Dell system, he primarily drew on support from his peers and his access to college staff through his position in the college advising center: "Last fall [the advisors in the advising center] made me apply for graduation in front of all of them, and without them I probably wouldn't have made it" (Antonio, Interview, 18 May 2017).

Morgan, like Antonio, lost her mother at a young age and her father was unable to care for her due to his alcohol abuse. Morgan sought emancipation from her father at 14 and lived with her brother and his wife through high school before enrolling in a large, less selective four-year private university in a major city in Texas. Like Antonio, she learned to be financially independent at a young age, and this responsibility continues to be a burden for her in college:

It's been really hard to balance work and school. And I know a lot of people have to do that, but I feel like it's really different for me, because I don't have a safety net. I don't have parents who can send me money. That is all on me. So, I always have to make sure that I have a safety net of money. If something happens, I have to be able to pay for it on my own. I mean, I do have my boyfriend, his family, to help support more, but it's not the same thing as having my own parents who are supposed to take care of me, who are going to be there. (Morgan, Interview, 10 May 2017).

To support herself, Morgan has bounced between a series of low-wage positions in restaurants and retail shops. She faces ongoing financial uncertainty and constantly feels stress to secure part-time wages to cover her school and living expenses every semester. The lack of financial security, and the unpredictable demands of management in her part-time positions, has recently impacted her academic performance:

The lowest grade I've ever gotten was a B before, in high school. And even then it was like a borderline B, like an 88 or 89. So last semester I was so busy working, and looking for work and concentrating on that and trying to find any way to make my bills and stuff. I ended up getting two Cs in my science classes. And this semester I got a C in my accounting class. And I think I'm going to get a C in my math class. So that's been difficult for me, because I feel like, you know, I actually really depend on my job, so I have to make sure that I'm working and I have to make sure that I'm getting my paycheck so I can afford school, my bills and everything that comes with that. (Morgan, Interview, 10 May 2017).

Morgan and Antonio describe in detail the challenges that they faced in college and how different domains of the college experience can impact academic performance. Antonio's anxiety and depression resulted in a steep decline in his GPA while Morgan's need to constantly secure work took her time away from studying. Morgan and Antonio did not turn to the Dell Scholars Program for support, but rather took the initiative to find local financial and social resources to support their persistence.

The interviews with Dell Scholars who do not routinely turn to the program for support also confirmed findings from prior research that has revealed differences in social resources between institutions that are more selective and less selective. Both Antonio and Morgan attend less selective institutions that admit a high proportion of students that apply. Less selective campuses are more likely to enroll the growing population of low-income students that seek a postsecondary degree, which subsequently leads to a strain on institution-based support services for the student population. Antonio described his institution as being supportive primarily because of the social support he received from his fraternity brothers and colleagues at the academic support center. He did not describe a close relationship with his advisor or reference any outreach from his school to help him persist when he was not attending his courses. Morgan also described an impersonal relationship with her advisor and the lack of high-quality services at the campus tutoring center. Furthermore, she talked about the frustrating pile of fees and procedural hurdles in the financial aid office:

The institution itself – I'm not in love with it. It's not just situations with me that have made me feel this way. One of my roommates has a similar situation to me. Her father had passed away when she was younger, and her mom ended up becoming a drug addict when she was in high school. So she had to bounce around, and she never got emancipated. So legally, she's still, you know, binded to her mom. But she doesn't see her that often. So she had to file her FAFSA a certain way, and they give her a hard time every year and try to make her pay more than she can afford. It's irritating; it just seems like they're so money hungry. Like they always change our parking, and they make it more expensive....So that's what drives me crazy. And then they have the students fees for the organizations that you join. They have dues. And I know every school has that, but I just don't have \$100 per semester to pay to be in the student organization, you know? (Morgan, Interview, 10 May 2017).

For students like Morgan and Antonio, who have no access to financial resources from home, a gap between the cost of attendance and financial aid brings stressors that can compromise academic performance and persistence. Their access to financial and social resources are notably different from their peers enrolled in more selective institutions, which are often equipped to provide low-income students with generous financial aid packages and extensive on-campus resources. Allison, for example, attends a more selective, private, small liberal arts institution in the Midwest. Given that Allison was raised in a diverse major city in Texas, she initially had a tough time socially integrating on a campus that enrolls a predominantly white and wealthy student population. In addition, she struggled with the academic rigor of her science courses. However, she had a financial aid package that fully covered her tuition, fees and living expenses after the Dell award allotment, and she could dedicate her time to studying and getting support instead of working. During the interview, Allison often referenced the rich set of academic support systems that her college has in place to support her persistence:

I met with my academic advisor and he was like, 'Well, you're not on the right track here because you need XY or Z GPA to graduate, and it is concerning.' So we started to change some courses and started requesting personal tutors. He worked with me to schedule individual office hours with professors. We started to go about things one-on-one....I was also sent to the Academic Support Office and did counseling....I had two advisors, but my biology advisor was the head of the department so he explained, 'We'll get you back on track. Don't worry. It's going to be okay, but we just need to make some changes and adjustments until we figure out what works for you' (Allison, Interview, 25 April 2017).

The personalized and in-depth attention that Allison receives from the faculty and staff at her college are remarkably different from the experiences that her peers described on their lessselective campuses. Allison's institution is able to assign two advisors to her, and both advisors provided her with ongoing guidance and individualized attention. Furthermore, her institution provides a staffed advising center that is solely dedicated to supporting minority students with adjusting to campus, a counseling center that offers free services for enrolled students, and an emergency aid grant for low-income students if they need to travel home for an emergency, which Allison needed to draw from during her sophomore year when her mother needed an unexpected surgery. Antonio, Morgan and Allison did not turn to the Dell Scholars Program for ongoing academic or social support. However, they all articulated how the financial and material resources provided by the program were important for their persistence. Morgan's financial aid package from her institution falls \$6,500 short of covering her tuition, fees and living expenses. Every year she depends on the \$5,000 from her Dell award to close most of that gap, and she is charged with maintaining employment to cover her remaining expenses:

I think that I have a thousand to two thousand that isn't met. And fortunately for me, I do keep my money saved up, so I am able to put my money towards that. But there are times where I do worry that I won't be able to make it. (Morgan, Interview, 10 May 2017).

Antonio's academic slump during his junior year resulted in him needing to enroll through a fifth year of school, which would have been financially impossible without the support of the program. And Allison, despite attending a selective private institution with generous financial aid packages, relies on the Dell Scholars Program award to fully close the gap between the cost of attendance and her financial aid. The interviews revealed that although there is a large proportion of scholars like Antonio, Morgan, and Allison who do not have frequent interactions with the program staff, the program's material award (i.e. the scholarship money, Chegg textbook credits, and laptop) is a critical piece in a larger and interconnected set of resources that the scholars draw from to support their persistence.

4.3.2.2 The Dell Scholars Program opens doors to early completion and additional education opportunities

The flexibility of the program's award disbursement policy enables the program to support scholars in achieving positive outcomes that go beyond on-time completion. In addition to reducing loan debt, and therefore relieving scholars of the post-graduation financial strain that is

faced by new college graduates, the Dell Scholars Program provides students who do not immediately need the financial award to cover the cost of attendance with the opportunity to accelerate their time to completion or apply their award disbursement to graduate school tuition. For these scholars, the program's main function is to provide an opportunity to reduce the opportunity cost associated with ongoing enrollment and/or pursue a graduate degree.

Daniella is a junior attending a large, more selective college in the University of California system and she uses her Dell award to cover the cost of summer courses. Daniella endured extreme hardship as a young woman. She was sexually assaulted by a relative, which resulted in a pregnancy during the 9th grade. As a young mother, she had little support from her family who were ashamed of her pregnancy. Child and social services intervened to legally force her father to house and care for Daniella and her newborn baby. At a young age, Daniella was forced to find resources to support herself and her infant on her own and she often relied on the support of staff at her high school.

Despite these burdensome circumstances, Daniella maintained a strong GPA and was admitted to the selective University of California institution that she now attends with her live-in boyfriend, who has adopted her daughter. In addition to earning the Dell Scholars Program slot, Daniella was accepted as a Gates Millennium Scholar, which covers her full cost of attendance during the academic year. Because the Gates scholarship allows Daniella to not work and focus on studying during the school year, she is able to use her Dell award to fund her summer courses:

The Dell award helps me a lot, especially during the summers because the other scholarships do not pay for summer school. So that's where I've been using the Dell money throughout these past years. I haven't used it for the academic year, but I'll be graduating in December (Daniella, Interview, 27 May 2017). The flexibility of the Dell award disbursement policy will enable Daniella to graduate a

135

year early. There are several cases of scholars like Daniella who perform well academically and have secured comfortable aid packages to get them through the school year. Because these scholars do well academically and are on-track to graduate on time, the program does not hesitate to disburse their award balance to other academic costs. However, within this subsample of scholars are also students that do rely on the program to help them troubleshoot barriers along the way.

David is currently a junior attending a large, less-selective institution in the University of California system. He grew up in central California in a single-parent household with six younger siblings. During high school, David would help his mother deliver newspapers during her night shifts from 1am until 7am before heading off to school. He continues to live at home to remain close to his family and he commutes 50 miles to campus every weekday during the school year. To cover the costs of his food, textbooks, gas and supplies, David works overnight shifts as a maintenance employee five times a week. Despite this full schedule, David has achieved a 3.96 cumulative GPA, majors in Biology, and maintains an enthusiastic attitude toward school.

David is an example of a subset of scholars that demonstrate ongoing resilience and motivation to adapt to the academic demands of their postsecondary institutions. When asked whether his commute or work responsibilities impacts his academic performance he said:

I figured it out. I think it motivates me more because I know that I don't have a lot of time and I can't mess up. I want to maximize every minute. So when I'm at school I'm in the library or the engineering building just doing work. When I'm there, I'm just doing work. I'm never doing anything else. I'm always looking at my computer and doing what I have to do. (David, Interview, 15 May 2017).

Like many first-generation, low-income students, David had to adjust to the academic rigor, large enrollment numbers and little individualized attention of postsecondary science courses. However, in terms of academic performance and socio-emotional well-being, David's first two years of college were very successful and he did not raise flags during any of his Dell

136

check-in processes. He has maintained a GPA well above average and has a support network of peers in his major with which he studies and shares resources for their courses.

Despite being self-sufficient overall, David relied on advising from the Dell team in his first year of enrollment. During his welcome call, a Dell Scholars Program Ambassador, who was also majoring in the sciences, advised David to take a lighter course load, which relieved him of additional stress as he figured out how to manage his school, commute, and work schedule:

I was initially registered to take calculus, biology, chemistry and physics are the same time. [The program ambassador] told me the he took on a full course load during his first semester and that it was really tough on him. He recommended that I take 12 units to see how it goes, and I ended up listening to his advice and it worked out great because I was still so worried about commuting back and forth...It wasn't too many units where it was overwhelming, and I was still adjusting to driving every day and getting up early, so year, it really helped me (David, Interview, 13 May 2017).

