

An Outcomes-Based Program Evaluation of Student U

Prepared for
Student U
Daniel Kimberg, Founder and Executive Director

May 1, 2011

Prepared by:
Joel McFarland
Master of Public Policy Candidate
Sanford School of Public Policy, Duke University

Advised by:
Dr. Helen Ladd
Professor of Public Policy Studies and Economics
Sanford School of Public Policy, Duke University

Executive Summary

Program Overview

Student U is a small nonprofit organization that offers summer and after-school educational programs to at-risk middle and high school students in Durham, North Carolina. Founded in 2007, the organization has grown rapidly, admitting a new cohort of fifty rising sixth-graders each summer. Student U continues to work with each cohort until high school graduation. The organization is currently piloting a high school program for the oldest cohort of participants, who entered ninth grade in the 2010-2011 school year.

Evaluation Goals and Methods

This project provides both a retrospective analysis of past program outcomes and a set of forward-looking recommendations for future evaluation and monitoring activities.

It focuses on two separate questions:

- Has Student U's middle school programming achieved intended student outcomes?
- What factors identify high school students who are not on track to achieve important program outcomes, such as high school graduation and college enrollment?

Middle School Program Evaluation

Data Limitations

My analysis uses data on participants' demographic characteristics and academic achievement levels, measured using North Carolina End of Grade (EOG) test scores. I was able to access longitudinal EOG data for only the first two cohorts of participants. Student

records provided by Student U were incomplete, and as a result I was able to obtain EOG data for only 75.5% of participants in these cohorts.

Participant Attrition Rates

The data show a 17% dropout rate for the first two cohorts of participants. This dropout rate includes all students, not just the 75% of students for whom I was able to access EOG data. Although I find no racial or ethnic disparities between program dropouts and continuing participants, boys were twice as likely to drop out as girls. Interviews with program staff indicate that the students who dropped out likely needed academic support, but were unwilling or unable to commit to Student U's intensive programming. This high attrition rate may undermine the program's mission of keeping promising educationally-disadvantaged students engaged with school.

Student Achievement

To compare participants' academic outcomes with those of demographically similar non-participating students, I form a non-randomized control group using nearest neighbor matching. A comparison of the treatment and quasi-experimental control group generates no significant effect of program participation on EOG scores. I acknowledge, however, that the small sample size and poor data quality could undermine the validity of my estimates. Moreover, even if the program has no effect on EOG scores, this finding does not indicate that the program fails to achieve any of its goals. Student U also focuses on students' social development and attitudes toward school, which are not considered in this analysis.

High School Program Benchmarks

Policy Review

The North Carolina Standard Course of Study defines four high school curricula that students may complete in order to fulfill graduation requirements. Student U participants should complete the college/university prep curriculum in order to be well prepared for postsecondary success. In addition, the University of North Carolina system sets minimum GPA, ACT, and SAT scores for admission to a campus of the university system. The UNC minimum standards, however, are set at extremely low levels. In order to be prepared for college-level academics, students should be encouraged to achieve at levels above the minimal standards.

Literature Review

My review of academic research summarizes a variety of indicators that predict high school graduation and college enrollment. These factors fall into three general categories: academic performance, educational engagement, and student background characteristics. While SU staff could collect data on many of these indicators, I recommend focusing on those factors most closely tied to academic requirements outlined in the policy review section, and on attitudinal factors that can be measured through Student U's annual student survey.

Recommendations to Facilitate Future Evaluations

Set modest, but sustainable data collection goals. While there are many available indicators of student success, collecting data on all of them will be unsustainable. Student U should establish a few, high-quality measures of student success. These factors include course

enrollment, course performance, SAT, and ACT test scores, and surveys measuring student attitudes and confidence about their future educational experiences.

Administer consistent surveys and maintain results. Without survey data, SU will be unable to assess its impact on important non-academic goals. Maintaining and analyzing survey responses is a time-consuming task, but Student U's decision to begin using a standardized, externally generated survey is a promising first step. To facilitate evaluation of individual student performance, SU must maintain survey records in a manner that allows individual student responses to be tracked across years.

Monitor attrition rates and explore the causes of student attrition. As outlined in Chapter 2, participant attrition poses a significant challenge for Student U. Depending on the reasons students drop out, this attrition may be a sign that the program is not keeping students engaged with school. Student U should monitor attrition rates, uncover the reasons why students drop out, and take steps to reduce attrition.

Table of Contents

Chapter 1: Overview.....	6
Student U History	
Program Model	
Population Served	
Previous Evaluation	
Evaluation Goals	
Evaluation Methods	
Chapter 2: Middle School Program Evaluation.....	11
Program Description	
Data Limitations	
Analysis of Participant Attrition Rates	
Descriptive Summary of SU Participants' Academic Achievement	
Nearest Neighbor Matching	
Chapter 3: Recommended Benchmarks for High School Program.....	27
Program Description	
Policy Review: High School Graduation and College Admission Requirements	
Literature Review: Early Predictors of Student Success	
Chapter 4: Conclusion.....	36
Summary of Middle School Program Findings	
Summary of High School Program Recommendations	

I. Overview

Student U History

Student U is a small nonprofit organization that offers summer and after-school educational programs to at-risk students in Durham Public Schools. Daniel Kimberg founded the organization in 2007 after graduating from Duke University. The program has grown rapidly, admitting a new cohort of fifty rising sixth-graders each summer. Student U continues to work with each cohort until high school graduation.

Student U is modeled after *Breakthrough Collaborative*, a national nonprofit operating in several large cities. Breakthrough Collaborative serves at-risk middle school students through a similar program of intensive summer instruction and school year mentoring. Kimberg chose to start a new nonprofit, rather than seek a branch office of *Breakthrough Collaborative*, because he felt that a locally-based organization would be better able to tailor its services to the Durham community's needs.

Program Model

Student U's programming has focused on keeping middle school students engaged with and excited about education. The middle school transition is a critical period for SU students, as this is a period when many promising students from traditionally disadvantaged backgrounds become disengaged with school (Wyner, Bridgeland et al. 2009). Student U's programming provides participants with academic support and enrichment, mentors, and a peer community that is focused on academic achievement. These programming elements are described in greater detail in Chapter 2.

The first cohort of students, recruited in 2007, recently began their ninth grade year. During the current school year (2010-2011), SU is piloting a new combination of programming to guide students towards high school graduation and prepare them for college success. The programming retains the mentoring, peer group, and academic support, but also includes an emphasis on coaching students and their families through the college admissions and financial aid processes. These program elements are described in greater detail in Chapter 3.

Student Recruitment and Population Served

Each year, Student U recruits a cohort of 50 rising sixth graders from Durham area schools. Over 75% of these students attend Durham Public Schools, but a small number attend local charter schools or private schools. Students apply to the program and are selected on the basis of their need for supplemental academic support. During the application process, SU interviews students and contacts their classroom teachers.

SU used a different recruitment process for the second cohort of students, who entered in 2008. To facilitate future evaluation, SU solicited 100 applications and randomly selected 50 participants from this pool. The remaining students did not participate and can be regarded as an experimental control group. While this cohort offers an ideal opportunity to use rigorous evaluation methods, I was unable to access data on the randomly selected non-participants.

