Scaling Success: Learning from Education Intervention Programs to Close the Racial Education Achievement Gap

by

Mobolaji Olatokunbo Akinpelu

B.Sc., Coppin State University (2012)

Submitted to the Institute for Data, Systems, and Society in partial fulfillment of the requirements for the degree of Master of Science in Technology and Policy

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June 2016

© Massachusetts Institute of Technology 2016. All rights reserved.

Signature redacted

Author ..............................................................

Institute for Data, Systems, and Society

Signature redacted

Certified by .

Richard C. Larson

Mitsui Professor of Engineering Systems

Director, Center for Engineering Systems Fundamentals

Thesis Supervisor

Signature redacted

Accepted by .

Munther A. Dahleh

William A. Coolidge Professor of Electrical Engineering and Computer Science

Director, Institute for Data, Systems, and Society

Acting Director, Technology and Policy Program
Scaling Success: Learning from Education Intervention Programs to Close the Racial Education Achievement Gap

by

Mobolaji Olatokunbo Akinpelu

Submitted to the Institute for Data, Systems, and Society on May 25, 2016, in partial fulfillment of the requirements for the degree of Master of Science in Technology and Policy

Abstract

An overview of American education reveals a concerning pattern: when outcomes are disaggregated by race, students from certain racial minority groups often have poorer outcomes than White students. This pattern, the racial education achievement gap, can be seen in different sorts of measures from the literature, including in the low representation of minority students at elite public institutions. To address this low representation, and to keep universities racially diverse, administrators and policymakers often turn to race-based affirmative action, the explicit (and contentious) consideration of an applicant's race in admissions decisions. College-centered education intervention programs are another tool administrators and policymakers use to address the gap reflected in elite college enrollment and to keep campuses diverse.

This thesis asks how do and how can appropriately designed college-based education intervention programs help to both keep racial diversity and close the racial educational achievement gap in America's colleges? To this end, chapter one lays out the motivating issues — the gap, affirmative action, and education intervention programs; chapter two contains the case study of two successful programs, focusing on the programs' designs, the participants' experiences, and the conditions that foster academic excellence in minority students; chapter three, in part using causal loop diagrams from system dynamics modelling, makes the case for appreciating education as a complex system — one with interlocking political, economic, pedagogic, and sociocultural forces — and thus urges caution in drawing conclusions from chapter two; and chapter four, drawing from the two preceding chapters, proposes three policy recommendations to improve not just the presence of minority students at selective institutions, but, more importantly, their overall academic thriving.

Thesis Supervisor: Richard C. Larson
Title: Mitsui Professor of Engineering Systems
Director, Center for Engineering Systems Fundamentals


Acknowledgments

I thank providence for the intellectual and temperamental inclinations that made writing this both stimulating and unsettling.

I thank my parents for shaping that which providence provided. A feeling of great awe and esteem for you ever floods me when I consider the benefits I continue to reap from the choices you made.

The personal and intellectual growth I experienced over the past two years have been at once profound and beyond what my mind could suggest when I started this journey. For the chance to experience this, I thank MIT and TPP.

Without the guidance of my advisor, Prof. Larson, this work would never have come this far. Thank you Dr. Queue for always insisting I carried two ideas in my head at once, for showing me to resist the seduction of simple, silver bullet solutions.

I also thank the many interviewees I spoke with for the work reported here. Your candor was compelling. Thank you also for setting a shining example of excellence to many like you, who look up to you, some of whom you even do not know of.

And thank you to Amenyonah, Barb, Julius, and Mark. Your unquestioning support kept me up when harsh winds blew, and your company keeps carrying me through. Thank you also to all the new friends I made playing soccer at UMass Boston starting in the summer of 2015. You brought laughter and release to me just when my journey became treacherous.
Contents

1 Introduction 13
   1.1 Motivation: The Racial Education Achievement Gap 15
   1.2 Motivation: Affirmative Action in American Higher Education 20
   1.3 Thesis Question on College-Based Education Intervention Programs 32

2 Conditions for Success: A Case Study of Two Education Intervention Programs 37
   2.1 Research Method and Data 39
   2.2 Narrative Analysis of Interview Data 46

3 The Racial Education Achievement Gap: A Complex Systems View 57
   3.1 What is a Complex System? 60
   3.2 Influences on Education as a Complex System 66
   3.3 Complexity: A Near View 73
   3.4 Simple Solutions in a Complex Education System: A Thought Experiment with System Dynamics 80

4 Policy Conclusions: No Silver Bullets 89
   4.1 Policy Recommendations 94
   4.2 A Final Word on Complexity and Chaos in the Education System 100

References 105
List of Figures

1-1 Race-Based Gaps in Math and Reading Skills .......................... 16
1-2 Percentage of students scoring at proficient or better at 12th grade mathematics, by race/ethnicity ........................................... 17
1-3 Trends in 12th grade mathematics achievement levels, by race/ethnicity ................................................................. 17
1-4 Percentage of students scoring at proficient or better at 12th grade reading, by race/ethnicity ................................................. 18
1-5 Graduation rates for bachelor’s students at 4-year post-secondary institutions, by race/ethnicity ...................................................... 18
1-6 Percentage of students at 4-year public institutions who attend elite research universities, by race/ethnicity ..................................... 19
1-7 Timeline of prominent decisions on affirmative action in American higher education ................................................................. 22
1-8 Effect of different admissions policies on enrollment at top 193 colleges ................................................................................. 28
1-9 Effect of affirmative action ban on Hispanic students enrollment at University of California Berkeley .............................................. 29
1-10 Effect of affirmative action ban on Black students enrollment at University of California Berkeley ................................................. 29
2-1 Themes Explored in Interview Protocols ................................. 41
2-2 Case Study Strategy ................................................................. 46
3-1 The Education System Modelled as an Atom with Multiple Spheres of Forces ................................................................. 72
3-2 Wealth Accumulation and the Racial Wealth Gap in 2011 .... 77
List of Tables
So long as you write what you wish to write, that is all that matters; and whether it matters for ages or only for hours, nobody can say. But to sacrifice a hair of the head of your vision, a shade of its colour in deference to some Headmaster with a silver pot in his hand or to some professor with a measuring rod up his sleeve, is the most abject treachery, and the sacrifice of wealth and chastity which used to be said to be the greatest of human disasters, a mere flea-bite in comparison.

Virginia Woolf, A Room of One's Own
Chapter 1

Introduction
Therefore I would ask you to write all kinds of books, hesitating at no subject however trivial or however vast. By hook or by crook, I hope that you will possess yourselves of money enough to travel and to idle, to contemplate the future or the past of the world, to dream over books and loiter at street corners and let the line of thought dip deep into the stream.

Virginia Woolf, A Room of One’s Own
1.1 Motivation: The Racial Education Achievement Gap

If one took a bird's eye view over the landscape of American education, one would notice a concerning pattern: when outcomes are disaggregated based on race, students from certain racial minority groups—in particular, Black, Hispanic, or Native American students—often have poorer outcomes than White students (U.S. Department of Education, National Center for Education Statistics, 2015b). Evidence of this pattern, the racial education achievement gap, can be seen in different measures from the literature, measures that show differences in outcomes based on race, and that these differences cannot be explained away as statistical quirks. This means these differences in outcomes are consistent with the definition—by the National Center of Education Statistics—of achievement gaps as occurring "when one group of students (such as, students grouped by race/ethnicity, gender) outperforms another group and the difference in average scores for the two groups is statistically significant (that is, larger than the margin of error)" (National Center for Education Statistics, 2015). To illustrate, we consider one evidence of this racial education achievement gap found in a report by The Educational Opportunity Monitoring Project at the Stanford Center for Education Policy Analysis. This report traces changes in the math and reading skills of 4th, 8th and 12th graders from 1975 to 2010, measuring the racial gap in standard deviations, and making comparisons between Black and White students on the one hand, and Hispanic and White students on the other hand. According to the report's analysis, despite a narrowing of the gaps in skills since the early years of the 21st century, the gaps are still as wide as one standard deviation or more for some outcomes.