David also needed the support of the program when his college displaced his institutional grant in his first year. Aid displacement is a common barrier that the program staff needs to assist new scholars with navigating. If a scholar requests an amount of money from the program that puts their financial aid balance above their cost of attendance, the institution will often displace institutional aid or grants once the Dell award arrives. This will result in scholars being under resourced their first year as they budget to meet their actual expenses, which can be quite a burden for students like David who commute long distances to school and buy expensive textbooks for science courses. David worked closely with the team to come up with a plan to avoid future displacement and established contact with a campus-based scholarship coordinator for ongoing assistance.

The flexibility of the program's award disbursement policy allows David to use his award

balance to cover the cost of his summer courses. As a result, David has accumulated course credits that put him almost an entire year ahead in a standard four-year completion track:

I'm actually on track to finish a year early if everything goes right, but sometimes the classes I need aren't available. If I had access to those classes, I could have graduated this year if it went according to plan, but I didn't get a certain class, which I expected because it's a class that unlocks all your upper division classes, so it's very hard to get. It's in very high demand. (David, Interview, 13 May 2017).

David could not request more money from Dell during the school-year without risking aid displacement from his institution, so he leveraged the circumstances to accelerate his credit accumulation. In addition, he speaks to the challenges that he must navigate as a student in a large, less-selective institution. David had the resources and motivation to graduate three semesters early, yet his institution has gateway courses that are in high-demand and are therefore inaccessible to undergraduate students. He also described institution-based challenges in the financial aid office as he attempted to understand the cause of his aid displacement. When he first learned of his aid displacement, he would wait in line at the financial aid office for hours before being told to make an appointment with the school's scholarship coordinator. Once he established a relationship with the coordinator, David had access to a valuable institutional resource that allowed his needs to be addressed efficiently. However, prior to that relationship, he depended on the support of the Dell Scholars Program:

In the first year I was completely lost. I didn't know where to go for [help with the displacement]. I called Dell. I didn't even know [the scholarship coordinator] then. I met her this year, during the beginning of this semester (David, Interview, 13 May 2017).

Scholars like David and Daniella demonstrate a consistent determinism to succeed in college. Although David leaned on the support of the program in the beginning of his enrollment, it is reasonable to assume that the support he received from the program was not a critical driver

138

of his persistence. Rather, scholars like David and Daniella are academically and financially positioned to draw on their Dell award balance to accelerate their time to degree completion and pursue post-graduate education opportunities. The flexibility of the program award has allowed both scholars to feel like their post-graduate goals are more attainable. David plans to attend medical school after he attains his bachelor's degree and he is considering using his award balance to fund preparation courses for the MCAT exam. And Daniella is already looking ahead to her next educational goal and plans to enroll in a master's degree program in teaching using her remaining Dell balance to cover costs that would otherwise be prohibitive.

4.3.2.3 The Dell Scholars Program is a critical source of financial and social support

The prior two sections presented stories of students that perceived the program as an important resource in their postsecondary trajectories, albeit not their primary source of social support or driver of persistence. In this section, I present the stories of Dell Scholars for whom the program is a critical source of support. Scholars that rely on the program as a critical resource are associated with a high number of contact notes and/or are assigned to a program intervention. Scatterplots of the administrative data (like those presented in Figure 9) reveal that there are scholars who maintain high cumulative grade point averages who find themselves in situations in which they greatly rely on the program for support. Shadia is one such case, and she is one of the data points in the Figure 9 scatterplot with a high GPA and a high number of contact notes. She grew up in the deep south in a single parent household, and is the oldest of three children. Throughout high school, Shadia was the primary caregiver for her two younger siblings and her mother, who had an extensive history of physical and mental illness and substance abuse. Despite these challenges, Shadia excelled in high school and earned a cumulative GPA over 4.0. In addition to earning a spot Dell Scholars program, Shadia received a state-sponsored merit scholarship. The state merit

scholarship was a last-dollar scholarship that covered a large proportion of Shadia's unmet need, therefore, she withdrew very little from her Dell award balance through the first three years of enrollment.

Shadia's progression through the first three years of college was quite smooth. She was continuously enrolled as a full-time student for every semester and maintained a high GPA. She completed each check-in process on time and did not request or require additional assistance from the program team. Everything appeared to be on track until her mother suddenly died during her junior year of college. In addition to the emotional strain caused by her mother's death, Shadia found herself in a difficult financial predicament with her institution. With her mother no longer alive, Shadia needed her father's tax forms to renew her FAFSA application. However, her father firmly refused to cooperate.

The Dell Scholars Program reached out to Shadia when she did not include a financial aid report in her renewal process. She explained her situation in detail to the program team after her file was escalated, and during the summer before her final year, she worked closely with the Retention Officer to devise a plan. The interactions between Shadia and the team are captured in a series of contact notes that remain in her file. Shadia had a high account balance that she was reserving for graduate school. However, given the pressing need to complete her final year, the Dell Scholars Program approved disbursement of a large proportion of her remaining balance to cover her cost of attendance for her final year. This payment allowed Shadia to enroll and complete her final year of college.

Shadia is an example of a student that came across an unexpected barrier to graduation that would have been unsurmountable without the financial and social support she received from the Dell Scholars Program. The absence of federal and institutional aid during her final year would have made enrollment impossible without the individualized help of the program and the flexibility of their policies.

There are also scholars that require ongoing intensive support from the program starting from soon after their initial enrollment. Marcos is currently a rising junior that is in the process of transferring from a two-year college to a four-year institution. During his senior year of high school, Marcos was bound to move from his hometown in Texas to a Highly Selective private institution in the northeast. However, when he revealed to his family that he is gay, his academic plans were shattered. Marcos was kicked out of his home and banned from any future communication with his family:

I came out to my parents because I wanted to tell them about my sexuality. So my stepfather, well my parents kicked me out because I have a little brother, and he's a half-brother. My stepfather didn't want me to turn him gay. So I had to get out. I came from parents that are very religious....My mom had to follow her religion, so she couldn't do anything. And then in the Latino culture, whatever the father says is whatever the family's going to do. My stepfather said, 'I can't have you.' So that summer after I graduated from high school, I had to leave. And so for a year I was homeless. I am still homeless, honestly, but for a year I was just going to friends' houses and stuff (Marcos, Interview, 18 July 2016).

When Marcos came out to his family, his parents refused to submit the financial information that is required for financial aid, and he subsequently lost his access to federal and institutional assistance. Marcos experienced a tumultuous year after high school as a homeless young adult and he engaged in alcohol and drug use to cope with the loss of his family and the stability of high school. He eventually relocated to another major city in Texas and initiated contact with the Dell Scholars Program to receive help with enrolling in a local community college:

I contacted the Dell Scholars Program. It was the first time I did so because I was embarrassed about being gay and I didn't want anyone to know what I was experiencing. So I decided to contact the program and they told me that it was okay and asked me where I was....It was a great experience. [The Retention Officer] walked me through the process of how I can enroll in community college. At first I contacted the financial aid office and it was like, it was really intimidating because you have to show all of this proof...If it wasn't for [the Retention Officer], there's no way that I would have had the push to enroll (Marcos, Interview, 18 July 2016).

The Dell Scholars Program was a critical source of support for Marcos as he navigated the challenging process of declaring himself financially independent. It was difficult for him to present proof of his financial independence given his lack of contact with his family and limited interactions with other organizations that could verify his circumstances. The Dell Scholars Program, however, could take on this role given their access to his application information and high school transcript data. He explains:

So I do my FAFSA and I have to file for independent status, and it was a process. It was the first time that I needed to reach out to other people because I needed two letters of reference. So I had to think about who knew about my situation. I used to have a job at [redacted] and my boss kind of knew my situation. So she wrote a letter. But other than her, I only had friends who knew what was going on. And the financial aid office explained that I had to have someone official, not just my friends, because my friends could say anything. So [the Retention Officer] stepped in on my behalf because she had this information; she had our conversations of us speaking about my situation (Marcos, Interview, 18 July 2016).

During his time in community college, Marcos was assigned to a program intervention, which established clear check-in times with the program and goals for transferring into a four-year institution. Marcos' ongoing homelessness presented academic and ongoing food and housing insecurity, and he would often reach out to the program for encouragement. When speaking with Marcos it was clear that the program played an enormous role not only in his persistence, but overall well-being:

Whenever I'm dealing with something very important, like the independent status thing, I go to [the Retention Officer]. Honestly, I would like to say that I have a really good connection with her, because there have been a few times where I didn't really care about college and the only reason I wanted to finish college is because of her, because of the support that she gives me and her being nice to me and telling me, 'You can do it, Marcos.' Because sometimes I feel like, why do this? And it's so sad because she's so apart from me. But I just feel like she's the closest person that I have (Marcos, Interview, 18 July 2016).

The last line of Marcos' statement above also speaks to an important limitation of the program's design. For scholars like him, the program's resources are the only stable set of resources that he has access to. Yet, it is extremely difficult for scholars and staff members to develop close personal connections because of the program's technology based model and large staff to student ratio. Marcos depends on the retention officer and feels an important connection to her, but he's also aware of the distance that is between them.

Marcos' severance from his family during his senior year put his college ambitions into a rapid tailspin. Although he didn't communicate with the Dell Scholars Program during the following year, they were available to assist him once he was ready to enroll in school. For Marcos, the Dell Scholars Program is the only source of financial, informational and social support. When talking about the program, he is direct about the critical role the staff has played in his persistence. And although Marcos continues to experience food and housing insecurities, he has successfully completed his associates degree and is in the process of transitioning into a four-year institution where he will continue this fall.

4.3.2.4 Conclusion

In this section, I presented evidence of how the Dell Scholar's Program model is designed to be flexible to the individual needs of scholars. This flexibility is clearly evident in the program's award disbursement patterns as well as the extent to which the program interacts with scholars who are not at academic risk. A close review of the program's administrative data coupled with interviews with current scholars revealed three typical scenarios of how scholars engage with program resources. First, there are a large proportion of scholars that do not have contact notes on file yet rely on the financial award of the program to support their persistence. Second, there are scholars that do not rely on the financial award to support their continued enrollment and draw on program resources to support access to summer course and post-graduate opportunities. And finally, there is a subset of scholars for which the program is a critical source of support.

The administrative dataset and interviews show how there are several interrelated factors that drive college persistence. In the case of these Dell Scholars, it's impossible to compare their outcomes to a counterfactual. Antonio, Morgan, and Allison drew their full award balance from the program every semester but rarely contacted the program for academic or social support. Would they persist absent of the financial award offered by the program? It's safe to assume that David and Daniella would have attained their degrees, but what would the opportunity cost have been if they could not have enrolled in summer courses? Would they still be planning to enroll in graduate school after they finish? And for students like Marcos and Shadia, for which they turned to the program for urgent assistance – what would have happened if the program was not there to provide them with the support they needed to overcome the massive hurdles that they found on their pathway to degree attainment? It is impossible to answer these questions in a rigorous way, but in the absence of a counterfactual there are three key themes that emerge from the stories of Dell Scholars. First, each scholar is experiencing college in their own way, with each expressing their own sentiment about the process, but all of them have had to overcome substantial challenges. These challenges include responsibilities and experiences that have carried over from their precollege lives, as well as the financial, academic and socio-emotional barriers that first-generation, low-income students are tasked to overcome when they step onto a campus. Second, there are clear differences in the resources that are available on campuses across institutional selectivity categories. Dell Scholars on more selective campuses experience unique challenges in adjusting to social environments that are predominantly white and upper class, but they are also more likely to have access to institutional staff to support them in overcoming roadblocks. The large proportion of scholars attending less selective institutions are more likely to encounter long lines at the financial aid office, mediocre and unpredictable tutoring services, and limited access to advisors or faculty. For these scholars, finding appropriate support is much more of a burden. Third, there is consensus across all of the scholars that the Dell Scholars Program is something that they need and appreciate, even if they don't identify the program as a main source of support. All the scholars, regardless of what type of institution they are attending or what their financial aid packages look like, rely on the laptop that the program provides and the Chegg textbook credits that are deposited into their account every semester. Beyond material resources, there is an underlying expression of gratefulness and relief that the program is there to have their backs if something unexpected occurs. David explains:

You always have the asset of the Dell Scholars Program when you need it. Like when I had [the displacement] problem, I didn't know who to go to. I can't go to anyone I know, and I didn't know how anything works. But of course I had the program, and I could call them, and they answered and explained what's going on. I always have that resource there, and having that connection there is important because you have someone to rely on that's aware of how college works (David, Interview, 13 May 2017).