Student selection prioritizes students who exhibit academic promise or potential, but lack the resources or skills needed to reach their full academic capabilities. Often students are financially disadvantaged and lack access to enriching extracurricular and summer activities and positive learning communities. To build a sense of community, SU also gives

priority in the admissions process to the siblings of current SU participants.

This focus leads SU to serve students from traditionally disadvantaged backgrounds. Table 1 shows that SU primarily serves black and Latino students from lower-income and less-educated families. This table summarizes student characteristics across all four cohorts of students currently enrolled in the program. For example, the first cohort of students entered Student U in 2007, is currently in the ninth grade, and is expected to graduate from high school in 2014. The final column of Table 1 compares the Student U participants' characteristics to the broader population of students in Durham Public Schools with the same expected graduation dates.

Table 1: Current Student Population Profile

	SU Participants (2014-17 grad. cohorts)*	Durham Public School Students (2014-17 grad. cohorts)**
<i>Race and ethnicity</i>		
Am. Indian	-	0.2%
Asian	-	2.4%
Black	64.0%	55.2%
Hispanic/Latino	28.0%	17.6%
Multiracial	-	3.8%
White	8.0%	20.8%
<i>Gender</i>		
Female	55.0%	50.0%
Male	45.0%	50.0%
<i>Socioeconomic status</i>		
Eligible for free/reduced price lunch	85%	52.2%
No family members have attended college	81%	N/A
<i>Total student population</i>	185	10,434

*Source: author calculations from SU data

** Source: author calculations from NCERDC data, includes DPS and charter school students

Previous Evaluation

This analysis builds upon a previous evaluation conducted by Libby Scott (2008). Her master's project conducted a preliminary analysis of student outcomes after Student U's first year of programming. Scott used a logic model to link student program activities to desired student outcomes. Her analysis relied on fifth grade EOG scores and survey data from students, parents, Student U teachers, and Durham Public Schools teachers.

Survey data revealed that over the course of the summer, student attitudes toward school and student behavior improved. However, a follow up survey during the middle of the school year found that many of these gains quickly faded. In response to these findings, Student U significantly expanded the scope of its school-year programming.

Scott's analysis was limited to one cohort of 50 students who had experienced one year of programming. While Scott had survey data from many different stakeholders, she had little access to academic data. Her analysis used only fifth grade End of Grade (EOG) test scores, which functioned as a pre-test of academic achievement before entering the program. Sixth grade EOG scores were unavailable. Instead, Scott measured student achievement using survey questions that asked Durham Public School teachers how confident they were that their students who participated in SU would pass their EOG tests.

My project benefits from a larger student population, which now includes four cohorts totaling nearly 200 students. In addition, I have access to EOG scores for multiple years, allowing me to conduct a more thorough analysis of academic outcomes. However, survey data are unavailable, so I am unable to assess program impacts on important non-academic outcomes, such as student attitudes about learning and aspirations for future education.

Evaluation Goals

This project provides both a retrospective analysis of past program outcomes and a set of forward-looking recommendations for future evaluation and monitoring activities.

It focuses on two separate questions:

- Has Student U's middle school programming achieved intended student outcomes?
- What factors identify high school students who are not on track to achieve important program outcomes, such as high school graduation and college enrollment?

Evaluation Methods

In Chapter 2, I evaluate the impact of Student U's middle school programming on participants' academic achievement. First, I describe and evaluate the significant attrition rates for Student U participants. Over the course of the program, a large percentage of each cohort dropped out of the program and was replaced by other students. I discuss the implications of the high attrition rate for the program's ability to achieve intended outcomes.

Second, I describe academic achievement trends among Student U participants and compare these trends to the broader population of Durham public and charter school students. This analysis focuses on the first two cohorts of program participants, for whom middle school End of Grade test scores are available.

Third, I estimate the effect of Student U on the academic outcomes of participants. My analysis focuses on End of Grade test scores as a measure of academic achievement. These math and reading tests are administered to all North Carolina students in grades 3 through 8 at the end of the school year. This outcome measure has the advantages of being consistently available for both participants and non-participants, and providing a standard

benchmark for academic proficiency¹. In addition, it is closely tied to SU’s mission of empowering all students to achieve at high levels. I was unable to access data measuring other outcomes related to SU’s mission, including student confidence, leadership, attitudes toward academics, and behavior in school.

To estimate the program effect, I use nearest neighbor matching to form a non-experimental control group. Thus, I compare outcomes for Student U participants with those of similar non-participating students in Durham Public Schools and Durham area charter schools. This strategy utilizes a rich dataset containing longitudinal academic and demographic data on all students in Durham public and charter schools.

To help establish benchmarks for high school program success, I conducted thorough interviews with Student U Executive Director Daniel Kimberg to identify program goals and intended impacts. Based on these discussions, I review relevant policies and academic research to help develop evidence-based benchmarks for high school participant success. I then summarize this research for SU staff consideration as it refines its proposed student progress benchmarks.

Chapter 2. Middle School Program Evaluation

The following section provides a detailed overview of middle school programming. I then examine attrition rates for Student U participants and use nearest neighbor matching to estimate the program’s effect on academic achievement.

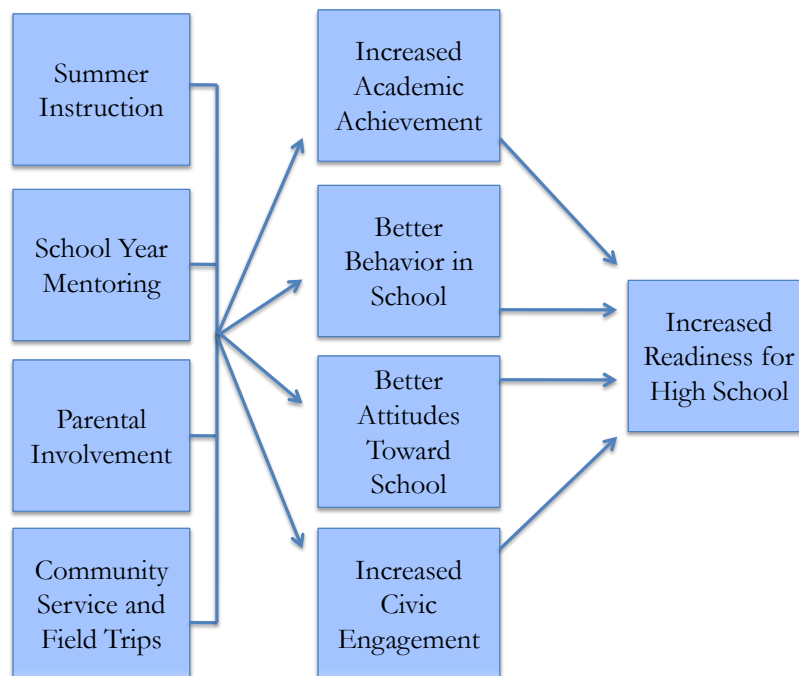
¹ “North Carolina End-of-Grade Tests are designed to measure student performance on the goals objectives, and grade levels competencies specified in the North Carolina Standard Course of Study.” For more information on End-of-Grade Tests, see <http://www.ncpublicschools.org/accountability/testing/eog/>

Program Description

The middle school program includes two components: a six-week summer academic program and enrichment activities during the school year. Figure 1 summarizes the program's components and intended outcomes in a logic model.