Another example of the racial education achievement gap can be seen in a different report: The Nation's Report Card, a data gathering and analysis project mandated by the United States Congress and billed as "the only ongoing assessment of what U.S. students know and can do in different subjects" (The Nation's Report Card,
According to the 2013 edition of The Nation's Report Card, while 47% of White students were proficient or better in 12th grade reading, only 16% and 23% respectively of Black and Hispanic students were proficient or better. In math, the percentages of students proficient or better were 33%, 12%, and 7% for White, Black, and Hispanic students respectively.

Looking at different sorts of data from other parts of the education system illustrates the existence of the racial achievement gap in a different way more pertinent to our purposes in this thesis. At the higher education level, there is a disparity in college graduation rates and access to quality education.
Figure 1-2: Percentage of students scoring at proficient or better at 12th grade mathematics, by race/ethnicity

Source: The Nation's Report Card 2013

Figure 1-3: Trends in 12th grade mathematics achievement levels, by race/ethnicity

Source: The Nation's Report Card 2013

Regarding graduation rates, data from the 2014 edition of the Digest of Education Statistics show that for the entering cohort of 2008, the most recent year for which there is data, the 4-year graduation rate from 4-year institutions is 43.7% for White students, compared to 21.4% for Black students, and 30.4% for Hispanic students (Digest of Education Statistics, 2015). A similar trend is seen if the focus is shifted
Figure 1-4: Percentage of students scoring at proficient or better at 12th grade reading, by race/ethnicity

Source: The Nation's Report Card 2013

Figure 1-5: Graduation rates for bachelor's students at 4-year post-secondary institutions, by race/ethnicity

Source: Digest of Education Statistics, 2015

to 4-year graduation rates for just public 4-year institutions (37.9% for Whites, 18.6% for Blacks, and 24.8% for Hispanics) or to 6-year graduation rates at all 4-year institutions (63.2% for Whites, 40.9% for Blacks, and 53.5% for Hispanics) (Digest of Education Statistics, 2015). And even though for more selective institutions the
graduation gap is narrower, minority students are underrepresented at these more selective institutions.

Figure 1-6: Percentage of students at 4-year public institutions who attend elite research universities, by race/ethnicity

Source: Digest of Education Statistics, 2012

From the best available data we have, we know that among the undergraduates in the United States' public, 4-year institutions, 27% attend elite research universities and among undergraduates who are White students, the number is 27% too (Digest of Education Statistics, 2012). However, for Black students, the number is 15%, and among Hispanic students, the number is 21% (Digest of Education Statistics, 2012). Among the graduate students in America's public, 4-year universities, 41% are at elite research universities, and for White graduate students, 40% of them are at elite research universities (Digest of Education Statistics, 2012). The corresponding numbers for Black and Hispanic graduate students are 24% and 32% (Digest of Education Statistics, 2012).
1.2 Motivation: Affirmative Action in American Higher Education

If the racial achievement gap is distinguished by how pervasive it is, another motivating issue for this thesis, affirmative action in higher education, is distinguished by how contentious it is. As we have seen, one particular manifestation of the racial education achievement gap is the comparatively low representation of minority students at elite undergraduate and graduate institutions. To shrink this particular manifestation of the gap, one tool administrators and policymakers in education turn to is race-based affirmative action, the explicit consideration of the race of an applicant in deciding whether or not to admit the applicant. Ideally, when race-based affirmative action is used as a factor in college admissions, it is not used as a blunt tool in a system of rigid racial quotas. That would be illegal. Instead, race ought to be used holistically along with other factors beyond test scores and GPAs. Yet, both the evidence for and the result of the explicit consideration of race in admissions to selective colleges can be seen in sharp differences in the test scores for students of different races. Based on the most recent and most comprehensive data available, Espenshade and Radford (2009) found, for example, that in applying to some of America’s most selective schools, the admissions preference Black applicants receive with respect to White applicants is the equivalent of 310 extra points on the SAT, and that the corresponding number for Hispanic applicants is 130 points (Espenshade & Radford, 2009). This means that, all else being equal, to have an equal chance of admission as a Black student, a White student would need SAT scores that are 310 points higher than a Black student’s and 130 points higher than a Hispanic student’s. This result of affirmative action — the difference in admission odds based on race — plays a significant part in the intense contentions about affirmative action.

The seeds of affirmative action in American higher education were planted during Civil Rights era. The policies and programs of affirmative action were inspired in part by the need for a framework for correcting the social and economic impact of centuries of government-sanctioned discrimination and maiming of Black people.
through slavery and Jim Crow laws. From its birth until now, affirmative action has
grown to benefit other groups historically marginalized in American society. Since its
beginning, nonetheless, affirmative action in American education has been challenged
in the court of law as unconstitutional, and in the court of public opinion as antithet-
cal to America's supposedly meritocratic and egalitarian principles. For example,
in one of the most important of these challenges, the U.S. Supreme Court ruled in
Regents of the University of California v. Bakke, 1978 that while affirmative action
could continue to play a role in college admissions because a diverse classroom is a
compelling state interest, enacting affirmative action through the setting of quotas
violated the Equal Protection Clause of the 14th Amendment to the U.S. Constitu-
tion. For states under the jurisdiction of the Fifth Circuit U.S. Court of Appeals, this
judgement by the Supreme Court was effectively reversed when the Supreme Court
refused to review Hopwood v. University of Texas Law School, 1996, a case in which
the appellate court had ruled that even for the purpose of furthering diversity, the
University of Texas Law School could not use race in admissions or other education
decisions. As a way to achieve diversity in its higher education system despite the
hurdle of Hopwood, the state of Texas instituted the Ten Percent Plan, a plan that
gives any student in the top ten percent of his or her high school graduating class an
automatic admission to all state-funded universities. This plan took advantage of the
racial segregation in the Texas public school system: since most Black and Hispanic
students attended high schools that were predominantly Black and Hispanic, the top
ten percent of students in these segregated schools were mostly Black and Hispanic;
this way, the plan provided access to Texas' public universities to Black and Hispanic
students, and provided these universities with an avenue to diversify their student
body. After Hopwood, the next major affirmative action case was in 2002, when
the U.S. Supreme Court found the use of an arbitrary point system in affirmative
action to be unconstitutional in Gratz v. Bollinger (University of Michigan), 2002.
By 2003, the Supreme Court reversed the decision of the Fifth Circuit in Hopwood
v. University of Texas Law School, 1996 by ruling in Gratz v. Bollinger (University
of Michigan), 2003 that race could be used in college admissions if it is used in a
narrow fashion towards the promotion of the government’s compelling interest in diversity in education. Alongside *Gratz v. Bollinger (University of Michigan)*, 2003 and other preceding lawsuits, affirmative action was being contested in several states — including California, Florida, Michigan, and Washington — that used referendums or legislative actions to ban the use of affirmative action in state education. These challenges through both federal and state executive, legislative, and judicial action serve as testament to the controversies that have continued to surround affirmative action since its beginning.