4.3.3 Key program component: The Dell Scholars Program work environment and staff background

In the first two sections of findings for this chapter, I focused on the structure and routines of the program model. I drew on evidence from the administrative dataset and interviews with scholars to illustrate how the program is designed to be responsive to academic risk, and how the program model is designed to be flexible to the needs of program participants. In this section, I shift to a discussion about the Dell Scholars Program's team members that bring this model to life through their implementation of program practices. I first discuss the culture of collaborative case management that is observable in staff interactions and routine meetings. I then talk about aspects of the work environment and the program's remarkable zero staff turnover rate. Finally, I discuss how the sociodemographic makeup of the program team drives their approach to their work.

4.3.3.1 Collaborative case management

The Dell Scholars Program's administrative tool is designed to allow for collective case management. The program's establishment of routines around documentation allows for any program team member to access a student file and have a detailed understanding of that scholar's history, academic performance over time, history of check requests, and any interactions that have occurred between that scholar and a team member. This process distributes the weight of case management across the team. Each escalation is assigned to one team member to take the lead on assisting a student. However, the model is designed to allow for easy assistance from other staff, and to allow for any team member to take over a case when and if someone needs to take a leave of absence. This design protects the program workflow, and the support available to scholars, from being susceptible to unexpected staff changes or emergencies.

The culture of collaborative case management permeates every staff routine. In every observed meeting, both in-person and virtually, the staff approach the individual cases of scholars as a team. The agendas of their weekly meetings are guided by the cycle of each check-in process. For example, during the summer months, the team is tasked with managing the onboarding process for new scholars while also addressing the pressing needs that arise during the renewal check-in processes for scholars who have completed their first or a few years of college enrollment. Observations of weekly team meetings revealed consistent patterns. First, the program team will check in about the processes that they are managing and responding to. Then they will review the number of escalations on the dashboard together on a projected screen. They then review each scholar's case together and in detail. If the escalation has been assigned to a staff member, that person will provide updates, discuss any pressing concerns, and solicit input and ideas. If the escalation is new, that scholar's case will be reviewed by the team and then assigned to a team member to take the lead before the end of the meeting. At the next meeting, that staff member will provide an update if that escalated case is still open, and the workflow cycle repeats.

The program staff members have different titles that differentiate their primary roles in the program model. The Retention Officer is a source of expertise around student processes and how to best assist students with staying on track. The Retention Associate manages the logistical processes, including all bulk messaging and incoming check requests from scholars. The Dell Scholars Program Ambassadors handle the front-line work around simple communication tasks and data collection. And finally, the program Team Lead is present to oversee the overall program, manage the budget and any staff requests, and maintain communication with other units of the Michael and Susan Dell Foundation. Although these different roles are clearly understood, when the team comes together to discuss a scholar's case, all notions of a staff hierarchy or unique roles

disappear. Every team member shifts their focus to the individual circumstances of that student, and together they figure out the best way to support that scholar to degree attainment.

The comprehensive nature of the program requires the team to piece together multiple pieces of a scholar's story before they move forward with a decision. A clear example of this is when a scholar submits a check request. Every fall and summer, scholars will submit check requests for payments to be disbursed to their institutions to cover the cost for the next semester. Since the program isn't automated in its award disbursement policies, a check request will require the Retention Associate to confirm that the scholar has completed the most recent check-in process, and does not have any open escalations that need to be reviewed. The program model closely couples their award disbursement practices with how a student is progressing, and staff collaboration is required even when a scholar is progressing smoothly:

I lean on [the Retention Officer] to tell me about student issues or about what's going on with them. For example, let's say a student wants to do an internship and that student has been working intensely with the [Retention Officer] and she has concerns about the student's financial situation and her persistence. I would check in with [the Retention Office] to say, 'Hey, this person wants to do an internship. This is what I'm thinking. I'm thinking I wouldn't want to approve a full amount and only give them this much. I know that you had concerns about the student persisting so I want to check in on how the student is progressing before I decide to release those funds.' And she can come back and say, 'Well I would rather you not release the funds, because it looks like this student is going to be on a seven-year track and I am worried about them not having funds for the next semester and I want them to focus on getting through their required classes.' So it is a lot of collaboration and working back and forth with each other (Retention Associate, Interview, 23 March 2016).

During the in-person observations it became clear that this is a common scenario in the program. A scholar will request something, and the staff responding to that request will check that

148

scholar's file. If there is an irregularity or a contact note that raises concerns, that staff member will collaborate with another team member to determine the best next step for that student. If there is a missing piece of data or if the Retention Officer needs additional information, she will either follow-up with the scholar herself or assign tasks to the Dell Scholars Program Ambassadors to collect additional information. The Dell Scholars Program Ambassadors will follow-up with the scholar and then summarize their findings to the Retention Officer, much in the way a medical intern will summarize a patient case to an attending in a hospital. In the end, it's the Retention Officer who will make the final decision, but she relies on the support and heterogeneous roles of the team to provide her with the information that she needs to determine the best way forward.

This collective case-management model has benefits that extend beyond program efficiency and preservation of the program model's workflow. The model's collective nature of the work has a palpable effect on staff morale, prevention of staff burnout, and promotion of shared accountability. Traditional case management models often result in staff siloes and staff members carrying the weight of their caseloads in isolation. In addition, traditional case management models heavily rely on the work performance of individual case managers, which brings a risk of some cases falling through the cracks. The Dell Scholars Program's collaborative model builds accountability into their team-based review process. Every open escalation is reviewed by the team, and so that team member is expected to have updated data on that student before the next week. The model trades in autonomy over student cases for shared accountability and responsibility. As a result, individual team members do not feel alone with the weight of the challenging student situations that they grapple with daily.

4.3.3.2 Work environment

The lean staffing structure of the program may immediately signal low overhead costs to policymakers who are interested in replicating the model. However, there is reasonable argument that the benefit of the small staff is not in the reduced cost, but rather the opportunity for the program to invest in the professional development, well-being, and happiness of the team. The turnover rate for the core team members – that is, the Retention Officer, Retention Associate and the Team Lead -- is zero.¹⁶ During the time of this study, the program hired an additional Retention Officer in preparation for an expansion of their 2016 cohort. Other than this additional hire, there have not been any dramatic shifts in the staffing structure since the hiring of the Retention Associate in 2013. The program rarely hires additional full-time staff members, and when they do, these individuals do not leave.

Conversations with the team members revealed a shared sentiment toward the work and the surrounding environment – the work is challenging and personally meaningful, they are sufficiently supported, and there are opportunities for growth and improvement. The program is housed in the Michael and Susan Dell Foundation, just outside of Austin, Texas. Each employee of the foundation receives a competitive compensation package, generous health and retirement benefits, as well as support for maternity and personal leave. Each work cubicle is outfitted with up-to-date computer systems and a walking treadmill desk. The kitchen is well-stocked and the conference rooms are outfitted with advanced virtual conference and projection systems. In addition, the program's budget supports regular staff trainings around project management, staff retreats for planning and reflection, and conference travel. The Team Lead and Retention Officer

¹⁶ The founding Team Lead moved to a different position in the Michael and Susan Dell Foundation in 2008. Between 2008 and the time of this study, no full-time employees of the Dell Scholars Program have left the team.

often attend conferences to keep up with the larger policies that may impact their participants, as well as stay up to date on program practices at large. In short, the Michael and Susan Dell Foundation has built and nurtured a pleasant work environment that attracts and retains a talented, dedicated workforce.

4.3.3.3 Staff cultural competency

I conclude this section with what I perceive as being a critical, yet quantitatively immeasurable, component of the Dell Scholars Program model: the socio-demographic makeup and the personal experiences of the program team. Every team member, including the core staff and the Dell Scholars Ambassadors, is a person of color and first-generation college student. Although it is impossible to quantify the impact of the staff's cultural competency on student outcomes, it would be irresponsible to ignore the palpable effect that the makeup of the staff has on the program's mission and how the team approaches their work.

During the interviews, each staff member talked about their own personal, academic, and professional backgrounds. Each core staff member experienced adversity in their own persistence pathways, and these personal experiences clearly drive the dedication they bring to their program roles:

So, as far as our team goes, we have characteristics that are similar to our students. We all come from low-income families. I started off having a family at a very young age and I dropped out of college. I have never finished my degree. I didn't have a program like this; my scholarship provider did not provide services like this. It was just a check if you're meeting requirements- 'Here is your check'. We are more of a college completion program, and I didn't have that. I had a family early and dropped out and I never finished. I've been able to share what I've experienced and what I've gone through with our students and let them know that this can be done. We are more than just a check. We genuinely care about these students and we

really want them to persist. And so we do share those experiences. And the background that we all come from, it makes the work more passionate. We just really want these students to do well so they can have a better life. We've been there. We've gone through that. We've been through the adversity that these students are dealing with. And we know the importance of a college degree in getting you to where you want to go; we know it does make a difference in your life. We are a very diverse team, and this is a huge plus because this is the demographic that are working with. Low income. First generation. Minority students. Having that experience and just having that on the team has been huge for us (Dell Scholars Program team member,¹⁷ Interview, 23 March 2016).

The interview with another staff member revealed a similar story of a young mother who was the recipient of a scholarship that did not provide social support in additional to a financial award. She explains:

When I went to college I had a two-year-old daughter and I was the first in my family to go to college. And I received a scholarship that was very similar to the Dell Scholars Program. It was actually an unmet need scholarship, so they almost covered the entirety of my educational expenses....Of course, being a first-gen student, I had no idea what that meant. So, when I started I had my daughter with me and I had just received my refund for my financial aid and I was really trying to figure it out. She had to be in day care because it was just me and her. And I had my refund check and I realized it wasn't going to work, you know? Because I'm budgeting and I see that I have this much to pay for rent, because I can't live on campus. And daycare at the time was more than my rent when I started school. So I was budgeting and I thought that I would have to start a day job or maybe drop down to part time or maybe this just won't work at all. You know? And I was sitting there struggling with this, and I met this person in my biology course, and I realized is well. So we just got to know each other, and I confided in her about

¹⁷ Given the personal nature of the quoted text, I do not identify the team member's title.

some of the financial difficulties that I was having. And she was like, 'Well I have this scholarship and this is how it works.' And I said, 'Oh my gosh, I have the same scholarship!' She explained that you can go to the financial aid office and ask for an increased cost of attendance to increase educational expenses because they can include childcare in there. Then your scholarship will come in and cover that because they cover unmet need...That was a critical intervention point in my persistence. Because had that not have happened, I probably wouldn't have made it (Dell Scholars Program team member, Interview, 4 March 2016).