The summer curriculum is based on material that students are likely to encounter the following year in school, but also includes personal skills and physical education. College students from local universities teach the summer program courses. Student U teachers are coached by experienced teachers from Durham Public Schools and Teach for America. This teaching experience is designed to inspire college students to pursue a career in education, though this outcome is not Student U's primary mission.

Figure 1: Logic model of Student U middle school program



During the school year, the Student U teachers continue to meet with students on a weekly basis. These interactions include enrichment activities such as a literary club, as well as remedial academic support as needed. Programming also includes monthly field trips led by SU teachers.

This comprehensive programming is designed to foster academic growth, good behavior, positive attitudes toward education, and civic engagement. Ultimately, this combination of program activities aims to keep students from becoming disengaged with school during early adolescence and prepare them for academic success in high school.

Data Limitations

My analysis of the middle school program is limited by missing data for many students. I obtained two years of de-identified EOG and demographic data from Student U, and used this data to identify SU participants in the NCERDC dataset. However, due to the incomplete data that I received from SU, I was able to identify only 77 of the 102 students in the 2014 and 2015 graduation cohorts who ever participated in Student U. Table 2 summarizes the differences in race, ethnicity, gender, and school enrollment between students for which I was able to assemble longitudinal EOG data and those for which I was not able to access EOG data.

The final column of Table 2 uses Fisher's exact tests to identify whether there is a statistically significant difference in the distribution of observed characteristics between the two groups. The high p-values indicate that there is no statistically significant difference in race, ethnicity, and gender. However, there is a clear distinction in school enrollment between the two groups. I was able to identify EOG data only for Durham Public Schools students, and not for charter or private school students. The lack of systematic differences

based on race, ethnicity, and gender leads me to believe that there is no selection bias on these characteristics, which supports the validity of my analyses in later sections.

Table 2: Comparison of Race, Ethnicity, Gender, and School Enrollment Between Participants with and without EOG Data

	Total Participants	Participants with Missing EOG Data	Participants with EOG Data	P-Value of Test Statistic for Difference Between Participants with and without EOG Data
<i>Race/Ethnicity</i>				
Black	72	76.0%	68.8%	0.900
Hispanic/Latino	17	20.0%	15.6%	
Multiracial	2	0.0%	2.6%	
White	1	0.0%	1.3%	
<i>Gender</i>				
Female	52	48.0%	51.9%	0.549
Male	50	52.0%	48.1%	
<i>School</i>				
Durham Public Schools	87	48.0%	97.4%	0.00**
Durham Charter Schools	7	28.0%	0.0%	
Private Schools	3	12.0%	0.0%	
Total	102	25	77	

**Difference is significant at 1% level

Source: Author Calculations from Student U Data

Analysis of Participant Attrition Rates

Attrition occurs when students initially accepted to Student U discontinue program participation. Attrition may occur for many reasons, as students move to new school districts, become disinterested in program activities, or find that they no longer need the services offered by the program. This section explains the problems associated with attrition, quantifies attrition in the Student U program, and discusses its implications for the program's effectiveness.

Problems Associated with Attrition

While some amount of attrition may be unavoidable due to student mobility, high attrition rates can undermine a program's ability to achieve its intended outcomes. Attrition is most troubling when it occurs in response to programming activities. For example, students who are at the highest risk of becoming disengaged with school may also become disengaged with and drop out of Student U. Student U programming is designed to help students transition through the difficult middle school years, so this disengagement would undermine the logic model outlined above.

If dropout occurs due to student disengagement, the program may be failing to help the students who are most in need of program services. This failing would be masked in summary statistics of participant achievement levels. As lower-achieving students drop out of the program, average achievement levels would rise among remaining students, and perhaps be inflated by the addition of more motivated students as replacements.

Ideally, attrition rates will be small and random. Few students will drop out, and typically will do so for reasons unrelated to their need for the program. Small, random attrition not only makes it easier to assess estimate a program's effectiveness; it also helps ensure that resources are spent efficiently. It is costly to spend program resources on students that drop out before realizing the full benefits of program participation.

Student U Attrition Rates

Table 3 summarizes attrition rates for the first two cohorts of Student U participants. In each cohort, Student U admitted 50 students during their 5th grade year. These students then began participating in the program during the summer following 5th grade. The 2014 cohort is currently in 9th grade and over the past four years 8 students have discontinued

participation. The 2013 cohort is currently in 8th grade and, over the past three years, 9 students have left the program. This results in attrition rates of 16% and 18% respectively.

Student U has admitted a limited number of students to replace program dropouts. Four replacement students were admitted to the 2014 cohort, and six to the 2015 cohort. These replacements allowed the program to nearly maintain the target cohort size of 50 students.

Table 3: Student U Participant Attrition Rates for 2014 and 2015 graduation cohorts

Graduation Cohort	Original 5th Grade Cohort	Program Dropouts	Attrition Rate	Added after 5th Grade	% of Current Students Added After 5th Grade	Total Current SU Participants
2014	50	8	16%	4	9%	46
2015	50	9	18%	6	13%	47

Source: author calculations from SU data

Table 4 summarizes the differences in demographic characteristics between students who continued in the program and those who dropped out. A Fisher’s exact test for equal distribution of race and ethnicity between the two groups shows no statistically significant differences. Members of all racial groups were roughly equally likely to drop out. However, male students dropped out at twice the rate of female students. This difference is marginally statistically significant at the 10% level. Students attending traditional public, charter, and private schools are all equally likely to drop out.

Table 4: Comparison of Student U Program Participants and Dropouts

	Continuing Participants	Dropouts	P-Value of Test Statistic for Difference Between Program Participants and Dropouts
<i>Race/Ethnic</i>			0.674
Black	80.0%	29.4%	
Hispanic/Latino	14.7%	11.8%	
Multiracial	1.3%		
White	1.3%		
<i>Gender</i>			0.062 [^]
Female	56.0%	29.4%	
Male	44.0%	70.6%	
<i>School</i>			0.543
Durham Public Schools	85.3%	64.7%	
Durham Charter Schools	10.7%	0.0%	
Private Schools	2.7%	0.0%	
Total	75	17	

[^] Difference significant at 10% level

Source: Author Calculations from Student U Data

Table 5 compares students who dropped out with those students who were admitted to maintain cohort size. The cell sizes are too small to permit meaningful significance tests, but it appears that the racial, ethnic, and school enrollment distribution of the new students roughly matched the students who dropped out. The new students, however, included equal numbers of male and female students, while those who dropped out were overwhelmingly male.