Staying on the theme of disagreements over affirmative action, irrespective of how affirmative action has been implemented technically, the results of and moral reasoning for affirmative action have drawn strong criticism. With appeals to moral reason, critics have drawn on a conception of justice as equality of opportunity, and of merit as primarily academic merit achieved in measures like standardized tests and GPAs, to criticize a collateral damage of affirmative action. For these critics, in the
zero-sum game of admissions to selective colleges, the use of affirmative action for Black students meaning lower admissions odds for White and Asian students is both unfair and unmeritorious. Other critics have focused on the results of affirmative action on its intended beneficiaries and have assailed affirmative action as doing more harm than good for its supposed beneficiaries. This latter critic was illustrated in 2015 as affirmative action in college admissions returned to the U.S. Supreme Court yet again — this time as Abigail Noel Fisher v. University of Texas at Austin, et al., 2013, a case in which the plaintiff contended that the University of Texas at Austin used race inappropriately as part of its affirmative action admissions policy. During oral arguments in this case, a justice of the Supreme Court, Justice Antonin Scalia, said this:

“There are those who contend that it does not benefit African-Americans to get them into the University of Texas where they do not do well, as opposed to having them go to a less-advanced school, a slower-track school where they do well. One of the briefs pointed out that most of the black scientists in this country don’t come from schools like the University of Texas. They come from lesser schools where they do not feel that they’re being pushed ahead in classes that are too fast for them. I’m just not impressed by the fact that the University of Texas may have fewer, maybe it ought to be fewer. And you know, when you take more, the number of blacks, really competent blacks admitted to lesser schools, turns out to be less. And I don’t think it stands to reason that it’s a good thing for the University of Texas to admit as many blacks as possible” (Abigail Noel Fisher v. University of Texas at Austin, et al., 2013).

In those five sentences, Justice Scalia illuminated — with the stark light of indelicate speech — the core arguments of those that accuse affirmative action of causing benevolent harm. Justice Scalia’s comments are cut from the same cloth as mismatch hypothesis, the claim that affirmative action, by giving admission preferences to un-
derprepared minority students, could actually harm instead of benefit them (Sander, 2004). The theory purports that when these students are placed in schools where their academic preparation (reflected in measures like their SAT scores and high school GPAs) is below that of the average student, they are more likely to get poor grades, feel the negative psychological effects of poor academic performance, switch to easier, non-STEM majors, or not graduate (Sander, 2004; Arcidiacono, Aucejo, & Spenner, 2012; Arcidiacono, Aucejo, & Hotz, 2013). Implicated also in Justice Scalia’s comments is a corollary to mismatch hypothesis known as the cascading effect. Cascading effect is the hypothesis that preferentially admitting unprepared minority students at the most selective and prestigious universities means that these students do not attend the next tier of schools (for which they are ideally prepared), and consequently, that these next tier of schools must admit relatively underprepared minority students to create a diverse student body, with the end result that the negative consequences predicted by the mismatch hypothesis cascades through the ranks of America’s universities (Sander, 2004).

For some of affirmative action’s critics, these demerits of affirmative action are enough reason to discontinue the use of affirmative action in American higher education:

“America is ready to move beyond race. However, if the government and public institutions continue to divide the country by ethnicity and race, the goal of a color-blind society will remain beyond our reach. Policies that promote race-based discrimination continue to undermine the American Dream, and the only way to end the vicious cycle of discrimination is to ensure that fair and equal treatment for everyone is a reality, not just a talking point” (Gratz, 2014).

“Racial discrimination is wrong, no matter the color preferred. We begin to transcend racism when we stop the practice of every form of it, by every
public body, now. To give favor to males or to females, or to whites or to blacks or to persons of any color, is morally wrong because doing so is intrinsically unfair. Color, nationality, and sex are not attributes that entitle anyone to more (or less) of the good things in life, or to any special favor (or disfavor). When, in the past, whites or males did receive such preference that was deeply wrong; it is no less wrong now when the colors or sexes are reversed” (Cohen, 1998).

“Americans overwhelmingly agree that discrimination on the basis of race, ethnicity, and sex is wrong. This belief holds fast no matter the type of discrimination — whether it is the politically correct version that discriminates against whites and often Asians by giving racial preferences to other racial or ethnic groups like blacks and Hispanics or the type that discriminates against black Americans and was at the heart of the 20th century civil rights struggle. Americans today want to “live in a nation where they will not be judged by the color of their skin but by the content of their character,” which was the vision of Dr. Martin Luther King, Jr...discrimination by government is wrong...students who are most able and willing to excel academically should be admitted to taxpayer-funded universities. Yet, due to determined opposition in Congress, efforts to eliminate such discrimination in federal programs have largely failed” (Clegg & von Spakovsky, 2014).

In contrast, supporters emphasize the benefits of affirmative action as an avenue to achieve diversity, citing research studies that have shown that college diversity contributes not only to classroom diversity, which can lead to improved educational outcomes (Marin, 2000; Gurin, 2003), but also to interactions across racial groups (even after college), engagement in citizenship, and acceptance of subgroups’ differences into a broader community (Gurin, 2003). For these proponents of affirmative
action, the conscious use of race in making admissions decisions to America’s selective colleges is justified partly because of the importance of diversity not just for enriching the present academic experience, but also for shaping the minds of the nation’s future leaders. The U.S Supreme Court, in its ruling on Grutter v. Bollinger involving the University of Michigan Law School, acknowledged this importance:

“Attaining a diverse student body is at the heart of the Law School’s proper institutional mission... the Law School defines its critical mass concept by reference to the substantial, important, and laudable educational benefits that diversity is designed to produce, including cross-racial understanding and the breaking down of racial stereotypes. The Law School’s claim is further bolstered by numerous expert studies and reports showing that such diversity promotes learning outcomes and better prepares students for an increasingly diverse workforce, for society, and for the legal profession. Major American businesses have made clear that the skills needed in today’s increasingly global marketplace can only be developed through exposure to widely diverse people, cultures, ideas, and viewpoints. High-ranking retired officers and civilian military leaders assert that a highly qualified, racially diverse officer corps is essential to national security. Moreover, because universities, and in particular, law schools, represent the training ground for a large number of the Nation’s leaders...the path to leadership must be visibly open to talented and qualified individuals of every race and ethnicity (Grutter v. Bollinger, 2003).

So have the U.S. military, corporate America, and America’s selective schools themselves, in filing amici briefs in favor of affirmative action cases:

“Based on decades of experience, amici have concluded that a highly qualified, racially diverse officer corps educated and trained to command our nation’s racially diverse enlisted ranks is essential to the military’s ability...
to fulfill its principal mission to provide national security... The military has made substantial progress towards its goal of a fully integrated, highly qualified officer corps. It cannot maintain the diversity it has achieved or make further progress unless it retains its ability to recruit and educate a diverse officer corps... The fact remains: Today, there is no race-neutral alternative that will fulfill the military's, and thus the nation's, compelling interest in national security” (Consolidated Brief of Lt. Gen. Julius W. Becton, Jr. et al. as Amici Curiae in Grutter v. Bollinger, United States Supreme Court, 2003).

“The students of today are this country's corporate and community leaders of the next half-century. For these students to realize their potential as leaders, it is essential that they be educated in an environment where they are exposed to diverse people, ideas, perspectives and interactions. In the experience of the amici businesses, today's global marketplace and the increasing diversity in the American population demand the cross-cultural experience and understanding gained from such an education” (Brief for Amici Curiae: 65 Leading American Businesses in Grutter v. Bollinger, United States Supreme Court, 2003).

“Academically selective universities have a compelling interest in ensuring that their student bodies incorporate the experiences and talents of the wide spectrum of racial and ethnic groups that make up our society. Amici should be free to compose a class that brings together many different kinds of students; that includes robust representation of students from different races and ethnicities; and that prepares graduates to work successfully in a diverse nation. Indeed, highly selective universities have long defined as
one of their central missions the training of the nation's business, government, academic, and professional leaders. By creating a broadly diverse class, amici's admissions policies help to assure that their graduates are well prepared to succeed in an increasingly complex and multi-racial society” (Brief of Harvard University et al. as Amici Curiae in Grutter v. Bollinger, United States Supreme Court, 2003).