She continues to describe how her own personal experiences in college have guided how

she approaches her work in supporting other college students:

I have always carried that interaction with Beth with me in my approach to my work. I always knew that we needed to know what was going on with students and that there were certain interventions and certain kinds of knowledge of the system and practices that I needed to implement for this work to be successful. I was always thinking, that we are the Beths in their worlds. We know what to do (Dell Scholars Program team member, Interview, 4 March 2016).

The personal backgrounds of the staff members, and sincere concern and commitment that they bring into their work, reveals how the program's data-informed practices and flexible policies emerged in response to their clear understanding of the often inflexible and unexpected challenges that their students face. The evolution of the program model was not rooted in research or policy papers on national persistence trends. Rather, the program model has evolved to be highly responsive to the challenges that scholars face because the individuals who built and nurture the program either lived through those challenges or they choose to grapple with novel challenges alongside the students that they deeply care for.

The personal backgrounds of the staff members, and the sincere concern and commitment that they bring into their work, reveals how the program's data-informed practices and flexible policies emerged in response to their clear understanding of the often inflexible and unexpected challenges that their students face. The evolution of the program model was not rooted in research or policy papers on national persistence trends. Rather, the program model has evolved to be highly responsive to the challenges that scholars face because the individuals who built and nurture the program either lived through those challenges or they choose to grapple with novel challenges alongside the students that they deeply care for.

Interviews with Dell Scholars revealed the importance of having a connection with an adult with a college degree who has experienced the challenges that they are currently enduring. For some scholars, this connection is a critical component of their ongoing persistence. One scholar that I interviewed established a close relationship with the Retention Officer in her first year of enrollment and referred to this connection as an essential source of support and information. She had two unexpected pregnancies during her first two years in college and found herself exhausted from the daily responsibilities of motherhood, work, and school:

I reached out to [the Retention Officer] and told her that I wanted to quit. I didn't want to go to school anymore. I no longer wanted to do anything. I was tired and I wanted to give up. I ran out of energy. I ran out of sleep. I wasn't okay and I wanted to quit already. She said, 'You're almost done. You have one more year. That's all you have. You're almost done, so stick it out. Try and do good and try and think about what is on the side. You're almost there.' So when she told me that, I thought about how it's only one year. I've been doing this for four years, and I've struggled for four years. I've struggled all my life. What kind of person would I be if I just quit right here? I didn't go to school for four years to quit. No. Not only would I have wasted money of my own, but I would have wasted other people's money. So I thought about everything, and I went ahead and took the two classes this summer and passed. That built up my confidence a lot. I started to think, 'Okay, I'm good and I'm normal again.' (Camila, Interview, 21 July 2017).

When asked about how her relationship with the Retention Officer evolved, Camila spoke to the program's knowledge about her life history and the Retention Officer's ability to personally relate to her own circumstances. She explains:

[The Retention Officer] and I have always had a really close relationship as far as every time I went through something. I would always reach out to her to get her advice, or ask her questions. She was always quick to respond, so I didn't have to wait around for days to have her respond to me. She would randomly message me and say, 'Hey, Camila, I was just thinking about you and the kids. How are the kids? How's college going? Is everything okay? Are you getting your books on time?' Stuff like that. I just feel like if somebody takes time out of their day to message you and check to see if you're doing okay. I just feel like that person cares a lot about you and that is a person you should reach out to.... I have a hard time reaching out people because they don't know me. The program tries to know you. They read essays about your life. They get to know you when you apply and they get to know your goals and stuff that you feel is an obstacle. None of my friends know what I go through on a daily basis. And I'd rather them not know because I'd rather them just see me as someone who succeeded....I just feel like [the Retention Officer] has been through something like what I've been through. She had kids and she had to work and she had to finish school, and it was hard. And I know what she went through because I'm going through it, and she knows what I'm going through now (Camila, Interview, 21 July 2017).

4.3.4 Key program component: Implementation of a continuous quality improvement strategy

There has been considerable momentum around continuous improvement in educational practices and research within the past decade. The Carnegie Foundation for the Advancement of Teaching has been a vocal leader in building and maintaining continuous improvement interventions to support better learning and teaching outcomes in educational settings across the United States. In their publications, the Carnegie Foundation identifies rigid criteria to guide the determination of a quality improvement strategy (Park et al., 2014). Specifically, they identify five interrelated components of improvement strategies. In this section, I present evidence of how the Dell Scholars Program has adopted four out of these five components and subsequently qualifies this program as an example of a continuous improvement model in the wild.

The first necessary component that is identified in the literature is that the initiative must be a system that focuses on a) a defined problem and ideal outcome, and b) a defined population that the initiative is trying to serve. The mission of the Dell Scholars Program specifically identifies both the outcome and the population of students that they target. The program is clear that their goal is support at least 80% of each cohort to six-year bachelor's degree attainment, and that they specifically aim to support low-income first-time beginning college students who have overcome a substantial amount of adversity and yet remain focused on attaining a four-year degree. The systems that the program has developed over time, both in terms of technological systems and the design of their workflow routines, are in place to support this goal.

The second necessary component of a quality improvement initiative is the recognition that variation in system performance is essential to improving processes, and this variation signals the core problems that need to be addressed by the initiative. An improvement initiative must aim to accurately understand for whom and under what conditions the initiative is supporting, and for whom and under what conditions the initiative falls short. The Dell Scholars Program has demonstrated their commitment to understanding variation in this system in the routines that they have in place to review their student data and the features that they add to their tool in response to what they observe. The program team collaborates closely with in-house data scientists to review their student data and develop risk indicators to better guide their efforts.

A clear example of this is the program's development of their Student Risk Indicator. The Student Risk Indicator is a color-coded indicator that is visible at the front page of each scholar's file. There are three parts to the indicator: academic, financial and situational. When a student reports information that signals that their persistence is at risk due to information reported in one of those areas, they receive a low score for that indicator and the color turns red. Through their years of experience with working with scholars, the team has become attuned to academic, financial and situation patterns that were adversely impacting and predicting persistence and degree attainment. The team worked with the foundation's technology team to design a feature in their administrative tool that would interpret the student data as it was entered into the system and generate an indicator of risk that would clearly and efficiently indicate the areas in which a scholar was at risk. A member of the technology team explains:

We started with program experience as a way of picking out which items we are going to measure. They have knowledge and experience over the many years -I don't know the combined years of the program officers in terms of supporting students – but it's a lot. And so we started with that and we broke it down into these basic areas. Then we double checked their intuition a little bit by doing very simple correlations between some of those events and the number of interventions, the propensity to drop out, that kind of thing. Nothing truly statistics oriented, just a rough idea of the trends – the trend line does go up, so there's obviously some kind of correlation that you can infer (Michael and Susan Dell Foundation Data Scientist, Interview, 22 February 2016).

157

Figure 10 presents a screenshot of a slide deck that was shared by the in-house data scientist that assisted in the development of the administrative tool's Student Risk Indicator.¹⁸



Figure 10. Screenshot from a slide deck from the Michael and Susan Dell Foundation about the methodology of the administrative tool's Student Risk Indicator

This slide is one of the many correlations that the technology and program team reviewed to guide the metrics underlying the Student Risk Indicator's scores and color-coding schemes. In this correlation, the team reviewed the relationship between scholars' high school grade point averages and the grade point averages that they reported at the end of their first year. The clear positive relationship between high school GPA and first year GPA led the team to include a low high school GPA as a weighted factor for the academic risk indicator during the onboarding process. The key point I want to make about the Student Risk Indicator is that these indicators were created in

¹⁸ This slide has been cropped to hide sensitive identifiable information about the Dell Scholars.

response to the variation the team was observing in the persistence and degree attainment rates of their students. The program team was aware of the variation in degree attainment rates, and so they developed a system that would illustrate this variation to better understand these outcomes and guide their improvement strategies.

The third necessary component of a quality improvement initiative is a commitment to seeing the designed system as a driver of observed outcomes. In addition, the leaders of the initiative must see the system as being embedded within a local context that informs assessment of the system's wide-scale utility. The Dell Scholars Program strays from this principal in that its processes do not reflect how the Carnegie Foundation uses this principal in their work around the improvement of teaching. The Carnegie Foundation's networked improvement initiatives facilitate quality improvement work across a diverse set of institutional settings and institutional actors. In their initiatives, they target an area of improvement and document the implementation of an improvement effort as well as the context in which the effort is occurring. The Dell Scholars Program is facilitating improvement work around degree attainment rates across a wide range of actors and institutions, but they have focused solely on the progress of the students and the immediate contextual factors that impact that student's persistence, such as family responsibilities, access to transportation and housing and food security. The Dell Scholars Program, reasonably, does not see the contextual factors of postsecondary institutions as something that they can manipulate or document cleanly. There are simply too many of them. However, the program does stay true to this principal in that it consistently links the success of scholars to their program mechanisms. If a scholar drops out, they attribute that loss to an area of their system that needs to be improved.

The fourth antecedent for quality improvement work is the initiative's capacity to measure and track key processes and outcomes. Throughout this paper, I have described the administrative tool as a key component of the program's model, and argued that the routines of the program around data collection and review are an underlying driver of the program's success. This tool allows the program to monitor the progress of their participants and review their data on a day-today basis. In addition, they have routines in place to reflect on each check-in process and identify data "blindspots" that they would like to begin measuring to build out a more comprehensive picture of the factors of the college experience that may impact persistence and degree attainment outcomes. The identification of data blindspots often leads to the development of new points of data collection and features in the administrative tool. For example, in 2015, the program began to collect data on indicators of scholar mindset in each of their check-in processes. The Dell Scholars Program team noticed that there was a substantial proportion of students who were struggling, but were not triggering the academic, financial and situational indicators of risk:

We noticed a lot of research that was being done on mindset. And there was something that [the Retention Officer] on our staff was staying – 'You know what? I can see that they're doing okay. Some of the main qualitative data or quantitative data isn't really telling us much because their GPA is fine. They're on track academically. But it was in really talking to them that I got a sense that they are really, really stressed out. They are barely holding it together. But they aren't being flagged as risks.' And so we wanted to get to this question: 'No matter how well you're doing academically, whether it is good or bad, how are you feeling about school in general?' And so [these mindset items] is our version 1.0 of Dell being into the mindset work with students and trying to get a better sense of what's going on with them and how they're feeling about stuff (Team Lead, Interview, 12 January 2016).

The program team continues to closely collaborate with the technology team to build out new features in the administrative tool that draws on aggregated scholar data to guide their practices. A recent conversation with the Retention Officer highlighted the productivity of these collaborations. During the time of this study, the technology team responded to a staff request to better identify scholars who are on the cusp of being on track to graduate within six years. The technology team then developed a new feature in the administrative tool that allows the program team to efficiently review cohort-level progress, which is displayed in Figure 11.