Table 5: Comparison of Participants who Dropped Out and Students Who Were Admitted to Replace Them

	Program Dropouts	Replacement Students
<i>Race/Ethnic</i>		
Black	5	7
Hispanic/Latino	2	2
Multiracial	0	1
White	0	0
<i>Gender</i>		
Female	5	5
Male	12	5
<i>School</i>		
Durham Public Schools	11	7
Durham Charter Schools	0	0
Private Schools	0	0
Total	17	10

Source: Author Calculations from Student U Data

Implications for Program Effectiveness

The presence of high attrition rates may be a source of concern for the Student U program. Given limited academic achievement data, I am unable to tell whether program dropouts were higher- or lower-achieving than average program participants. These data, however, would provide critical information on whether Student U is achieving its intended impact. Program staff have indicated that students who dropped out were likely in need of academic assistance, but were unwilling or unable to commit to Student U’s intensive programming.

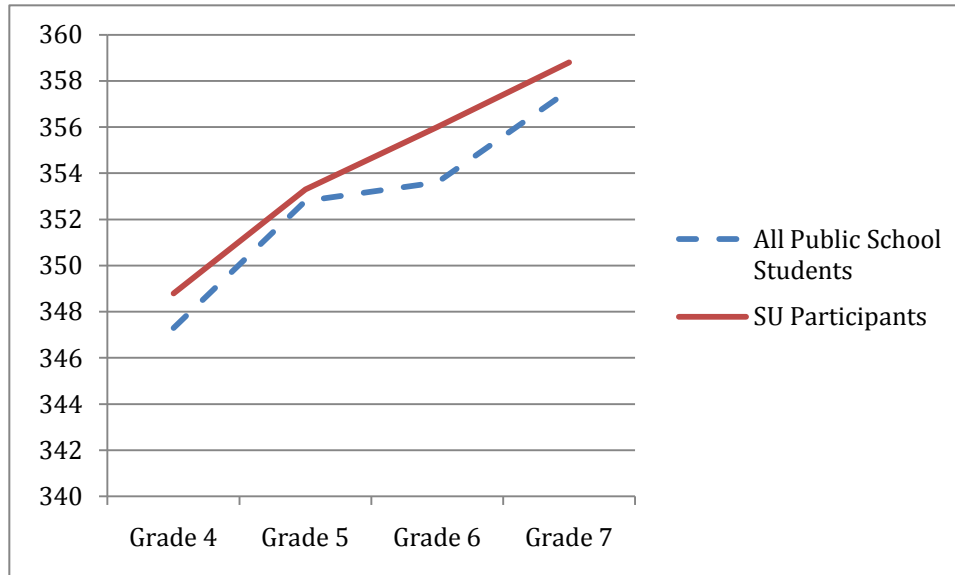
Attrition rates may rise further during the high school program, as SU has indicated that middle school participants must “re-apply” for the program and demonstrate their

commitment to participation in the high school program. This step is mainly intended to bolster student commitment, but may result in a larger participant turnover. Student U should carefully monitor the characteristics of students who decide not to continue in the high school program.

Descriptive Summary of SU Participant Academic Achievement

A simple descriptive analysis shows that Student U achievement levels differ from general Durham public and charter school achievement levels. This analysis is meant to give context to the nearest neighbor matching analysis in the next section, and does not offer a causal estimate of the program's effect on student academic achievement.

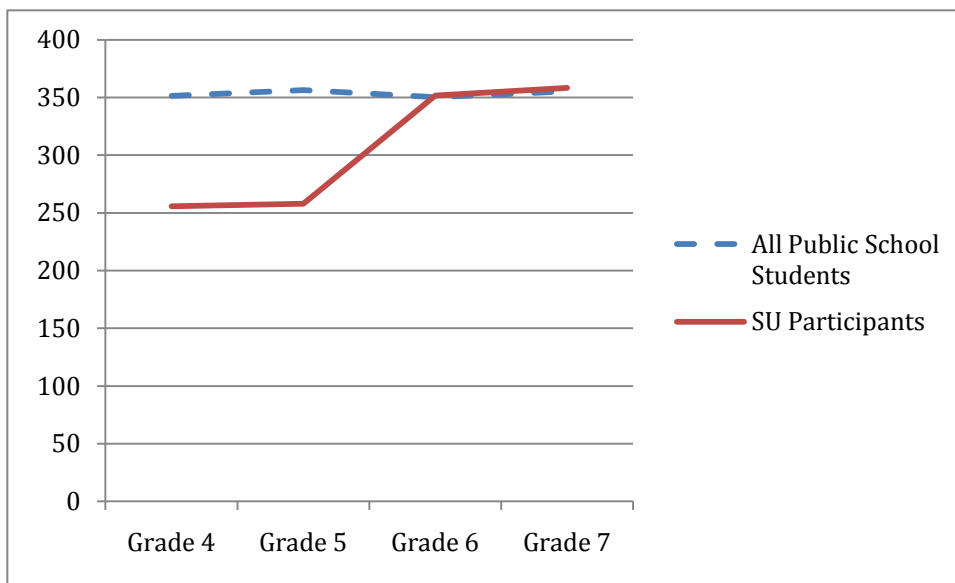
Figure 2: Cohort 1 (Expected Graduation Date: 2014) Math EOG Scores



The graphs in Figures 2 through 5 show Math and Reading End-of-Grade test score trends for the 2014 and 2015 graduating cohorts. For each cohort, I show trends for SU

participants and all Durham public and charter school students. As outlined in the Data Limitations section, I was able to access longitudinal data for only 77 of the 102 students in the 2014 and 2015 graduation cohorts that participated in Student U. The total Durham public and charter school data includes nearly roughly 2,000 students for each test in each cohort.

Figure 3: Cohort 1 (Expected Graduation Date: 2014) Reading EOG Scores



The graphs show inconsistent relationships between DPS and SU student achievement levels. On average, the 2014 cohort of SU participants appear to score higher than public school students in math both before and after joining SU. Their reading scores start out below average, but catch up to average Durham public school levels immediately after starting the program. The 2015 cohort math scores are below average both before and after program participation, while the cohort's reading scores are indistinguishable from the mean Durham public school achievement levels.