For its advocates, affirmative action is also partly justified on the basis that the hallways of selective colleges are the stairways to not just knowledge, but also — and perhaps more importantly — prestige and power (as Supreme Court alluded to in Grutter v. Bollinger), both practical and useful tools for influence in society. This justification makes explicit the conception of seats at a place like University of California Berkeley as not just educational artifacts, but also political artifacts that underrepresented communities will do well to access if they want influence in the how the society they live in is imagined and realized. For advocates then, what is dire and untenable is scenarios that result from the banning of affirmative action's use in selective colleges, scenarios that include a further widening of the achievement gap with respect to retention and graduation (Cortes, 2010; Espenshade & Radford, 2009) and a further shifting of minority students away from selective colleges to less selective ones (Hinrichs, 2012; Espenshade & Radford, 2009).

Figure 1-8: Effect of different admissions policies on enrollment at top 193 colleges

This contentious climate that surrounds affirmative action today — a climate that has also surrounded America's politics for a while — means that a reflexive partisanship sometimes greets any talk around affirmative action in American education. Given the partisan predispositions about this topic, we anticipate that varied political machinations will follow the Supreme Court's expected landmark ruling on the constitutionality of affirmative action in *Abigail Noel Fisher v. University of Texas at Austin, et al., 2013* — irrespective of what the judgement is. We expect that notwithstanding the stance of the ruling, political debate about affirmative action's
usefulness and fairness will continue, and partisan ruses to undermine or fortify affirmative action will abound. On the one hand, the ethos — some would say, mythos — of meritocracy, so intimately wound into the American psyche as it is, would lead some to continue to virulently reject the idea that race might be considered in American education at all. For others, certain as they are that the dominant spirit of America, past and present, is one of the oppression of non-White people, the idea that race would not be considered in education would be further proof of continued racial discrimination in America. For the former group, the answer to the question of affirmative action in American education would hew closely to this sentiment expressed by Chief Justice John Roberts:

“The way to stop discrimination on the basis of race is to stop discriminating on the basis of race.”.

And for the latter group, President Lyndon B. Johnson would more convincing:

“...freedom is not enough. You do not wipe away the scars of centuries by saying: Now you are free to go where you want, and do as you desire, and choose the leaders you please. You do not take a person who, for years, has been hobbled by chains and liberate him, bring him up to the starting line of a race and then say, ‘you are free to compete with all the others,’ and still justly believe that you have been completely fair. Thus it is not enough just to open the gates of opportunity. All our citizens must have the ability to walk through those gates. This is the next and the more profound stage of the battle for civil rights. We seek not just freedom but opportunity. We seek not just legal equity but human ability, not just equality as a right and a theory but equality as a fact and equality as a result.” (Lyndon Johnson, 1965).

While here we accept President Johnson's sentiment even as we look forward to a
world where Chief Justice Robert’s vision is realized for all Americans, we nonethe-
less, acknowledge that where we fall on this issue does not belie its fundamental 
contentiousness. Our goal here, then, is to expand the terms under which these fu-
ture debates will be conducted, and inform the tools of the anticipated machinations;
to say that it is not sufficient to ask how well racial minorities are represented in 
America’s universities, if we are not also questioning how successful they are, and the 
conditions they need to be successful.
1.3 Thesis Question on College-Based Education Intervention Programs

The motivations outlined for this thesis might lead one to take away a glut of educational failure as the single story of minority students. That would be a mistake. For to the questions of how successful minority students are, and the conditions they need to be successful, we have existence proofs of an answer: these are examples of educational triumph that illuminate our imagination, and cause to feel out, in flourishing individual lives and successful institutional programs, the texture of success, and tools needed to achieve that success. Take for example Jamie Escalante, a math teacher at Garfield High School, East Los Angeles, who was immortalized in the critically acclaimed 1988 Hollywood movie, *Stand and Deliver*, for his demanding and inspiring teaching. Escalante arrived at Garfield in 1974 to find a decrepit math program, which he determined to turn around by expecting high performance from his students and providing engaging and stimulating instruction that would elicit such performance. In 1982, he came to the attention of the national media when the Educational Testing Service (ETS) suspected 18 of the students he taught of cheating. These students were suspected because in passing the difficult Advance Placement (AP) Calculus examination, they used similar strategies and made similar errors — understandable since they were taught in the same manner by the same person. When these students retook the AP exam, they passed again, thus skyrocketing Escalante and his methods of teaching into national attention. Before Escalante, Garfield, which had 70% of its student population poor and 95% Black or Hispanic, did not have an AP Calculus program. In fact, Escalante was mocked by his colleagues for expecting a transformation from mediocrity from his students. For many years after Escalante's arrival and popularity, Garfield students continued to enroll for and pass the AP Calculus exams at rates that were simply unthinkable for a school of its pedigree. They also attended top-tier universities like Princeton, MIT, and University of California Berkeley, which was close to miracle for students that many did not expect to graduate high school (Lanier, 2010).
Another existence proof of success can be seen in the University of Texas at Austin. There, when chemistry professor David Laude noticed a consistent bimodal distribution in the grades of students in the introductory chemistry class he taught, he did not interpret the students’ grades as some unequivocal and inevitable reflection of their innate ability to grasp chemistry. Instead, Laude, who had several decades before struggled in a similar class, and who was intimately aware of what it felt like to not settle seamlessly into a college environment, asked for data on the backgrounds of students that appeared in the lower tail of the distribution of grades. There, he found that these students were mostly from low-income households and, instead of guiding these failing students to lenient remedial programs that left them less likely to graduate, as was the practice at University of Texas at Austin, he specifically sought them out for dedicated attention. Starting in the fall of 1999, Laude, using what he had learned from data about his past students, analyzed the data on the students coming into his chemistry class and identified 50 students predicted to fail because of their low SATs, low family income, and less educated parents. While maintaining the same rigorous curriculum served to the larger class, Laude taught this group of 50 students separately in their own small group, augmenting their instruction with 2 hours per week of extra lessons, providing them with peer mentors and advisors who monitored their progress to intervene in case they fell behind, and infusing them with a sense that they were exceptional students, not underachieving ones. This intervention had the effect of bringing up these students to similar levels of achievement as their peers in the larger class and improving their hitherto abysmal graduation odds to a level above the university’s average. To expand this program beyond his chemistry class to the wider university, Laude, in 2012, enlisted the help of David Yeager, a psychology professor trained in a research tradition that found that students — especially those from underrepresented groups — were often sabotaged in fulfilling their potential by doubts about their belonging to their new institution and/or beliefs that they possessed fixed, limited intelligence that could not be increased by further study. Together, Laude and Yeager combined the strategies he used in his chemistry class with psychological interventions that primed students’ minds for success, and
this lead to a 4% increase in the number of racially and economically disadvantaged students that completed at least 12 credits in their first semester (Tough, 2014).

David Laude, Jamie Escalante, and the programs they ran serve as powerful illustrations of targeted education interventions and the results they can get with learners. Yet even though Laude and Escalante whet our appetite for examples of the flourishing that can occur when students are exposed to certain enriching educational environments, they do not fully satiate us. Instead, even as we keep an eye on our two motivating issues, Laude and Escalante’s results push us to ask more questions about the characteristics of a collection of programs similar to theirs, and about the experiences of the participants of such programs. These programs — hereon referred to as college-centered education intervention programs — are sometimes used to address one manifestation or the other of the educational achievement gap revealed in America’s universities. One definition of these programs, used by Gullatt and Jan, characterizes them as “student-centered programs operated by universities and colleges, federal or state agencies, or non-profit organizations that target primarily individual students rather than classrooms or whole schools” (Gullatt & Jan, 2003). College-centered intervention programs could be thought of as programs administered by different levels of government or by private organizations to target students susceptible to the educational achievement gap with academic and mental services that prepare them to graduate from college and be successful thereafter. These programs often involve some combination of “counseling, academic enrichment, parental involvement, personal enrichment, social integration, mentoring, and scholarships” (Gandara & Bial, 1999). Also, these programs can be categorized along multiple dimensions including along the dimension of the point in the education pipeline they target. Here, some programs target students in the latter part of high school, hoping to prepare them for college; some focus on the summer between high school and college; others provide augmentative services to students in their freshman year; and others prepare college students for graduate school. The programs arise as an attempt to help a subset of students flourish in college by dedicating attention to their educational and psychological needs in a manner that the larger, more impersonal
school system may fail to.