2011 Scholar Cohort On-time and potential on-time graduate dashboard								
On Time Grads 206						Potential Grads 20	Cahort Goal: 255	Cohort Size: 300
On Time Grad Count			Potential Grad List					
	Scholar Count	% of Cohort	Graduation Track	Scholar ID	Scholar Name	Scholar Status	GPA (Current)	Degree Progress 🗧
On-Time Grads	206	68.7%		2039	tion	Active	2.49	93%
Potential Grads	20	6.7%		2220		Probation - Enrollment	3.06	92%
On-Time Forecast	226	75.3%		2051		Probation - Enrollment	2.50	88%
29 short of o		2307 E	mat	Active	3.50	87%		
Years To Graduate	2	0.7%		2010	nfor	Active	3.39	86%
2	2	0.7%		2151	Redacted identifiable i	Active	2.35	83%
3	19	6.3%		2246		Active	2.50	83%
4	129	43.0%		2279		Active	2.86	81%
5	56	18.7%		2140		Probation - Multiple	3.31	75%
Null	13	4.3%		2263		Active	3.02	
Total Actual Grads	219	73.0%		2028		Hold	3.10	
Associates	1	0.3%		2193		Probation - Enrollment	2.43	67%

Figure 11. Screenshot of a new feature in the administrative tool that allows the staff to review cohort-level progress and target intervention points

In this dashboard, the Dell Scholars Program team can review the degree attainment progress of each cohort, as well as the degree progress for the individual scholars within this cohort. The feature was designed to generate key descriptive data points, such as how many scholars are currently short of graduating on time, the number of estimated years remaining to degree attainment and the proportion of each cohort with that amount of time remaining in their trajectory.

The fifth and final component of a quality improvement campaign highlighted by the Carnegie Foundation is that an initiative must employ a "specific and coherent methodology to improve systems and processes" (Park et al., 2014, 5). The program does not employ a specific, pre-determined methodology to guide their improvement practices. Rather, their routines for data collection, data review, and data-informed systems and workflow improvement have evolved from their experiences and ongoing collaborations with in-house data scientists and their technology team. They have developed their own improvement strategies to guide their needs. This in-house, evidence-based methodology for guiding the improvement of their work allows them to refine their processes and improve the outcomes of their students at the same capacity that any prescribed, outside improvement methodology would have produced. I would argue that the shared commitment to student success that I observed across the Michael and Susan Dell Foundation, coupled with the internal capacity for teams with different pools of expertise (e.g. data scientists, computer scientists, and the Dell Scholars Program team) to closely collaborate around improvement efforts, has resulted in a more robust methodology that is anchored by mutual trust and commitment to the overarching mission.

4.4 **DISCUSSION**

In this chapter, I constructed an explanatory narrative to couple with the causal impact estimates that were discussed in the first part of this study. I organized this narrative around four key program components that emerged from analysis of staff and student interviews, program observations, and the program's administrative data. The first component identified focused on the proactive design of the program model, the core of which is guided by the program's sophisticated administrative tool. The administrative tool facilitates the routine data collection processes with which the program staff draw on information about the scholars to guide their work. It has facilitated the automated process of identifying scholars with persistence trajectories that are in immediate risk. In addition, the tool has evolved with an ever-expanding capacity to display data and degree progress to program staff in an efficient and meaningful way. This tool is what enables the Dell Scholars Program to maintain a lean staffing structure despite a growing client population, and is arguably the operational core of the Dell Scholars Program.

The second key program component identified was the program's flexible, client-focused program practices and policies. The program has strayed from traditional merit- and need-based scholarship programs that either only allocate funds to assist with unmet need, and/or only allows participants to access money if they meet a rigid set of requirements. In addition, the program model maintains an open communication line with all scholars, regardless of their academic performance or financial need. These flexible policies enable scholars to draw on the program for resources that are most needed in their individual contexts, and subsequently diversifies the ways through which the program promotes student success. In addition, these flexible policies open the door for a new line of inquiry around long-term outcomes beyond degree attainment such as graduate school matriculation and completion outcomes, and labor-related outcomes around employment and wages.

If the administrative tool is the operational core, or essentially the brain, of the program model, it is the makeup and aggregated experiences of the Dell Scholars Program team that functions as the program's beating heart. It is impossible to decouple the outcomes and the key

161

program components that I have identified in this paper from the people who implement the work. First, the risk indicators in the administrative tool, as well as the program's policies and workflow routines, were designed by the program staff by drawing on what they have observed in their dayto-day work *over time*. I emphasize the time component here because the zero-turnover rate in the staff has certainly impacted the extent and rate at which the program model has been able to evolve. The administrative tool is only as effective as human learning that has influenced its design, and the program's success in retaining its core staff over time has resulted in a fluid transfer of knowledge between its staff and the tools they use to support their work. Second, the sociodemographic history and makeup of the staff has had a palpable impact on their ability to directly relate to the experiences of the students that they serve. The flexible design of the program's policies clearly reflects this unique source of knowledge and expertise. The Dell Scholars Program staff members have lived through the challenges that their students face, and they are more effective practitioners and program designers because of this.

Finally, I discussed the program's implementation of continuous quality improvement strategies. The Dell Scholars Program's commitment to the improvement of their practices is evident in how they capture information, how they review this information, and how they use this information to refine their tools and practices. This commitment to quality improvement is evident in their practices as well as the practices that I observed in the Michael and Susan Dell Foundation as a whole. The foundation's employment of data scientists and a highly-skilled, in-house technological team reflects an organizational-wide loyalty to evidence-driven social impact initiatives. This access to technological resources and expertise is a rare and unique asset. Unlike the vast majority of mon-profit organizations that rely on grants to fund the development of data management and analysis tools, the Dell Scholars Program team has in-house access to individuals
that can help them understand their data and refine their tools in real time. And they take full advantage of the resources and routines that are required to guide meaningful improvement strategies.

5.0 DISCUSSION AND IMPLICATIONS

In this study, I evaluated the impact of the Dell Scholars Program, a college success initiative that provides low-income, first-generation college students with a combination of a tangible financial resources and social support from the point of enrollment until degree attainment. This investigation answered three primary research questions. First, what is the impact of the Dell Scholars Program on persistence and degree attainment outcomes for all Dell Scholars? Second, what is the impact of the Dell Scholars Program on loan borrowing behavior, academic progress and academic achievement that are known predictors of college success? And finally, what are the key program components that drive the reported causal effects?

This study builds off a prior impact evaluation of the Dell Scholars Program that used a regression-discontinuity analytic design to estimate the program impact on program participants near the selection threshold. This investigation builds off this earlier study by using difference-indifferences and matching analytic strategies to estimate impacts for all scholars, including those beyond that selection threshold. This extension of the regression-discontinuity study offers several advantages. First, the expansion of the sample size and inclusion of scholars away from the threshold presents an opportunity to examine heterogeneous impacts. Scholars away from the selection threshold, on average, have higher high school GPAs and are more likely to enroll in Elite and Highly Selective institutions. The inclusion of these scholars in the analyses revealed consistent differences in impact estimates across institutional selectivity categories. Specifically, the program has a 9 percentage point and 18 percentage point impact on four and six year degree attainment rates for scholars in less selective institutions, compared to a 6 percentage point (n.s.) and 10 percentage point impact on four and six year degree attainment rates for their peers in more selective colleges. This trend of larger impacts for scholars in less selective schools was consistent across outcomes for persistence rates, stopout and dropout rates, academic progress, and academic achievement. The magnitude of the impacts switched across institutional categories for impact estimates for loan-borrowing behavior and work hours. In other words, this analytic design opened the door for me to investigate *for whom* the Dell Scholars Program model is most beneficial. Findings from this study revealed that the program has larger impacts on enrollment and academic outcomes for scholars in less selective schools, and larger impacts on college financing outcomes for students in more selective institutions, where the cost of attendance is often higher and more prohibitive.

These findings are arguably more meaningful than those generated by the regressiondiscontinuity study when considering the implications for the design of college success interventions. The detected heterogeneous effects across selectivity categories matter when thoughtfully considering the population of interest in this study. First-generation and low-income students are associated with attrition rates that are higher than their more well-resourced peers, and understanding where most of these students are enrolling is an important consideration in thinking about large-scale improvement strategies. Increased enrollment for low-income students has been predominantly concentrated in Selective, Less Selective, and Non-Selective institutions (Carnevale & Strohl, 2010). This trend is illustrated in Figure 12, which shows socioeconomic distribution across college selectivity categories in 1982 and 2006. Enrollment patterns for the





Figure 12. Socioeconomic distribution at colleges by selectivity for 1982 and 2006. These graphs were recreated from Carnevale & Strohl (2010).

lowest two income groups in the Elite, Highly Selective and Very Selective institutions are relatively stable over time compared to the patterns that are observed in the Selective, Less Selective and Non-Selective selectivity categories. Policymakers that are interested in closing the college completion gap need to be attuned to interventions that effectively support low-income students in the institutions in which their enrollment is concentrated. In addition, it is important to consider the current performance of these institutions. Although there is notable variation of graduation rates within institutional selectivity categories (Carevale & Strohl, 2010), analysis of the six-year graduation rates of the institutions that enroll scholars and their matched counterparts reveals a meaningful difference in institutional performance. I display this in Figure 13 below.



Figure 13. Distribution of 2013 six-year graduation rates for institutions that enroll Dell Scholars and their matched BPS counterparts

Low-income, first-generation students are more likely to enroll in less selective institutions, and these types of institutions are linked with six-year graduation rates that are considerably lower than what is observed in more selective institutions.

Why are these institutions struggling with graduation performance? One hypothesis is that institutional performance is weighed down by the influx of an underprepared student population. This hypothesis, however, has been contested by opposing theories that link low graduation performance with a decrease and state- and federal-funding, and subsequently diminished institutional resources. Bound, Lovenstein & Turner (2007) found that increased time-to-completion trends were localized outside of our nation's more selective institutions, that the change in the composition of the study body accounts for essentially none of the observed increases, and that this trend is more likely attributable to the reductions in college resources and per-pupil spending on support services and faculty quality. Those institutions that are absorbing more low-income students are also more likely to have *less* resources dedicated to supporting those students to degree attainment.

Disparities in outcomes across institutional selectivity categories are evident throughout the analyses in this paper. The coefficients for the baseline matched BPS subjects reveal a consistent pattern across the impact estimates for persistence and degree attainment outcomes: students in less selective institutions are less likely to persist, are less likely to graduate, and are more likely to stop out and drop out within their first four years of enrollment. Furthermore, the matching strategies and longitudinal data available from the Dell Scholars Program and the BPS dataset opened the door to generate impact estimates on academic and college financing outcomes that allow for me to piece together a story of what is happening to scholars and their matched counterparts between the point of enrollment and degree attainment. The BPS subjects in less selective institutions are behind their peers in more selective institutions across every measure. They are more likely to fall behind in accumulating credits toward their degree, more likely to have lower cumulative grade point averages, more likely to have incidents of earning a GPA below 2.0, and more likely to earn less than three-quarters of the credits they attempted within a semester.