Figure 4: Cohort 2 (Expected Graduation Date: 2015) Math EOG scores

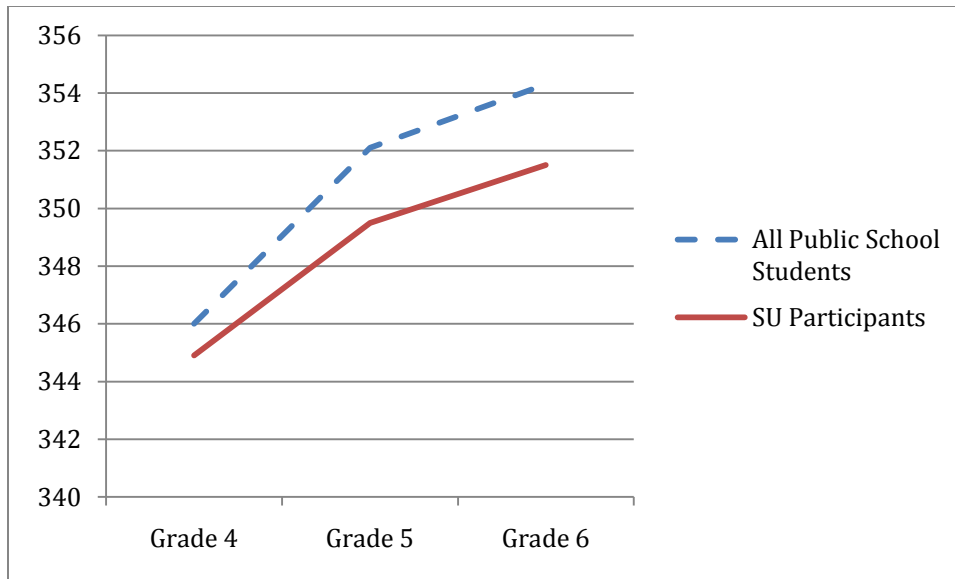
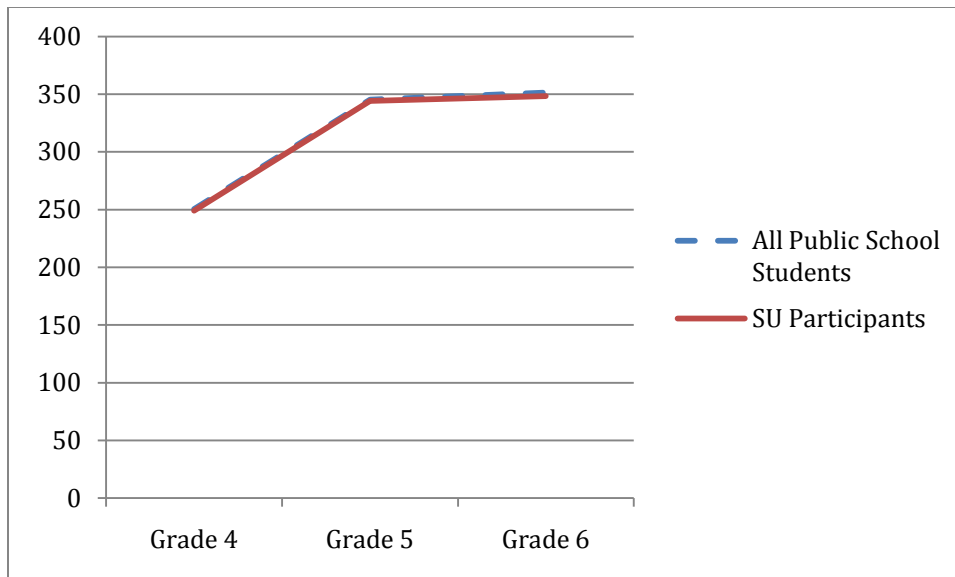


Figure 5: Cohort 2 (Expected Graduation Date: 2015) Reading EOG scores



Few trends or conclusions emerge from these data. These mixed trends may be the result of incomplete data, as I have access to longitudinal data on only 75% of program participants. However, these mixed trends are not entirely implausible, given that student

recruitment differed tremendously between the 2014 and 2015 cohorts. The first cohort was selected through a careful review of student applications, while the second cohort was randomly selected.

Nearest Neighbor Matching

Methods

I use nearest neighbor matching to compare SU student outcomes with those of similar non-participating students in Durham Public Schools and Durham charter schools. From a large dataset containing all non-participating students, this method uses a Stata program to select a control group that is highly similar to program participants on observable characteristics. (Abadie, Drukker et al. 2001). The treatment effect estimate is the difference in mean achievement level between the participants and the nonexperimental control group.

Two factors can undermine this analytical strategy. First, this matching process does not address bias arising from unobservable characteristics. For example, if program participants were extremely motivated compared to the general student population, matching would be unable to select a similarly motivated control group. A comparison of the highly motivated treatment group and less motivated control group would exaggerate the estimated program effect. Second, matching strategies require common support, that is, a population of non-participants that are similar to the participants on observable characteristics (Heckman, Ichimura et al. 1997).

Many matching analyses use propensity score matching, which calculates each individual's likelihood of being assigned to the treatment group, based on their observed characteristics (Rosenbaum and Rubin 1983; Dehejia and Wahba 2002). Matches are then

formed on the basis of this calculated propensity score, rather than directly based on the observable characteristics. In this evaluation, I use nearest neighbor matching rather than propensity scores because there are so few participants in SU that all students would have an extremely low propensity score for SU participation.

This matching method yields an estimate of the program's effect on program participants, referred to as a treatment on the treated (TOT) estimate (Harding 2003). This estimate does not generalize to the hypothetical effect of the program if it were expanded to reach a broader student population.

Data

From Student U, I obtained comprehensive demographic and achievement score data on participating students. The North Carolina Education Research Data Center (NCERDC) provided a comprehensive dataset of all Durham public and charter school students. The NCERDC data span four years, including the 2005-2006 through 2008-2009 school years, and contain comprehensive End-of-Grade test scores and demographic data. The nonexperimental control group is drawn from the NCERDC data.

There is a time lag in my access to data, so I am able to access outcome data for only the first two cohorts that entered Student U. For the 2014 cohort, my data include 6th and 7th grade academic outcomes, both of which may have been influenced by Student U participation, which began in the summer between 5th and 6th grade. For the 2015 cohort, my data include 6th grade academic outcomes. I was able to access comprehensive longitudinal data for 77 of the 102 students in these two cohorts.

Model Specification

My outcomes of interest are math and reading EOG scores in middle school. I have normalized these scores in order to make them comparable across years. I subtracted each

student’s score from the mean test score across all students in the state, and divided by the standard deviation, yielding a z-score. Since the scores are normalized, I am able to pool the 2014 and 2015 cohorts to increase my sample size. My treatment indicator is a binary variable which identifies SU participants. I generate separate estimates of the program’s effect on math and reading.

I match on several covariates observed prior to program assignment. These include 4th and 5th grade EOGs, elementary school attended, and gender. These variables should be correlated with both SU participation and student achievement. The variables used in this analysis are summarized in Table 6.

Table 6: Matching Variables

Variable	Description
Outcomes	
Middle School EOG math test scale score	6 th and 7 th grade End-of-Grade math scale scores, normalized to permit comparisons across years
Middle School EOG reading test scale score	6 th and 7 th grade End-of-Grade reading scale scores, normalized to permit comparisons across years
Main Independent Variable	
Student U participation	Indicates whether student participated in Student U
Matching Variables	
Elementary EOG math test scale score	4 and 5 th grade End-of-Grade math scale score
Elementary EOG reading test scale score	4 and 5 th grade End-of-Grade reading scale score
Gender	Student gender: male, female
Elementary School	Elementary school attended by student

The sample size is relatively small, including just 77 students. In order to increase statistical power and check the robustness of my findings, I run each matching strategy three times. Models A, B, and C selection one, four, and ten matches respectively for each SU participant. The larger number of matches should increase the precision of my estimates by increasing the sample size and reducing the standard errors.