The question this thesis asks then is this: how do and how can appropriately designed college-based education intervention programs help to both keep racial diversity and close the racial educational achievement gap on America’s college campuses? By focusing cases studies on two particularly successful college-based education intervention programs (MIT Summer Research Program and Meyerhoff Scholars Program), we seek to qualitatively investigate what factors successful college-based education intervention programs share and the ways in which these factors contribute to the programs’ impact. We seek to analyze college-centered education intervention programs to extract the features that make them tick, the challenges that undermine them, the results they accomplish, and insights they reveal on how to design and scale education intervention appropriately. We hope our answers to these questions might influence policy discussions on what might be done to address the well-documented disparities in educational outcomes for different racial groups in America. And in seeking answers to these questions, we are in part guided by the shared characteristics of Laude and Escalante’s programs: the individual attention they paid to their students, the high expectations they had of their students, the autonomy they had in running their programs, and the patience they had to allow their programs play out. Towards the end we have delineated here, the remainder of this thesis is organized as follows: chapter two contains the case study of two commendable education intervention programs, chapter three explains the idea of a complex system and makes the case for appreciating education as a complex system, and chapter four draws from the two preceding chapters to make policy recommendations.
Chapter 2

Conditions for Success: A Case Study of Two Education Intervention Programs
Indeed, the conversation for a moment lagged. The human frame being what it is, heart, body and brain all mixed together, and not contained in separate compartments as they will be no doubt in another million years, a good dinner is of great importance to good talk. One cannot think well, love well, sleep well, if one has not dined well. The lamp in the spine does not light on beef and prunes.

Virginia Woolf, A Room of One's Own
2.1 Research Method and Data

To answer the question raised in the introduction, we conducted a case study two education intervention programs, Meyerhoff Scholars Program at the University of Maryland Baltimore County (UMBC) and MIT Summer Research Program at Massachusetts Institute of Technology (MIT). We chose these two programs for at least three reasons. First, they have a reputation for and evidence of successfully impacting students. For example, Black Meyerhoff scholars were found to be 5.3 times more likely to enter STEM graduate programs than a comparison group of equally talented students who declined to enroll in Meyerhoff (Maton, Pollard, Weise, & Hrabowski III, 2012). In fact, the Meyerhoff model has gained such nationwide acclaim that it is being replicated at the University of North Carolina Chapel Hill (UNC) and Pennsylvania State University (HHMI News, 2014). Second, they are two of the more entrenched education intervention programs, having been around for multiple decades. And third, because our having contacts at both of their home institutions made getting interview subjects relatively easy. We chose a case study approach because it is a methodology especially suited for “why” and “how” questions. For this case study, we conducted open-ended interviews with the program administrators of these two premier programs dedicated to preparing minority students for graduate school in the STEM area. We also conducted interviews with seven students who participated in these programs before attending PhD programs at distinguished universities. While these interviews with people involved with these two programs constitute the central part of the approach we have taken to answer our question, they do not represent the whole of our approach. We also spoke informally with administrators of other similar programs and faculty members closely involved with the recruitment and experience of minority students at selective institutions.

To develop questions for our interview protocols, we conducted a systematic search of the education literature to learn what is known about education intervention programs. Through this search, we found that deliberate research evaluations of education intervention programs are uncommon. When studies exist, participants are
sometimes asked to assess their acquisition of research skills like study design, literature review, and data collection, although such studies are limited by small sample sizes and lack of control groups (Kremer & Bringle, 1990; Bauer & Bennett, 2003; Kardash, 2000). Some other studies focus on graduate school attendance rates of students that undergo undergraduate research experiences versus those that do not, albeit with the caveat that these studies are unable to prove that the programs cause students' gains (Maton & Hrabowski III, 2004; Kremer & Bringle, 1990). Nonetheless, there is some research through which we can learn about some factors that make certain aspects of education intervention programs successful. For example, by using a control group of students that would have been admitted to programs but for funding shortage, Nagda et al. (1998) found that undergraduate research program focused on minority students increased retention rates (Nagda, Gregerman, Jonides, Lerner, & von Hippel, 1998). In evaluating the long-term impact of a summer science program on high school students' interest and perception of abilities in science, Markowitz found that the program provided a positive impact on their performance in advanced science classes and their desires to pursue science careers (Markowitz, 2004). Maton, Hrabowski, and Scmitt, using a comparison group of students admitted to the Meyerhoff Scholars Program at UMBC but who declined to attend, and an historical sample of graduates from UMBC, found that the program participants graduated with higher grade point averages (GPAs), graduated with science and engineering degrees at higher rates, and gained admission to graduate school at higher rates (Maton, Hrabowski III, & Schmitt, 2000; Hrabowski III & Maton, 1995). Bauer and Bennett, using a comparison group of alumni of undergraduate research program at the University of Delaware, found that when compared to their peers not involved in undergraduate research, undergraduates who are directly involved in faculty research rate their experience as highly beneficial, report enhancement of their ability to carry out research and higher satisfaction with their overall education, were more likely to continue beyond the bachelor's degree and twice as likely to complete a doctoral degree (Bauer & Bennett, 2003). To the question of what undergraduate research experience designs contribute to positive results Hrabowski et al. (1995)
found, through interview and survey data, that the community, study groups, and research mentorship were some of the especially important components of the experience (Maton et al., 2000; Hrabowski III & Maton, 1995). Furthermore, Hrabowski and Maton, in assessing the Meyerhoff Scholars Program at UMBC, distill four factors that contribute to college students' success in the sciences: academic and social integration; knowledge and skill development; support and motivation; and monitoring and advising (Maton & Hrabowski III, 2004). We combined these findings with a scouring of the sociology and psychology literature to learn what is known on what psychosocial conditions contribute to effective learning. Eventually, this two-pronged search of the literature formed the basis for the propositions we investigated using the two sets of interview protocols we designed.

Figure 2-1: Themes Explored in Interview Protocols

For interviewing administrators, we designed this protocol:

*Building off current contentions on affirmative action, the research goal is to an-
alyze education intervention programs, extract the features that make them tick, the
challenges that undermine them, the results they accomplish, and insights they reveal
on how to design and scale education intervention appropriately.

I. Program Goal vis-a-vis Educational Achievement Gap

- Can you start by speaking generally about what this program is, what it
does, the problem it is designed to solve and how it solves it?
- What rationale guides this program?
- Is there any research-supported theory of education and learning on which
this program is based?
- Are you familiar with the educational achievement gap between minority
students and the rest of the population? In what ways does this program
implicitly or explicitly address the minority achievement gap?

II. Program Design

- Could you walk me through the program’s structure/design; that is, the
different components, like financial assistance or mentorship, brought to-
gether for the program experience, and how you anticipate these will be
helpful to students?
- Tell me about some aspects of the program you are most proud of.
- How is this program funded?
- What, if any, are the conditions for the funding?
- How guaranteed is this funding?
- How much does this program cost per student per year?
- What explains the explicit (or lack of explicit) incorporation of research
and evaluation into this program?

III. Program Evaluation and Results

- What is success for this program?
How do you measure success?

What activities does this program succeed at?

Why does it succeed at these activities?

What aspects of the program’s design accounts for this success?

What can this program do better at?

Why doesn’t it do as well as it could at this?

How can it do better at this activity?

What aspect of the program’s design accounts for this area of improvement?

What sort of challenges have you faced in running this program e.g. finding enough qualified students?

What lessons have you learned from these challenges?