These larger trends and findings present an important question when considering larger policy implications: Why and how is the Dell Scholars Program consistently producing larger impacts for scholars in less selective institutions? One hypothesis is that the program model is effectively providing scholars with access to critical support services that are not longer, or were never offered, on those less selective campuses. The findings from the second part of this study allow for an evidence-based investigation into this hypothesis. The explanatory case study delved deeply into the program model and administrative data to unpack how the program achieves their results. Drawing on the diverse set of evidence that I had on hand, I identified four key program components that contribute to the program's impacts:

- A proactive, data-informed social support system that is highly responsive to persistence risk indicators;
- Flexible, client-focused program practices;
- The program's work environment and staff background;
- And implementation of a continuous quality improvement strategy.

The flexibility of the program practices both enriched and challenged this impact evaluation. The program model is designed to be useful for Dell Scholars in different ways. From a practitioner and student point of view, this program design is ideal. However, from a research perspective, this design presented insurmountable barriers for identifying causal pathways. If the Dell Scholars Program award was simply a last-dollar scholarship that covered a proportion of a student's unmet need, then I could draw a clean conclusion that the program impacted degree attainment rates by way of relieving the students of financial hardship. Given the comprehensive and flexible design of the program, I am unable to arrive at concrete conclusions about what elements of the program impacted which of the outcomes that I observed. Although I could show that the program model is responsive to academic risk indicators and reduces loan borrowing after the first year, I cannot conclude to what extent this evidence drives outcomes for some Dell Scholars more than others.

Yet, the variability that I observed in the extent to which the scholars leaned on the resources more than others greatly enriched the narrative and overall understanding of what is quite special about this program: The Dell Scholars Program is designed to tailor their outreach and support to the individual needs of their scholars. Descriptive and anecdotal evidence of this tailoring suggests that the program has larger impacts for Dell Scholars in less selective institutions because those scholars are more likely to need support across multiple domains of the college experience, and the program is positioned to provide it to them.

The literature review presented in Chapter 2 introduced a key construct that I considered as I approached this work: organizational embeddedness. This construct posits that an individual's social capital greatly depends on the organizations with which that person routinely interacts, and the fewer the resources someone has in their personal networks, the more their outcomes depend on these interactions. (Allard & Small, 2013; Small, 2009). The descriptive statistics of the samples in this study show that the program serves a predominantly very low-income, minority and first-generation population of students. Given that this population of students are less likely to have access to adults in their personal networks who have attained a degree, they are forced to navigate the postsecondary landscape at a great disadvantage, relying on the information and resources available in the organizations that they interact with to support their persistence.

Interviews with scholars unearthed stories of astounding perseverance. The typical scholar overcomes extraordinary adversity prior to and after their enrollment in college, and the interviews and analyses of program contact notes reveal that the Dell Scholars Program's role in a scholar's persistence trajectory is defined by their needs. For scholars in institutions associated with low costs or larger expenditures toward financial aid and ample student support services, the program's role in their persistence may be minimal. However, for those scholars in institutions with sparse or low-quality support services, the program's financial and social resources can be critical for success. Although the four interrelated program components that make the model unique cannot be disentangled to identify one driving mechanism, the program is an example of organizational embeddedness in action.

The literature review also summarized impact estimates from causal studies on college success interventions. Prior research has shown that impacts are related to two important characteristics of college success initiatives: the scope and length of the support that the initiative provides. Programs that provide support across multiple domains (i.e. academic and financial) of the college experience have larger impacts than those initiatives that solely target one domain. And given that impacts have shown to fade as more time progresses after an intervention, sustained support systems are more effective than short-term fixes. Programs that meet these two conditions are identified as comprehensive support programs, and this impact evaluation places the Dell Scholars Program in the same category as the CUNY ASAP program and the Carolina Covenant in terms of the significance and magnitude of the program's impacts on persistence and degree attainment rates. This work, however, fills a unique niche in this evaluation space given the extensive reach of the Dell Scholars Program. Unlike CUNY ASAP and the Carolina Covenant programs, which are designed to support students in one institutional context, the Dell Scholars

Program serves students across hundreds of institutions in almost fifty states. Findings from this study are promising when considering the recent interest in college success initiatives that are charged with supporting students across a diverse set of institutional contexts (i.e. alumni support offices in charter management organizations).

There are, of course, limitations in the program's design. The physical distance between the program staff and their participants constrains the development of meaningful connections. Dell Scholars who did not perceive the program as an important source of social support consistently referenced proximity and lack of personal connection as reasons for searching for support elsewhere. The Retention Officer cannot be the parent with the master's degree at the dinner table for more than a thousand scholars. The benefit of a lean staffing model and reliance on technological tools to conduct direct services work comes with the tradeoff of sacrificing the deeply personal, in-person connections that so many of us often rely on. Scholars are not immune to the onslaught of challenges and barriers that await them after enrollment and acceptance into the program. The findings from this impact evaluation reveal that the program is effective in supporting a large proportion of these students in overcoming these barriers and persisting toward a degree. However, it became clear through the interviews, and in reviewing the cases of scholars who did not persist, that there is a clear barrier that divides what this program model can achieve and what it does not have the capacity to do. In this larger story of a program that achieves remarkable results, there are individual stories of scholars who do not make it. These are the scholars who are in an academic, financial or situational hole that is far too deep for the program's lift. These are the cases that weigh on the program staff, and that sparked the ongoing momentum of building a program model that is more proactive. They are a testimony to the limits of webbased interventions in the absence of intensive social or institutional support.

The key program components identified in this study have built off one another in how they have evolved through the program's development. This presents important considerations for policymakers and administrators who may be interested in replicating this model across different institutional contexts. There are important questions to consider that the data at hand do not allow me to answer. Would the program model be effective without the monetary incentive that is used to induce scholars to enter their data into the key check-in points? To what extent would the program model be effective for other subpopulations of students? These are indeed pressing questions to consider when thinking about the feasibility of bringing this program model to scale.

Finally, there have been recent developments that alleviate reasonable concerns about the cost of developing a sophisticated administrative tool. The Michael and Susan Dell Foundation has invested in the development of a similar web-based tool for use by other college success initiatives as a part of their larger "mission-investing" initiative. This tool is now available for purchase by other organizations that may benefit from the routine data collection and analysis processes that the Dell Scholars Program has developed in their model over time. Perhaps most importantly, in considering how findings from this study can go further, the release of this tool opens the door for replication studies that can shed light on the effectiveness of the administrative tool in varying contexts. The findings from this study, paired with future studies that take advantage of the public's access to this administrative tool, have the potential to generate important and nuanced evidence for the field as we continue to grapple with an ongoing, yet increasingly more pressing, question: How can our institutions and organizations better support our country's most vulnerable students?

APPENDIX

CHAPTER 3 OUTCOME VARIABLES

In this appendix, I detail the construction of the outcome variables considered in Chapter 3, the data sources, and the analytic strategy

used to generate impact estimates.

Variable name	Description	Data source(s)	Analytic strategy	
			DID	FD
Persistence	For each student in cohort <i>t</i> , enrollment in the fall and spring of year <i>t</i> and in the fall of year $t+1$ for second year persistence, and $t+2$ for third year persistence. A student is assigned a value of 1 if she persisted and a value of 0 otherwise.	NSC; BPS 04/09	Х	
Stopping out	A student is assigned a value of 1 if she does not have an enrollment record for any term during the academic calendar year within the first four years after initial enrollment.	NSC; BPS 04/09	Х	
Dropping out	A student is assigned a value of 1 if she does not have an enrollment record for any term during the academic calendar year and no subsequent enrollment record thereafter, within the first four years of enrollment.	NSC; BPS 04/09	x	

Variable name	Description	Data source(s)	Analyt DID	ic strategy FD
On-time BA attainment	Completion of a bachelor's degree within 48 months of initial enrollment. A student is assigned a value of 1 if she earned a bachelor's degree within 48 months of initial enrollment and a value of 0 otherwise.	NSC; BPS 04/09	X	
Six-year BA attainment	Completion of a bachelor's degree within 72 months. A student is assigned a value of 1 if she earned a bachelor's degree within 72 months and a value of 0 otherwise.	NSC; BPS 04/09	х	
First-year loan borrowing	I investigate three variables for loan borrowing: federal loans, Parent PLUS loans, and private loans. A student is assigned a value of 1 if she takes on that type of loan. Federal loans include Stafford, Perkins and Parent PLUS loans.	Dell administrative dataset; BPS 04/09		х
Credits earned, cumulative	Cumulative credits earned in an academic year. I adjusted the raw number of credits using enrollment intensity data and information in the IPEDs datasets that reports the number of credits that are required for students to be considered full-time enrollees. The number of cumulative credits that a subject earned were adjusted using this information to allow for analysis of student progress across a common scale. Students were enrolled full-time and on-track if they had 32. 64, 96 and 128 adjusted cumulative credits earned in their first, second, third and fourth years of enrollment, respectively.	Dell administrative dataset; BPS 04/09		Х
Earned less than ³ / ₄ credits attempted, years 1-4	Drawing on term-level academic performance data a student is assigned a value of 1 if she earned less than three-quarters of the credits attempted in any term within the first four years of enrollment.	Dell administrative dataset; BPS 04/09		х
Cumulative GPA	I use term-level academic performance data to construct the cumulative grade point average for each of the first four years of enrollment. The cumulative grade point average is the mean of the reported grade point averages for each term leading to the time point of interest. For example, the second year cumulative GPA is the mean of the GPAs reported in the first four terms of enrollment. Missing term-level grade point averages are included in mean. For example, if a student only stopped out during the third expected term of enrollment, the	Dell administrative dataset; BPS 04/09		Х

Variable name	Description	Data source(s)	Analytic strategy DID FD	
	cumulative GPA for year two is the mean of the GPAs reported in the first, second, and fourth terms.			
GPA < 2.0 sometime in years 1-4	Drawing on term-level academic performance data a student is assigned a value of 1 if she earned less than a 2.0 GPA in any term within the first four years of enrollment.	Dell administrative dataset; BPS 04/09		x

BIBLIOGRAPHY

- Allard, S.W., & Small, M.L. (2013). Reconsidering the urban disadvantaged: The role of systems, institutions, and organizations. *The ANNALS of the American Academy of Political and Social Science*, 647(1), 6-20.
- Angrist, J., Hudson, S., & Pallais, A. (2015). Evaluating econometric evaluations of postsecondary aid. *The American Economic Review*, 105(5): 502-507.
- Angrist, J., Hudson, S., & Pallais, A. (2014). Leveling up: Early results from a randomized evaluation of post-secondary aid (Working Paper No. w20800). National Bureau of Economic Research.
- Angrist, J., Lang, D., & Oreopoulos, P. (2009). Incentives and services for college achievement: Evidence from a randomized trial. *American Economic Journal: Applied Economics*, 1(1), 136-163.
- Angrist, J. D., & Rokkanen, M. (2015). Wanna get away? Regression discontinuity estimation of exam school effects away from the cutoff. *Journal of the American Statistical Association*, *110*(512), 1331-1344.
- Aronson, J., Fried, C. B., & Good, C. (2002). Reducing the effects of stereotype threat on African American college students by shaping theories of intelligence. *Journal of Experimental Social Psychology*, 38(2), 113-125.
- Angrist, J., Lang, D., & Oreopoulos, P. (2009). Incentives and services for college achievement: Evidence from a randomized trial. *American Economic Journal: Applied Economics*, 136-163.
- Attewell, P., Lavin, D., Domina, T., & Levey, T. (2006). New evidence on college remediation. *Journal of Higher Education*, 77(5), 886-924.
- Avery, C., Howell, J. S., & Page, L.C. (2014). A review of the role of college counseling, coaching, and mentoring on students' postsecondary outcomes. New York: The College Board.
- Bailey, M.J., & Dynarski, S.M. (2011). Inequality in postsecondary education. In G.J. Duncan & R.J. Murnane (Eds.), *Whither opportunity?: Rising inequality, schools, and children's life chances* (207-228). New York: Russell Sage Foundation.