Results

Table 7: Nearest neighbor matching estimators of Student U program effect

	Model A (1 match)	Model B (4 matches)	Model C (10 matches)
Math EOG			
Treatment on treated estimate	0.138	-0.037	-0.191
(Std Error)	(0.104)	(0.119)	(0.136)
N	5740	3488	3488
Reading EOG			
Treatment on treated estimate	0.163	-0.074	-0.311
(Std Error)	(0.160)	(0.155)	(0.156)*
N	3451	3451	3451

* p-value<.05

This matching analysis generates no statistically significant positive effect of program participation on math EOG scores. The third specification, which uses 10 matches for each SU participant, yields a statistically significant negative program effect on reading EOG scores. For both outcomes, the first model generates a positive coefficient, but the coefficient becomes negative as more matches are added. The negative estimates are unexpected, as they imply that participation in Student U leads to lower test scores. While these findings are discouraging, several factors threaten their validity. Before concluding that

the Student U program is ineffective, one should consider the validity threats discussed below.

Validity Concerns

In many respects, nearest neighbor matching is well suited to an evaluation of Student U. The program serves a small group of DPS students, so it is not difficult to find similar non-participating students. In addition, EOG scale scores provide a uniform outcome available for all students.

However, the matching estimates above may be biased by participant selection on unobservable characteristics. Matching estimates rely on observable variables, and cannot match students to be similar on characteristics such as motivation or talent that are not measured in the dataset. For example, Student U requires a significant time commitment from students and their families. It is likely that participants are more motivated and have more involved parents than the average student in Durham Public Schools, in which case the matching analysis would yield upwardly biased estimates of the program effect. Selection on unobservable characteristics undermines the internal validity of the matching estimates.

This analysis is also limited by available outcome data. The effect of the program may be cumulative, and it may be difficult to discern measurable effects within one or two years of entering the seven-year Student U program. Moreover, the analysis is at best an incomplete picture of program results, as I was able to access longitudinal achievement data for only 75.5% of students in these two cohorts.

It is possible, of course, that Student U simply has no effect on End of Grade test scores. The program does not offer intensive test preparation, so it is not directly focused on this outcome. Even if it has no effect on these scores, this does not indicate that the program fails to achieve any of its goals. As outlined in the logic model, the program is also

concerned with students' social development and attitudes toward school. Without survey data, it is impossible to assess the program's impact on these outcomes.

Chapter 3: Recommended Benchmarks for High School Program

This chapter describes Student U's recently launched high school program, and outlines benchmarks for identifying students who are at risk of not achieving important outcomes such as high school graduation and college admission. These benchmarks are based on a review of relevant policies and research literature.

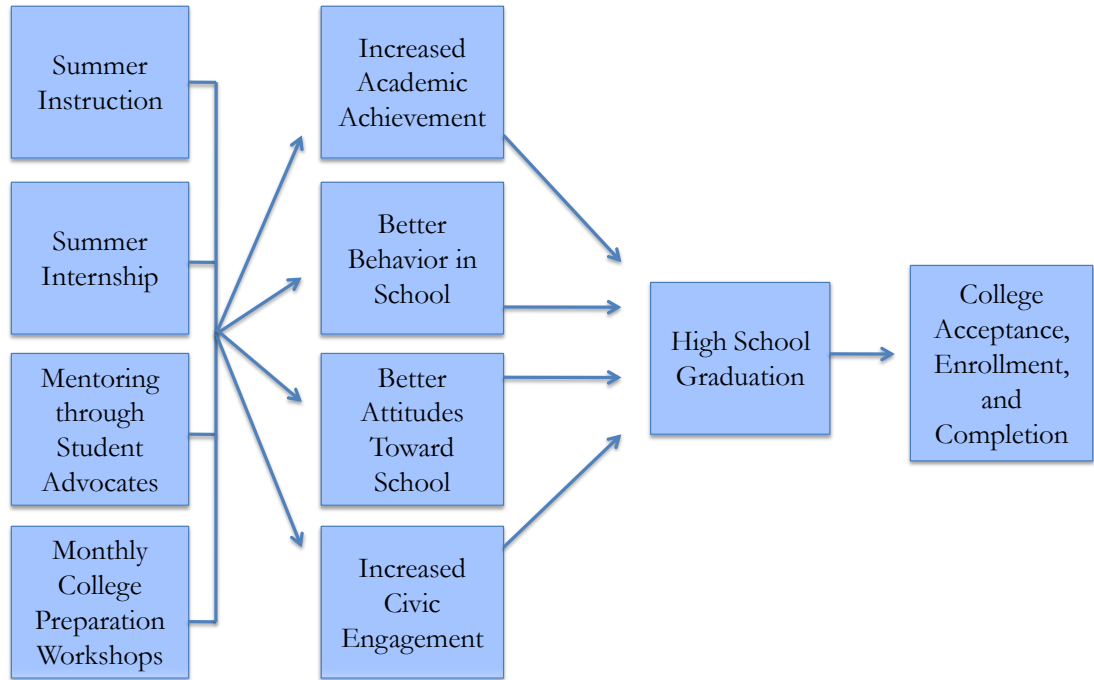
The research outlined in this chapter is designed to supplement a recently established draft of benchmarks defined by SU staff. Those benchmarks define an ideal academic and personal growth trajectory that would fully prepare students for postsecondary success. This chapter provides Student U with evidence-based research to help program staff identify participants who are most at risk of not achieving postsecondary success.

Program Description

Student U's recently launched high school program involves four components: an internship and academic instruction during the summer, and mentoring and monthly student/parent workshops during the school year. Figure 6 summarizes the program's components and intended outcomes in a logic model.

Summer internships place students with community organizations, including Student U, where they gain direct work experience. This experience is designed to develop students' leadership skills and sense of civic engagement. The class of 2014 cohort just completed its first summer internship.

Figure 6: Logic model of Student U high school program



Summer academic instruction is designed to prepare students for the curriculum they are likely to encounter in their upcoming year of high school. This component was not included in the first high school summer session for the class of 2014, but SU plans to offer academic instruction during future summer sessions. The summer curriculum may include remedial classes, as well as enrichment courses aimed at developing creativity and critical thinking skills. The summer program concludes with a trip to visit out-of-state colleges.

During the school year, Durham Public School teachers will volunteer as “student advocates,” meeting with SU students biweekly for mentoring and to track their academic progress. The advocates will be in communication with other Student U staff and will also help connect students to community resources. Each advocate will work with approximately 7 students.

The monthly workshops will teach students and their parents about preparing for college. The curriculum for these sessions covers a range of topics, including goal setting, test preparation, financial aid, and college admissions. The workshops will also involve a brief community service project to be completed by SU staff, students, and parents.

After the first cohort of students graduates from high school, SU plans to track alumni enrollment, persistence and graduation rates in college.

Goals for High School Participants

Through conversations with SU Executive Director Daniel Kimberg, I have identified the following intended outcomes for Student U participants.

1. Graduate from high school in four years
2. Achieve at high levels in academic coursework
3. Have meaningful opportunities for personal growth and development of non-academic skills
4. Gain admission to a four-year college or university
5. Access sufficient financial resources to afford a four-year college education
6. Maintain a sense of community and belonging in Student U

Many of the above outcomes occur at the end of high school, but attaining them requires that students perform at high levels throughout their high school career. Thus, Student U staff has requested a series of intermediate benchmarks to assess student progress toward the long-term educational attainment goals listed above.