Have you ever had to make changes to this program’s design due to what you learned from an evaluative process?

If so, what, why, and how?

Have you had unsuccessful students? How have you handled this? What policies do you have to address this?

IV. Potential Program Improvement or Roadblocks

What other elements need to be added to or removed from this program?

Why hasn’t this happened?

If you were given an extra million dollars, what would you do with it?

What would it take for you to serve 10 times the number of students you serve now?

What roadblocks do you anticipate?

What would it take to entrench this program and make it serve its target population for decades?
• What would the world of URM education have to look like for this program to stop being needed?
• Are you aware that affirmative action came back up to the Supreme Court a few months ago?
• What are your thoughts on affirmative action and how it affects the sort of work you do?

V. Conclusion

• Now that you know what my research is about and what I would like to know about this program, is there anything I should have asked but didn’t?
• Is there something I should go read more about?

For interviewing students, we designed this protocol:

Building off current contentions on affirmative action, the research goal is to analyze education intervention programs, extract the features that make them tick, the challenges that undermine them, the results they accomplish, and insights they reveal on how to design and scale education intervention appropriately.

I. Experience Before Program

• Can you start by walking me through your academic history before you signed up for this program?
• What kind of student were you with respect to academic preparation and motivation?
• As a scholar, how confident were you in your academic ability?
• How conscious were you of your status as a racial minority and a scholar at the same time?
• Do any particular triumphs or challenges stand out from that period?
• How did you get interested in the program?
What was applying to the program like?

Why did you choose to take part in the program after getting accepted?

What expectations did you have going into the program?

II. Experience During Program

Walk me through your experience in the program.

What activities did you take part in?

What skills did you pick up?

What challenges did you face?

How well did the program match your expectations?

What surprised you about the program?

What did the program do particularly well?

What could it have done better?

What is the strongest impression the program made on you?

III. Experience After Program

In what, if any, ways did the program contribute to what you have done afterwards?

What, among what you have faced so far, did the program particularly prepare you well for?

What, among what you have faced so far, did the program not particularly prepare you well for?

What should I have asked that I didn’t?

Is there anything else you would like to tell me?

The interviews were transcribed using a software called Transcibe, and then passed through high level coding using NVivo. All told, we ended up with almost 8 hours of interview audio.
2.2 Narrative Analysis of Interview Data

In interviews with at least a dozen individuals, some of whom are directly quoted here, a coherent and credible recipe emerges of the sort of factors that helps minority students succeed academically. In the collective stories of our interviewees, we see the ingredients that come together to produce minority success in large numbers, and the disillusion that ensues when these ingredients are missing. It turns out the soup of academic excellence starts with a base of a family culture that promotes the importance of and provides the preparation for academic achievement. To provide the information and preparation needed for high performance, we also see, can be costly. And to complete the recipe, a generous helping of an unwavering affirmation of a student’s worth is added. Our successful subjects were a product of these ingredients, with their families starting the cooking, and these education intervention programs continuing the work.

This was certainly the case for Marika, who told her story with warmth and awe,
betraying a fondness for a father who gave a lot for her and asked for the best of her. Yet the event she told of could not have been much fun to her adolescent self. From her telling, one day, her sister, while completing some home work, left out a “r” in spelling “Africa”. In response, her Afrocentric father, furious at her sister, ordered them both to spell “Africa” repeatedly, to fill a legal pad with a thousand reminders of who they were, and why they must ask the best of themselves. Ending her story by underlining the clime of awareness that permeated her childhood home, she said about her father: “he’s just very about knowing where you come from, knowing the truth about you know the history of slavery in this country, the slave state, you know the way that these institutions still exist and manifest oppression in the era that we live now, the connections to back then. There was no secret in my family about this, we talked about it.” These twin threads, of an awareness of racial identity and a striving for academic excellence, continued to reoccur in our conversation with Marika. To see this, we need not look any further than the fact that Marika’s father signed Marika up for a college-preparatory magnet school, enrolled her sister in private after-school tutoring, and pushed Marika to apply to the famous Historically Black University (HBU) in her state, where she could talk to his friend about majoring in science. And in pursuing educational excellence, it was not enough to merely go through the motions. Whether signing the sisters up for male sport teams or forbidding them from cheer-leading when they could be playing the sport instead, Marika’s father had an attitude that said, “Let them tell you no. You don’t tell yourself no. You go out there and you try.” Marika’s success then — she is in the final year of an engineering PhD program at MIT — was built on a familiar firm foundation: a parent that cared enough to push hard and knew enough to open doors.

Propelled by her family in this manner, Marika enrolled at the local university with plans to graduate with a STEM major. Beyond this plan for study in STEM though, Marika did not expect much else from her college years. Nor did she entertain any ideas about graduate school, or the doctoral degree she is now about to earn. From her telling, what she wanted most was that ultimate lure of teenage life: to be cool. To build past this stage of unknowing to where is now, she needed
someone to reinforce the foundations that her father built those many years ago, someone that would set high expectations and create growth opportunities. This is the role the MIT Summer Research Program (MSRP) filled for Marika. Started in 1986, MSRP was established “to promote the value of graduate education; to improve the research enterprise through increased diversity; and to prepare and recruit the best and brightest for graduate education at MIT”. MSRP recruits undergraduate students in science and engineering at U.S. universities to conduct research with MIT faculty over 10 weeks in the summer. This way, the program looks to increase the preparation and motivation of these students for advanced degrees in science and engineering. Although at its inception, MSRP was a manifestation of MIT’s effort to tackle the underrepresentation of minorities in science and engineering research in the U.S., today, the program’s focus has expanded to include other underserved groups, like students from low socio-economic backgrounds or first generation students. Students who participate in MSRP, which is an all-expenses paid experience, get research supervision and career counseling from MIT faculty, postdoctoral fellows, and graduate students. They also get access to cutting edge research facilities, with the opportunity to co-author a published paper. The program experience is enhanced through several activities like weekly seminars on topics relevant to personal, academic, and professional growth; and frequent social outings to develop important interpersonal bonds.

Marika did not know about any of these benefits of MSRP though — in fact, she did not want to apply. When her friend Kenny, who had attended the program the previous year, asked her to apply, she thought to herself, “boy, you don’t know me, you don’t know my grades, I’m not MIT material”. To Marika, “MIT material” did not look like her, MIT material was supposed to be naturally gifted, like Ben Affleck in the movie Goodwill Hunting. Figuring that she did not have much to lose, Marika overcame her reluctance, and chose to apply. She submitted an application, got accepted, and came to MIT in the summer, an experience she said changed her life. Anyone who saw her describe her experience would understand that she was not being dramatic in describing it as life-changing. Her face opening up like a roused
sunflower, her arms thrust out as if to grasp the weight of the transformation, she described the effect the summer at MIT had on her: “I left after the summer was over and I literally felt like oh my God, my life has changed, like I’m not going to be the same. And the reason why I say that is because when I came in, I had this you know conception of who I am, what my abilities are, this idea of what it takes to compete at MIT, to do graduate level research, to interact with these people. And to go through 9 weeks of doing that, and at the end, have people coming up to you like you are like doing well at it, it just completely debunked all the myths I had about myself. Now, I could no longer say to myself, ‘you’re not MIT material, you can’t compete’, like that was done, they took that away from me...I could not use it as a crutch anymore, like you know you can do this so now it’s a choice, do you want to or you don’t want to, you know.”