- Bailey, T., Jenkins, D., & Leinbach, T. (2005). What we know about community college lowincome and minority student outcomes: Descriptive statistics from national surveys. New York: Community College Research Center.
- Bailey, T., Jeong, D. W., & Cho, S. W. (2010). Referral, enrollment, and completion in developmental education sequences in community colleges. *Economics of Education Review*, 29(2), 255-270.
- Barnett, E. A., Bork, R. H., Mayer, A. K., Pretlow, J., Wathington, H. D., & Weiss, M. J. (2012). Bridging the gap: An impact study of eight developmental summer bridge programs in Texas. New York: National Center for Postsecondary Research Report.
- Battistin, E., & Rettore, E. (2008). Ineligibles and eligible non-participants as a double comparison group in regression-discontinuity designs. *Journal of Econometrics*, 142(2), 715-730.
- Baum, S., Ma, J. & Payea, K. (2013). *Education pays 2013: The benefits of higher education for individuals and society*. New York: The College Board.
- Baum, S., Ma, J., Bell, D. W., & Elliott, D. C. (2014). *Trends in college pricing, 2014*. New York: The College Board.
- Bean, J., & Eaton, S. B. (2001). The psychology underlying successful retention practices. *Journal* of College Student Retention: Research, Theory & Practice, 3(1), 73-89.
- Becker, G. S. (2009). *Human capital: A theoretical and empirical analysis, with special reference to education.* Chicago: University of Chicago Press.
- Bell, A. D., Rowan-Kenyon, H. T., & Perna, L. W. (2009). College knowledge of 9th and 11th grade students: Variation by school and state context. *The Journal of Higher Education*, 80(6), 663-685.
- Bettinger, E. (2004). How financial aid affects persistence. In C. M. Hoxby (Ed.), *College choices: The economics of where to go, when to go, and how to pay for it* (207–238). Chicago: University of Chicago Press.
- Bettinger, E. P., & Baker, R. B. (2014). The effects of student coaching: An evaluation of a randomized experiment in student advising. *Educational Evaluation and Policy Analysis*, *36*(1): 3-19.
- Bettinger, E. P., & Long, B. T. (2005). Do faculty serve as role models? The impact of instructor gender on female students. *The American Economic Review*, 95(2), 152-157.
- Black, S.E., Cortes, K.E., & Lincove, J.A. (2015). Academic undermatching of high-achieving minority students: Evidence from race-neutral and holistic admissions policies. *American Economic Review*, 105(5), 604-10.

- Borgatti, S. P., & Foster, P. C. (2003). The network paradigm in organizational research: A review and typology. *Journal of Management*, 29(6), 991-1013.
- Bound, J., Lovenheim, M. F., & Turner, S. (2010). Why have college completion rates declined? An analysis of changing student preparation and collegiate resources. *American Economic Journal of Applied Economics*, 2(3), 129.
- Bourdieu, P. (1973). The three forms of theoretical knowledge. *Social Science Information*, *12*(1), 53-80.
- Bourdieu, P. (1986). The forms of capital. In J. Richardson (Ed.) *Handbook of Theory and Research for the Sociology of Education* (46-58). New York: Greenwood.
- Braxton, J. M., Doyle, W. R., Hartley III, H. V., Hirschy, A. S., Jones, W. A., & McLendon, M. K. (2013). *Rethinking college student retention*. San Francisco: John Wiley & Sons.
- Brock, T. (2010). Young adults and higher education: Barriers and breakthroughs to success. *The Future of Children*, 20(1), 109-132.
- Brown, J. & Kruzweil, M. (2016). *Student success by design: CUNY's Guttman Community College*. Retrieved from: http://guttman.cuny.edu/2016/02/04/new-case-study-focuses-on-guttmans-model/
- Cahalan, M., & Perna, L.W. (2015). *Indicators of higher education equity in the United States*. Washington D.C.: Pell Institute.
- Calcagno, J. C., & Long, B. T. (2008). The impact of postsecondary remediation using a regression discontinuity approach: Addressing endogenous sorting and noncompliance (Working Paper No. w14194). Retrieved from National Bureau of Economic Research website: www.nber.org/papers/w14194
- Castleman, B. L., & Long, B. T. (2016). Looking beyond enrollment: The causal effect of needbased grants on college access, persistence, and graduation. *Journal of Labor Economics*, 34(4), 1023-1073.
- Chetty, R., Grusky, D., Hell, M., Hendren, N. Manduca, R. & Narang, J. (2017). The fading American dream: Trends in absolute mobility since 1940. (No. w22910). National Bureau of Economic Research.
- Coburn, C. E., Mata, W. S., & Choi, L. (2013). The embeddedness of teachers' social networks: Evidence from a study of mathematics reform. *Sociology of Education*, 86(4), 311-342.
- Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology*, 94, 95-120.

- Deil-Amen, R., & Rosenbaum, J. E. (2002). The unintended consequences of stigma-free remediation. *Sociology of Education*, 249-268.
- Deming, D., & Dynarski, S. (2009). Into college, out of poverty? Policies to increase the postsecondary attainment of the poor (Working Paper No. w15387). Retrieved from National Bureau of Economic Research website: www.nber.org/papers/w15387
- DesJardins, S. L., & McCall, B. P. (2008). The impact of the Gates Millennium Scholars program on the retention, college finance-and work-related choices, and future educational aspirations of low-income minority students. *Unpublished manuscript*.
- Dika, S. L., & Singh, K. (2002). Applications of social capital in educational literature: A critical synthesis. *Review of Educational Research*, 72(1), 31-60.
- Dufur, M. J., Parcel, T. L., & Troutman, K. P. (2013). Does capital at home matter more than capital at school? Social capital effects on academic achievement. *Research in Social Stratification and Mobility*, *31*, 1-21.
- Dweck, C. (2006). *Mindset: The new psychology of success*. New York: Random House.
- Dynarski, S. (2004). The new merit aid. In C. Hoxby (Ed.) *College choices: The economics of where to go, when to go, and how to pay for it* (63-100). Chicago, IL: University of Chicago Press.
- Dynarski, S. (2008). Building the stock of college-educated labor. *Journal of human resources*, 43(3), 576-610.
- Dynarski, S., & Scott-Clayton, J. (2013). Financial aid policy: Lessons from research (Working Paper No. w18710). Retrieved from National Bureau of Economic Research website: www.nber.org/papers/w18710
- Eccles, J. S., Wigfield, A., & Schiefele, U. (1998). *Motivation to succeed*. San Francisco: John Wiley & Sons Inc.
- Engle, J., & O'Brien, C. (2007). *Demography is not destiny: Increasing the graduation rates of low-income college students at large public universities.* Washington D.C.: Pell Institute.
- Ganimian, A.J. & Murnane, R.J., (2016). Improving education in developing countries: Lessons from rigorous impact evaluations. *Review of Educational Research*, 86(3), 1-37.
- Goldrick-Rab, S. (2010). Challenges and opportunities for improving community college student success. *Review of Educational Research*, 80(3), 437-469.
- Goldrick-Rab, S., Kelchen, R., Harris, D. N., & Benson, J. (2016). Reducing income inequality in educational attainment: Experimental evidence on the impact of financial aid on college completion. *American Journal of Sociology*, *121*(6), 1762-1817.

- Goodman, J., Hurwitz, M., & Smith, J. (2015). College access, initial college choice and degree completion (Working Paper No. w20996). Retrieved from National Bureau of Economic Research website: www.nber.org/papers/w20996
- Habley, W. R., Bloom, J. L., & Robbins, S. (2012). *Increasing persistence: Research-based* strategies for college student success. San Francisco: John Wiley & Sons.
- Hearn, J. C., Jones, A. P., & Kurban, E. R. (2013). Access, persistence, and completion in the state context. In L.W. Perna & A. Jones (Eds) *The state of college access and completion: Improving college success for students from underrepresented groups* (166-189). New York: Routledge.
- Heller, D.E. (2013). The role of finances in postsecondary access and success. In L.W. Perna & A. Jones (Eds.), *The state of college access and completion: Improving college success for students from underrepresented groups* (96-114). New York: Routledge.
- Hossler, D., Braxton, J., & Coppersmith, G. (1989). Understanding student college choice. In J. Smart (Ed.), *Higher Education: Handbook of Theory and Research*, Vol. 5. New York: Agathon.
- Howell, J.S., & Pender, M. (2016). The costs and benefits of enrolling in an academically matched college. *Economics of Education Review*, *51*, 152-168.
- Hoxby, C. M., & Avery, C. (2012). The missing "one-offs": The hidden supply of high-achieving, low-income students (Working Paper No.18586). Retrieved from National Bureau of Economic Research website: http://www.nber.org/papers/w18586.
- Hutchins, J. & Robinson, J. (2016). Bringing CUNY Accelerated Study in Associate Programs to Ohio: Early findings from a demonstration in three community colleges. New York: MDRC.
- Iacus, S.M., King, G. & Porro, G. (2009). CEM: software for coarsened exact matching. Journal of Statistical Software, 30(9): 1-27.
- Institute of Education Sciences (2015) What Works Clearinghouse Postsecondary Education Evidence Review Protocol. Retrieved from:ies.ed.gov/ncee/wwc/documentsum.aspx?sid=242
- Jenkins, D., Zeidenberg, M., & Kienzl, G. (2009). Educational outcomes of I-BEST, Washington State Community and Technical College System's Integrated Basic Education and Skills Training Program: Findings from a multivariate analysis. (CCRC Working Paper No. 16). Community College Research Center, Columbia University.
- Jones, A.P. (2013). Introduction: Improving postsecondary access ,persistence and completion in the United States. In L.W. Perna & A.P. Jones (Eds.) *The state of college access and completion: Improving college success for students from underrepresented groups*. New York: Routledge.