Policy Review: High School Graduation and College Admission Requirements

Two of the intended outcomes for the high school program, high school graduation and college admission, require that students meet a set of policy-defined criteria. These requirements are outlined below and represent a minimum baseline for student achievement. Wherever possible, students should be encouraged to surpass these benchmarks. Below I summarize high school graduation requirements set by the state of North Carolina and Durham Public Schools, as well as the admission standards for the University of North Carolina system.

High School Graduation Requirements

The North Carolina Standard Course of Study defines four curricula that student may choose from in order to meet credit requirements for high school graduation (DPI 2010). These tracks differ based on students' post-graduation plans. Given Student U's goal of having all students gain admission to a four-year college or university, benchmarks should focus on completing the "College/University Prep" track. This course of study meets entrance requirements for the University of North Carolina system, and is summarized in Table 8.

In addition to the credit requirements, North Carolina high school students must pass End-of-Course (EOC) tests with a level III proficiency or higher. While recently passed state legislation reduces testing requirements, students must still pass EOCs in Algebra I, Biology, and English I in order to graduate (2011). College-bound students often take Algebra I in 8th grade, and should take it in 9th grade at the latest. English I is normally taken in 9th grade, and Biology in 10th grade.

Finally, Durham Public Schools requires that students complete a graduation project involving four parts, as outlined below (2007). With Student U staff guidance, this project

represents an excellent opportunity to produce a portfolio of work that will be attractive in the college admissions process.

- Research paper (8-10 pages on approved topic of student choice)
- Product related to paper that requires significant hours of work
- Portfolio that reflects the entire project process
- Presentation to a panel of community and faculty members

UNC Admission Requirements

Students who complete the “College/University Prep” curriculum defined in the North Carolina Standard Course of Study and obtain required grade point averages and SAT or ACT scores are guaranteed admission to at least one of the UNC system campuses (2011). However, this does not mean that they are guaranteed admission to one of the more selective campuses, such as UNC-Chapel Hill or NC State University. These campuses generally have more rigorous academic standards, though the exact criteria for admission are not available.

In addition, the UNC system sets minimum high school grade point averages, SAT scores, and ACT scores. Applicants must have a cumulative GPA of 2.5 across all courses taken. Applicants must take either the SAT or ACT, including the writing section, which is now included in every SAT exam. Students taking the ACT must specify in their test registration that they would like to take the “ACT Plus Writing.” Students must achieve a minimum SAT score of 700 (combined critical reading and Math) or a minimum ACT score of 15 (composite, excluding writing) in order to qualify for admission (2011). These GPA and ACT/SAT scores, however, are extremely low and should not be regarded as an achievement target. In order to be competitive for admission to the more selective UNC campuses, students must achieve at higher levels.

Table 8: North Carolina Standard Course of Study High School Graduation Requirements, College / University Prep Track

Subject	College / University Prep
English	4 Credits I, II, III, IV
Mathematics	4 Credits Algebra I, Algebra II, Geometry, and higher level math course with Algebra II as prerequisite OR Integrated Mathematics I, I, II, and a credit beyond Integrated Mathematics III
Science	3 Credits A Physical Science course, Biology, Earth/Environmental Science
Social Studies	3 Credits World History, Civics & Economics, US History (2 courses to meet UNC admission requirements-US History & I Elective)
Second Language	2 Credits in the same language
Computer Skills	No specific course required, students must demonstrate proficiency through state testing
Health and Physical Education	1 Credit Health/Physical Education
Career	Not Required
Electives or Other Requirements	3 Credits and other credits designated by LEA
Arts Education	Recommended: at least one credit in an arts discipline and/or requirement by local decision
Total	20 Credits plus any local requirements

Source: <http://www.ncpublicschools.org/docs/curriculum/home/graduationrequirements.pdf>

Literature Review: Early Predictors of Student Success

In this section, I review relevant academic literature on key indicators of high school graduation and post-secondary success. I draw on research studying predictors of high school graduation and college enrollment. The findings below are organized into three categories: academic performance, educational engagement, and student background.

Academic Performance

Course Enrollment. Unsurprisingly, enrollment in a college preparatory curriculum increases a student's probability of high school graduation, doubling it according to some studies (Rumberger and Arellano 2007). Math course enrollment is frequently cited as a key component of the college prep curriculum. Taking Algebra I in 8th grade is particularly important indicator, as it prepares students to take pre-calculus, calculus, or another advanced math course in high school (Horn and Bobbitt 2000; Swail, Cabrera et al. 2005).

Course Performance. Course performance, as measured by teacher-assigned grades, are a stronger predictor of high school graduation than achievement scores (Rumberger and Lim 2008). A study of Chicago Public School students found that the number of courses failed during a student's first year of high school was a strong negative predictor of high school graduation (Allensworth and Easton 2007).

Educational Engagement

Extracurricular Involvement. Research has found that students who participate in school related activities are more likely to remain engaged with school and graduate. These results are surprisingly large, with one study of California students finding that participation in sports had a larger effect on whether students graduated than improved test scores did (Rumberger and Arellano 2007).

School Attendance. Students who miss school frequently are less likely to eventually graduate, and this effect can be predicted from data collected in early high school. In a study of Chicago Public School students, Allensworth and Easton found that first year students who miss two weeks or more of school have less than a 50% chance of graduating four years later (Allensworth and Easton 2005).

School Behavior. Many behaviors—both in and out of school—are strong indicators that a student will fail to graduate from high school. These include truancy, suspension, substance abuse, drinking, and pregnancy (Brooks-Gunn, Guo et al. 1993; Rumberger and Lim 2008). However, most of these factors are difficult to measure. While data on incidents leading to student suspension are easily obtained, research shows that less formal data, including positive feedback from classroom teachers, is a stronger predictor of high school graduation (Jerald 2006).

Attitudes and Expectations. Student attitudes are strong predictors of high school graduation, and Student U's surveys could be leveraged to measure this factor. A student's intention to seek a four-year college degree, measured as early as middle school, can help identify which students are likely to complete high school (Brooks-Gunn, Guo et al. 1993). However, this is unlikely to be a helpful indicator for Student U, as it is likely all participants will express interest in college. Interestingly, students beliefs about their own academic competence is another strong predictor of graduation (Akey 2006). This measure could be included in surveys to identify students who lack confidence in their academic skills and may waver in their commitment to postsecondary education.

Student Background

Student Mobility. Studies analyzing both national longitudinal data and individual school district performance have found that student mobility increases a student's likelihood

of dropping out. In this case, student mobility includes any transfer between schools (during or between school years), other than transfers from middle to high school. Students who make even one change of school between 6th and 12th grades (other than transferring from middle to high school) are twice as likely to drop out of high school as students who did not transfer (Rumberger and Larson 1998). This finding has been confirmed in studies of individual school districts' dropout trends (Jerald 2006).

Overage Status. Student U may want to investigate which of its participants have been retained in elementary school, and track whether any students fail to advance in grades in middle and high school. Students who do not accumulate enough status to move from first-year to sophomore status in high school are particularly likely to drop out, as this may signal serious problems with the students' middle-to-high-school transition (2006; Rumberger and Arellano 2007).