If the idea of MSRP being so transformative still sounds hyperbolic, listening to someone who should understand why Marika had such a transformative experience at MSRP reassured us. In our discussion with a dean at the MIT office that runs MSRP, we saw glimpses of why Marika was moved to describe her experience in language so evocative of salvation. Replying to a question about how MSRP addresses the racial achievement gap, this dean described how the program helps students reshape what they think is possible, how students that come to the program with only a vague idea of going to graduate school can leave with an expanded imagination, a sense that they have the ability to be at a university of MIT’s stature, and that there is a place for them at a university of MIT’s caliber. This description certainly fit Marika’s experience. The unsure young girl who arrived MIT the summer of 2008 left with the confidence and motivation to focus anew on classes, pursue research ideas, build relationships with professors who would write letters of recommendation, and eventually apply to top schools like MIT, Harvard, Yale and Stanford. How did the program achieve this effect on Marika and others among the hundreds of students it has served for three decades? Through deliberately designed program activities, that is how. For one, Marika and other members of her MSRP cohort listened to panels of MIT graduate students — graduate students that looked like them, graduate students
from similar social and educational backgrounds to them — talk about how they got into MIT and what the MIT experience was like. Also, the students listened to talks by MIT faculty on everything from their research to their career journeys to what they look for in prospective students. Between the discussions with the graduate students and the conversations with the faculty, the students participating in MSRP that year would have found it easier to imagine a future as a graduate student at MIT. Also, the students did not only go through experiences that moved them to dream bigger dreams, they also received information and preparation that made it more likely that their dreams would come to pass. They, in addition to conducting research for three months, received training in dissecting and understanding scientific research papers, preparation in communicating research findings using a poster presentation, practice for the important Graduate Records Examination (GRE), guidance in writing a statement of purpose that admissions committees of competitive graduate programs would find compelling, and connections to MIT graduate students who continued to provide mentorship even past the end of the program.

This story of information, preparation, and elevated expectations is similar for the other program we looked at: Meyerhoff Scholars Program at University of Maryland Baltimore County (UMBC), a nationally recognized education intervention program with success in graduating minority students through college and through graduate programs. The Meyerhoff Scholars Program was created in 1988 when renowned educator, Dr. Freeman Hrabowski, then Provost and now President of UMBC, sought and received the generous support of Baltimore area philanthropists, Robert and Jane Meyerhoff, for a program to prepare young African American men for careers doing scientific research. Since then, this program has evolved into a leading pipeline carrying talented minority students from college through graduate education in science and engineering at prestigious schools, including Harvard, MIT, Johns Hopkins, Carnegie Mellon, among others. Today, the Meyerhoff Scholars Program shows the rest of the country the way to educate minority students that go on to earn PhDs and MD-PhDs in STEM fields. Importantly, the program regularly assesses itself by analyzing data on participants using statistical comparison samples, surveys, and interviews.
Participants are studied starting from their enrollment in the program through their graduation and through their eventual enrollment in graduate programs. From these analyses, we learn that with an annual enrollment of 270 students today, the program has, since 1993, graduated over 1000 students, and that its alumni since inception have earned 209 PhDs and 239 masters degrees. Also, we learn that students who attend the program are five times more likely to have graduated from or be currently attending a STEM PhD or MD/PhD program than a comparison group of students who got admitted to the program but chose to go to a different college.

This suffusion with academic excellence we see here was also familiar to Jorah, a Meyerhoff scholar we spoke with, who saw the emphasis on academic distinction in the people and programming he encountered at Meyerhoff. When we spoke, Jorah, a who is now completing a PhD at MIT, however remembered the Meyerhoff Scholars Program as not just a bastion of excellence, but also as a place that showed him — in his words — “how the sausage was made”. “You ever get the sense that when people are successful, it look so easy for them to get there,” he asked, attempting to explain the epiphany on what is required for academic success that he came to through Meyerhoff. At Meyerhoff, he continued, “I started seeing how the sausage was made so to speak in that some of the most successful students in my class were doing all sorts of things, things that I wasn’t doing...it was just incredible to see what it took. You really get to see the inner workings.” Staying on the themes of learning about and being inspired by success, Jorah continued, “you might not have access to an older student to tell you how they got into medical school or you might not have access to tell you how the student aced biochemistry. Like you don’t get that and you could imagine what it took but until you actually hear from people who are successful, it is probably different from what you imagined. So that was helpful, in sort of seeing what it took for different people to be successful.” And when pressed to explain what it took, what this new insight he had gathered from the program was, he said simply, “it was just a lot of studying and a lot of work...in high school, I worked really hard and I did pretty well, but I didn’t work that hard...but I think it [Meyerhoff Scholars Program] was more work than I was ever prepared to do, and
I was challenged much harder than I was ever prepared for.”

Just like Marika, Jorah was raised in a family that placed a high value on education. And just like both Jorah and Marika, Jedikah, another Meyerhoff scholar we spoke with, found immense value in being with a group of high-achieving students that looked like him. Recounting how he came from a high school where the number of other high-achieving minority students was so small that he could easily identify all of them, Jedikah described his Meyerhoff experience as being like a breathe of fresh air. And then, further extolling the impact of the Meyerhoff program, he continued: “you know just to be around that like 60 other like minority students...it did something to you, it helped your confidence, so like that was just powerful, that was one of the the most powerful things, and you know we, of course there was a yeah, we are all eighteen and you know we became more like brothers and sisters, you know, but I think that was the biggest part for me was just having that solidarity and you worked together and they actually did kind of beat that into us like you know you help each other out...we really did, now I don’t think, I think our cohort was a little special but by and large, I think most cohorts really did kind of work together on things, by and large.”

This atmosphere of high expectations, nurturing, and solidarity that both Jedikah and Jorah attested to did not result from happenstance. Just as with the with MSRP, the climate of the Meyerhoff Scholars Program is deliberately created to foster the sort of academic and psychosocial conditions that engender success. The program purposefully recruits for students that are academically prepared for science, engineering, and math, and who show commitment to a post-graduate, research-based degree and career. The Meyerhoff model is to focus on high-ability students, imbue them with the drive to become leading scientists and researchers, and immerse them in an environment where they get the inputs to make their aspirations a reality. For example, students who are accepted to the program get money to cover part or all of their school fees. Once in the program, students are exposed of a variety of activities, including research. Students start research as early as freshman year, and once they have gained some experience, the program uses its networks to fan them out to
research and professional internships over the summer. Students also get to regularly check-in with administrators on their academic progress. The most important contribution of the program is arguably made before any of these though, before the first classes of the fall semester are filled with green and grinning students, when scholars accepted to Meyerhoff are gathered together to live in groups on UMBC's campus and experience weeks of Summer Bridge. Conducted in the summer before freshman year, Summer Bridge is the foundation of the program experience. There, students get their first taste of the program's demanding level of excellence. There, too, students experience for the first time the feeling that everyone involved in the program is committed to their success. At Summer Bridge, scholars receive academic preparation by taking intense classes that introduce them to science classes they will take in the fall. They also receive, by taking part in other sorts of activities, exacting training in attributes important to success in the STEM fields, attributes like study skills (including studying in groups), time management, and problem solving. Between getting accustomed to high expectations and getting exposed to rigorous training, scholars cultivate a tight peer support group, which will be important during their time at UMBC. Jedikah described Summer Bridge this way: "The whole idea of it is...three things: it's like part hazing...you work hard and...you are sort of clustered on campus....but we bonded. Not every cohort bonds, but our cohort bonded. So you have a shared experience, this intense experience, but what it does is that, so number one, it is supposed to help you bond; two, it is supposed to help you get acclimated to university resources so you know where the library is, you know where the halls are, you know where the food is, so when you get to campus in the fall, that variable is removed from the equation; the third thing it does is that it is a great equalizer, so they have different tracks that kind of help you get up to speed on things that you were missing. So you know, I didn’t take Calculus in high school...so I didn’t know what the difference quotient was, and all other 49 of them did...so we took Pre-Cal...and then you know, you kind of take out a major so they got you started on a path at day one, which I think is good and bad, but you know by the time you started in the fall, you were headed towards something." He continued, "We went to
like research institutions, corporations, I think we had guest speakers, we have professional development seminars, so that idea was to kind of help to give us a vision of where we wanted to go and what we wanted to be...I would say one thing that I do remember getting out of that program was sort of viewing like if I got through that, I could get through anything because I didn’t believe we had to read this 700 page book in 6 weeks and this is on top of classes and so we were basically doing that at night, so once I learned I could do that off of minimal sleep, because we were only getting at most 4-6 hours of sleep a night, you know we were mostly getting 4-6 hours of sleep a night, so when I got through that pretty successfully, when I had difficulty later on or challenges of like timelines, I say well I can do that, you know, so this shouldn’t be that bad.” In all then — and at the very least, in Jedikah’s words — we see that through (and beyond) Summer Bridge, Meyerhoff sets it scholars up for success by providing them “a family-like, campus-based social and academic support system.”