- Karp, M. M. (2011). Toward a new understanding of non-academic student support: Four mechanisms encouraging positive student outcomes in the community college. (CCRC Working Paper No. 28). Community College Research Center, Columbia University.
- King, G., & Nielsen, R. (2015). Why propensity scores should not be used for matching. Retrieved from: https://gking.harvard.edu/files/gking/files/psnot.pdf
- King, G., Nielsen, R., Coberley, C., Pope, J. E., & Wells, A. (2011). Comparative effectiveness of matching methods for causal inference. *Unpublished manuscript*.
- Kuh, G. D., Kinzie, J., Buckley, J. A., Bridges, B. K., & Hayek, J. C. (2011). Piecing Together the Student Success Puzzle: Research, Propositions, and Recommendations: ASHE Higher Education Report (Vol. 116). San Francisco: John Wiley & Sons.
- Leppel, K. (2002). Similarities and differences in the college persistence of men and women. *The Review of Higher Education*, 25(4), 433-450.
- Lin, N. (2002). *Social capital: A theory of social structure and action* (Vol. 19). Cambridge: Cambridge University Press.
- Lin, N., Cook, K. S., & Burt, R. S. (Eds.). (2001). *Social capital: Theory and research*. Transaction Publishers.
- Linden, A., & Adams, J. L. (2012). Combining the regression discontinuity design and propensity score-based weighting to improve causal inference in program evaluation. *Journal of evaluation in clinical practice*, 18(2), 317-325.
- Long, B. T., & Boatman, A. (2013). The role of remedial and developmental courses in access and persistence. In L.W. Perna & A. Jones (Eds.), *The state of college access and completion: Improving college success for students from underrepresented groups* (77-95). New York, NY: Routledge.
- Long, B. T., & Riley, E. (2007). Financial aid: A broken bridge to college access?. *Harvard Educational Review*, 77(1), 39-63.
- Martorell, P., & McFarlin Jr, I. (2011). Help or hindrance? The effects of college remediation on academic and labor market outcomes. *The Review of Economics and Statistics*, 93(2), 436-454.
- Mattern, K.D., Shaw, E.K., & Marini, J. (2013). Does college readiness translate to college completion? (Research Note 2013-9). Retrieved from: research.collegeboard.org
- Mayer, A., Patel, R., & Gutierrez, M. (2015). Four-year effects on degree receipt and employment outcomes from a performance-based scholarship program in Ohio. (Working Paper no.2594482) Retrieved from SSRN website.

- Mealli, F., & Rampichini, C. (2012). Evaluating the effects of university grants by using regression discontinuity designs. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, 175(3), 775-798.
- Muraskin, L., & Lee, J. (2004). *Raising the graduation rates of low-income college students*. Washington D.C.: Pell Institute.
- Padgett, R. D., & Keup, J. R. (2011). 2009 National survey of first-year seminars: Ongoing efforts to support students in transition. National Resource Center for the First-Year Experience and Students in Transition, University of South Carolina.
- Page, L.C., Castleman, B.L., Kehoe, S.S, & Sahadewo, G.A. (2017). More than dollars for scholars: The impact of the Dell Scholars Program on college access, persistence, and degree attainment. Working paper.
- Page, L.C, & Scott-Clayton, J.E. (2016). Improving college access in the United States: Barriers and policy responses. *Economics of Education Review*, *51*, 4-22.
- Park, S, Hironoka, S., Carver, P., & Nordstrum, L. (2013). *Continuous improvement in education*. Stanford: Carnegie Foundation for the Advancement of Teaching.
- Paulsen, M. B. (2001). The economics of human capital and investment in higher education. In M.B. Paulsen & J.C. Smart (Eds.), *The finance of higher education: Theory, research, policy, and practice* (55-94). New York: Algora Publishing.
- Pallais, A. (2013). Small differences that matter: mistakes in applying to college (Working Paper No. 19480). Retrieved from National Bureau of Economic Research website: www.nber.org/papers/w19480.
- Pascarella, E. T., & Terenzini, P. T. (2005). *How college affects students* (Vol. 2). K. A. Feldman (Ed.). San Francisco: Jossey-Bass.
- Pell Institute (2011). 6-year degree attainment rates for sutdents enrolled in a post-secondary *institution*. Washington, D.C.: Pell Institute.
- Permzadian & Credé (2016). Do first-year seminars improve college grades and retention? A quantitative review of their overall effectiveness and an examination of moderators of effectiveness. *Review of Educational Research*, 86(1), 277-316.
- Perna, L. W., Rowan-Kenyon, H. T., Thomas, S. L., Bell, A., Anderson, R., & Li, C. (2008). The role of college counseling in shaping college opportunity: Variations across high schools. *The Review of Higher Education*, 31(2), 131-159.
- Perna, L. W., & Thomas, S. L. (2006). A framework for reducing the college success gap and promoting success for all. *National Symposium on Postsecondary Student Success:*

Spearheading a Dialog on Student Success, Retrieved from http://repository.upenn.edu/gse_pubs/328

- Perna, L. W., & Titus, M. A. (2005). The relationship between parental involvement as social capital and college enrollment: An examination of racial/ethnic group differences. *The Journal* of Higher Education, 76(5), 485-518.
- Radford, A.W., Berkner, L., Wheeless, S.C., and Shepherd, B. (2010). *Persistence and attainment* of 2003–04 beginning postsecondary students: After 6 years (NCES 2011-151). Washington, DC: National Center for Education Statistics. Retrieved from http://nces.ed.gov/pubsearch
- Reardon, S.F., Baker, R., & Klasik, D. (2012). Race, income, and enrollment patterns in highly selective colleges, 1982-2004. Center for Education Policy Analysis, Stanford University. Retrieved from http://cepa.stanford.edu/content/race-income-and-enrollmentpatterns-highlyselective-colleges-1982-2004.
- Roderick, M., Coca, V., & Nagaoka, J. (2011). Potholes on the road to college: High school effects in shaping urban students' participation in college application, four-year college enrollment, and college match. *Sociology of Education*, 84(3), 178-211.
- Rodriguez, A. (2015). Understanding the Parent PLUS loan debate in the context of black families. In D. Cunnigen & M. Bruce (Eds.), *Race in the age of Obama: Part 2* (pp. 147-170). Bingley, UK: Emerald Group Publishing.
- Rosenbaum, J. E., Deil-Amen, R., & Person, A. E. (2007). *After Admission: From College Access to College Success: From College Access to College Success*. New York: Russell Sage Foundation.
- Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1), 41-55.
- Rubin, D. B. (1974). Estimating causal effects of treatments in randomized and nonrandomized studies. *Journal of Educational Psychology*, 66(5), 688.
- Rubin, D. B. (1978). Bayesian inference for causal effects: The role of randomization. *The Annals of Statistics*, 34-58.
- Rutschow, E. Z., Cullinan, D., & Welbeck, R. (2012). *Keeping students on course: An impact study of a student success course at Guilford Technical Community College*. New York: MDRC.
- Schneider, M. & Yin, L.M. (2011) *The hidden costs of community colleges*. Washington D.C.: American Institutes for Research.

- Scott-Clayton, J. (2011). The shapeless river: Does a lack of structure inhibit students' progress at community colleges? (CCRC Working Paper No. 25). Community College Research Center, Columbia University.
- Scott-Clayton, J. (2011). On money and motivation: A quasi-experimental analysis of financial incentives for college achievement. *Journal of Human Resources*, *46*(3), 614-646.
- Scott-Clayton, J. & Minaya, V. (2016). Should student employment be subsidized? Conditional counterfactuals and the outcomes of work-study participation. *Economics of Education Review*, 52, 1-18.
- Scrivener, S., Bloom, D., LeBlanc, A., Paxson, C., Rouse, C. E., & Sommo, C. (2008). A good start: Two-year effects of a freshmen learning community program at Kingsborough Community College. New York: MDRC.
- Scrivener, S., Sommo, C., & Collado, H. (2009). *Getting back on track: Effects of a community college program for probationary students.* New York: MDRC.
- Scrivener, S., & Weiss, M. J. (2009). More guidance, better results? Three-year effects of an enhanced student services program at two community colleges. New York: MDRC.
- Scrivener, S., Weiss, M.J., Ratledge, A., Rudd, T., Sommo, C., & Freques, H. (2015). Doubling graduation rates: Three-year effects of CUNY's Accelerated Study in Associate Programs (ASAP) for developmental education. New York: MDRC.
- Seidman, A. (2005). *College student retention: Formula for student success*. Westport: Greenwood Publishing Group.
- Shapiro, D., Dundar, A., Wakhungu, P.K., Yuan, X., Nathan, A. & Hwang, Y. (2015). Completing college: A national view of student attainment rates – Fall 2009 Cohort. Herndon: National Student Clearinghouse Research Center
- Schudde, L., & Scott-Clayton, J. (2016). Pell Grants as Performance-Based Scholarships? An Examination of Satisfactory Academic Progress Requirements in the Nation's Largest Need-Based Aid Program. *Research in Higher Education*, 57(8): 943-967.
- Sowers, N. & Yamada, H. (2015) *Pathways impact report*. San Francisco: Carnegie Foundation for the Advancement of Teaching.
- Small, M. L. (2009). *Unanticipated gains: Origins of network inequality in everyday life*. Oxford: Oxford University Press.
- Smith, J. (2013). The effect of college applications on enrollment. *The BE Journal of Economic Analysis & Policy*, *14*(1), 151-188.

- Snyder, T. D., & Dillow, S. A. (2015). *Digest of education statistics 2015*. Washington, D.C.: National Center for Education Statistics.
- Stanton-Salazar, R. D. (2011). A social capital framework for the study of institutional agents and their role in the empowerment of low-status students and youth. *Youth & Society*, *43*(3), 1066-1109.
- Steiner, P. M., Cook, T. D., Shadish, W. R., & Clark, M. H. (2010). The importance of covariate selection in controlling for selection bias in observational studies. *Psychological Methods*, 15(3), 250.
- Toutkoushian, R. K., & Shafiq, M. N. (2010). A conceptual analysis of state support for higher education: Appropriations versus need-based financial aid. *Research in Higher Education*, 51(1), 40-64.
- Tierney, W. G. (1999). Models of minority college-going and retention: Cultural integrity versus cultural suicide. *Journal of Negro Education*, 80-91.
- Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research*, 45(1), 89-125.
- Tinto, V. (1987). *Leaving college: Rethinking the causes and cures of student attrition*. Chicago: University of Chicago Press.
- Tinto, V. (2006). Research and practice of student retention: What next?. Journal of College Student Retention: Research, Theory & Practice, 8(1), 1-19.
- U.S. Department of Education. (2014). *Calculators and interest rates*. Federal Student Aid. Retrieved from http://direct.ed.gov/calc.html
- Walton, G. M., & Cohen, G. L. (2007). A question of belonging: race, social fit, and achievement. *Journal of Personality and Social Psychology*, 92(1), 82.
- Walton, G. M., & Cohen, G. L. (2011). A brief social-belonging intervention improves academic and health outcomes of minority students. *Science*,*331*(6023), 1447-1451.
- Welbeck, R., Diamond, J., Mayer, A., & Richburg-Hayes, L. (2014). *Piecing together the college* affordability puzzle: Student characteristics and patterns of (un)affordability. New York: MDRC.
- Wyatt, J. N., Wiley, A., Camara, W. J., & Proestler, N. (2012). *The development of an index of academic rigor for college readiness*. New York: The College Board.
- Yeager, D. S., & Walton, G. M. (2011). Social-psychological interventions in education: They're not magic. *Review of Educational Research*, 81(2), 267-301.

Yin, R. K. (2013). Case study research: Design and methods. Thousand Oaks: Sage Publications.

Ziol-Guest, K.M. & Lee, K.T.H. (2016). Parent income-based gaps in schooling: Cross-cohort trends in the NLSYs and the PSID. *AERA Open*, 2(2).