Summary of Findings

The factors discussed above offer an easily-measured set of indicators for student success. These findings complement and lend research-based support to the benchmarks recently outlined by Student U. School personnel can easily obtain data on nearly all of the indicators discussed above. Since high school teachers will serve as “student advocates,” they should have easy access to student data. Data on student attitudes and expectations regarding future educational attainment should be easy to collect if SU maintains its current practice of surveying students each summer.

Teachers will have easy access to data, but maintaining timely and accurate student records is likely to be more challenging. Student U will need to have a data collection and reporting system that is consistent and sustainable. Effective data collection will likely

require strict internal deadlines and a limited scope for data collection. Collecting data on all of the above outcomes is likely to be too burdensome for SU staff and ultimately unsustainable. Instead, it may be wise to focus on the policy-oriented indicators, such as course completion, GPA, and SAT scores, which are most closely tied to student success and most easily accessed by SU staff.

Chapter 4: Conclusion

Summary of Middle School Program Findings

My nearest neighbor matching analysis shows no effect of program participation on academic achievement. This method was limited by small sample size and considered only two program outcomes, math and reading test scores. Thus, it cannot offer a complete picture of program effectiveness.

More importantly, my analysis highlights the high rates of participant attrition in the first two program cohorts. This attrition undermines Student U's ability to convincingly demonstrate that it is keeping at-risk youth from becoming disengaged with school during their middle school years. It may be the case that students who are at risk of becoming disengaged with school are also becoming disengaged with Student U and leaving the program.

Summary of High School Program Recommendations

Student U's proposed high school benchmarks present an ideal academic and personal growth trajectory that will leave students well prepared for postsecondary academic

success. However, some students may struggle to meet these benchmarks. My review of relevant policies and research indicates a number of ways to identify which students are most at risk of dropping out of high school or not enrolling in college. These include monitoring students' course enrollment, course performance, extracurricular involvement, attendance, classroom behavior, attitudes toward education, and school transfers. SU staff should prioritize monitoring course completion, GPA, SAT scores, and other policy-related factors that affect high school graduation and college acceptance rates. Student U's participant surveys and the student advocates' interactions with teachers and counselors offer excellent ways to monitor these critical predictive factors.

Recommendations to Facilitate Future Evaluations

The quality of future SU program evaluations will depend on the quality of data collected by SU staff. Collecting and maintaining thorough, valid data is a resource intensive task. In order to minimize burden on program staff and maximize data quality, I offer these recommendations for future data collection activities.

Set modest, but sustainable data collection goals. While there are many available indicators of student success, collecting data on all of them will be unsustainable. Student U should establish a few, high-quality measures of student success. These factors include course enrollment, course performance, SAT and ACT test scores, and surveys measuring student attitudes and confidence about their future educational experiences.

Administer consistent surveys and maintain results. Without survey data, SU will be unable to assess its impact on important non-academic goals. Yet maintaining and analyzing survey responses is a time-consuming task. Student U's decision to begin using a standardized, externally-generated survey is a promising first step. Student U must also maintain student

response records in a manner that allows individual student responses to be tracked across years.

Monitor attrition rates and explore the causes of student attrition. As outlined in Chapter 2, participant attrition poses a significant challenge for Student U. Depending on the reasons students drop out, this attrition may be a sign that the program is not keeping students engaged with school. Student U should monitor attrition rates, uncover the reasons why students drop out, and take steps to reduce attrition.

Works Cited

(2006). *Summary Findings of Research and Development Work on Overage Under-Credited Youth in New York City. O. o. M. P. t. Graduation.* New York, New York City Department of Education.

(2007). *High School Exit Standards.* D. P. Schools. Durham, NC.

(2011). *Course & Admission Requirements.* U. o. N. Carolina. Raleigh, NC, University of North Carolina.

(2011). *Perdue won't veto bill that scraps 4 tests.* Charlotte Observer. Charlotte, NC.

Abadie, A., D. Drukker, et al. (2001). "Implementing Matching Estimators for Average Treatment Effects i Stata." The Stata Journal **1**(1): 1-18.

Akey, T. M. (2006). *School Context, Student Attitudes and Behavior, and Academic Achievement: .* New York, MDRC.

Allensworth, E. M. and J. Q. Easton (2005). *The On-Track Indicator as a Predictor of High School Graduation.* Chicago, Consortium on Chicago School Research.

Allensworth, E. M. and J. Q. Easton (2007). *What Matters for Staying On-Track and Graduating in Chicago Public High Schools: A Close Look at Course Grades, Failures and Attendance in the Freshman Year.* Chicago, Consortium on Chicago School Research.

Brooks-Gunn, J., G. Guo, et al. (1993). "Who Drops Out of and Who Continues Beyond High School? A 20-Year Follow-Up of Black Urban Youth." Journal of Research on Adolescence **3**(3): 271-294.

Dehejia, R. and S. Wahba (2002). "Propensity Score-Matching Methods for Nonexperimental Causal Studies." The Review of Economics and Statistics **84**(1): 151-161.

DPI, N. (2010). *High School Graduation Requirements* N. C. D. o. P. Instruction.

Harding, D. (2003). "Counterfactual Model of Neighborhood Effects: The Effect of Neighborhood Poverty on Dropping Out and Teenage Pregnancy." American Journal of Sociology **109**: 676-719.

Heckman, J., H. Ichimura, et al. (1997). "Matching As An Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme." Review of Economic Studies **64**: 605-654.

Horn, L. and L. Bobbitt (2000). *Mapping the Road to College: First-Generation Students' Math Track, Planning Strategies, and Context of Support*. N. C. f. E. Statistics. Washington, DC.

Jerald, C. D. (2006). *Identifying Potential Dropouts: Key Lessons for Building an Early Warning Data System*. Washington, DC, Achieve, Inc
Jobs for the Future.

Rosenbaum, P. and D. Rubin (1983). "The Central Rol of the Propensity Score in Observational Studies for Causal Effects." *Biometrika* **70**(1): 41-55.

Rumberger, R. and B. Arellano (2007). *Student and School Predictors of High School Graduation in California*. *California Dropout Research Project*. Santa Barbara, CA, University of California, Santa Barbara.

Rumberger, R. and S. A. Lim (2008). *Why Students Drop Out of School: A Review of 25 Years of Research*. *California Dropout Research Project*. Santa Barbara, CA, University of California, Santa Barbara.

Rumberger, R. W. and K. A. Larson (1998). "Student Mobility and the Increased Risk of High School Dropout." *American Journal of Education* **107**(1): 1-35.

Scott, L. (2008). *A Preliminary Evaluation of Student U*. *Sanford School of Public Policy*. Durham, NC, Duke University. **Master's of Public Policy**: 50.

Swail, W. S., A. F. Cabrera, et al. (2005). *Pathways to the Bachelor's Degree for Latino Students*. *Latino Students and the Educational Pipeline*. Stafford, VA, The Educational Policy Institute.

Wyner, J. S., J. M. Bridgeland, et al. (2009). *Achievement Trap: How America is Failing Millions of High-Achieving Students from Lower-Income Families*. Washington, DC, Jack Kent Cooke Foundation
Civic Enterprises, LLC.