The importance of this support system was underscored by Marika, Jorah, and many other students we spoke with, who, after leaving programs like Meyerhoff and MSRP to other academic environments — for example, PhD programs — that did not deliberately cultivate the conditions for their success, suddenly felt like fishes out of water. With carefully curated information, preparation, and affirmation gone, these students felt a sudden jolt, a turbulence in their academic and mental lives that they were not prepared for. Marika put it this way: “One of the things that I did struggle with, that I was shocked that I struggled as much as I did with this was the cultural shift when I got here [MIT]. I was struggling emotionally the first 7 weeks, 8 weeks...so remember I came from a HBCU, so it was all black folk, all your people, same everything in terms of you got an opinion, somebody agrees with you, you know, somebody is saying the same thing you saying, that kind of thing, it’s just like all of the ways that I identify myself were just like amplified and accentuated in this new environment and I took it the wrong way. I was so scared and so fearful, it paralyzed me.” And when asked about a particular episode that illustrates this cultural shift, she continued, “I think it is twofold with me because I’m black and I’m a woman,
right. So it was kind of hard for me to like organize what I was getting, like am I getting it because I am a woman, are you talking to me like this because I'm black, like why should I be mad at you right now, like I didn’t know how to deal.” Here, Marika was referring in part to an episode that happened during visit weekend, the weekend when admitted students visit MIT and try to match with professors who can supervise their PhD research. On this weekend, a possible match came to her, and advised, “I just wanted to let you know that your undergrad institution didn’t prepare you to be here, so you going to struggle, like you going to have a hard time, and I just wanted you to know that.” And when she did struggle with classes at MIT and asked for help from this professor, she got reminded of their previous conversation, almost as an “I told you so.” And Jorah, who, just like Marika, had tales about the training wheels of an affirmative environment coming off, put his understanding of that experience this way: “You have just spent four years feeling like you are God’s gift, and you probably were, and a lot of people having your back and wanting the best for you, and no one tells you that’s a pretty special thing and that when you leave, you are not going to have that so much anymore, and some places more than others... I don’t think a lot of students then were prepared to deal with an environment that’s not as positive as what they are used to. And it’s hard and I think that’s where the mental part comes in, because it takes sort of mental strategy to try to deal with that. It’s not like war, but it’s kind of like war.”

On the whole, what stands out about the programs is how comprehensive they are. Both programs understand how important a holistic approach is to educational success. Where some programs might offer just academic or research inputs, these programs recognize the impact of broader psychosocial factors on success: this informs the involvement of mentors, peers, and the wider university community in the experience of participants. Not only do Meyerhoff and MSRP recognize the importance of nonacademic factors to academic success, they deliberately — with programming that focuses on skills like communication, time management, and interpersonal interaction — infuse and study the habits that can influence such success. In addition to their broad sweep of program building blocks however, we see, in these programs, and
in the lives they have touched, evidence that when high achieving students raised in a home culture that values academic excellence are placed in an environment in which they don’t have to worry about meeting financial needs, in which high expectations of academic excellence are maintained, in which information and preparation needed to succeed are provided, and in which the psychosocial atmosphere needed for flourishing is cultivated, then they can succeed. Aptly, the importance of these factors is buttressed by the disenchantment that arises in their absence.
Chapter 3

The Racial Education Achievement Gap: A Complex Systems View
So imperceptibly I found myself adopting a new attitude towards the other half of the human race. It was absurd to blame any class or any sex, as a whole. Great bodies of people are never responsible for what they do. They are driven by instincts which are not within their control.

Virginia Woolf, *A Room of One’s Own*
What the previous chapter demonstrates is the seemingly banal idea that given the right conditions — conditions of high expectation, adequate preparation, and sufficient information — students of color do succeed academically. A tempting conclusion to draw from this might be one that asserts that these conditions are all that is necessary for the intellectual flourishing we have just witnessed. Here in this chapter, our aim is to show why such reductionist temptation is to be resisted, and to present an alternative to the draw of such simplicity. To achieve this goal, we need to work with a different set of tools, we need to see through a different sort of lens; where the previous chapter zoomed in on the particular, we need here to back out and take in the general — better put: the systemic. The new lens we present here then is the field of Complex Systems, with its complement, System Dynamics. With this lens, we can conduct broader analyses of and provide more robust answers to the questions of how it is that persistent disparities exist in the educational achievement of different races in America. We can also start to investigate what must be done to close the embarrassing gaps. Toward this goal we have set ourselves then, this chapter proceeds thus: section 3.1 provides an introduction to complex systems; section 3.2 explores broadly the places — the domains of the sociocultural, the political, the economic, and the pedagogic — where one might look if wanted to use complex systems' thinking to consider the factors implicated in the racial achievement gap; section 3.3 jumps off section 3.2 to investigate particular issues that induce minority underachievement; and section 3.4 deploys the tools of system dynamics to illustrate how the factors sections 3.2 and 3.3 shine a light on might interact in a complex system.
3.1 What is a Complex System?

Without delving deeply into etymology, we can surmise that when people think about the word *system*, they conjure notions of parts that interact in some (typically complicated) manner to form a whole and its characteristics. Take for example a system we have all encountered at some point in our lives: the transportation system. The transportation system to the average person might include artifacts like drivers, pilots, sailors, buses, cars, planes, trains, ships, roads, oceans, tracks, light houses, control towers, traffic lights, and so on. By considering these artifacts, such a person would be showing that he has some sense of how vast and involved the transportation system is, and how varied its artifacts are. What they would have yet to show however, and what they may lack — in part due to how rudimentary human mental models can be, and in part due to the common and comfortable division of what mankind knows into self-contained categories — is an understanding of how transportation might or might not be a complex system. The problems identified, arguments proffered, and recommendations to be proposed in this thesis rest on this uncommon conception of a system as complex, a conception we now realize with an outline from its definitions, some shade from its characteristics, and some color from an example of its opposite.

In getting a firm grasp of what is meant by a complex system, it probably does not help that the expression's constituent terms — “complex” and “system” — are common words of the English language whose colloquial meanings lend themselves to an easy and intuitive understanding. It is ironic then that complex systems does not have a simple, readily accepted definition — unsurprising for a field of scientific inquiry of relatively nascent birth — less than 100 years — and modest stature. Instead, it has a collection of characteristics with which it is associated and by which it might be recognized. To sketch a rough outline of these characteristics then, we, borrowing from Ladyman et al. (2012), sample a few definitions from the literature:

- *In a general sense, the adjective “complex” describes a system or component that by design or function or both is difficult to understand and verify. In physical systems, complexity is determined by such factors as the number of components*
and the intricacy of the interfaces between them, the number and intricacy of conditional branches, the degree of nesting, and the types of data structures (Weng, Bhalla, & Iyengar, 1999).

- **A complex system is literally one in which there are multiple interactions between many different components** (Rind, 1999).

- **Common to all studies on complexity are systems with multiple elements adapting or reacting to the pattern these elements create** (Arthur, 1999).

- **In recent years the scientific community has coined the rubric “complex system” to describe phenomena, structures, aggregates, organisms, or problems that share some common themes: (i) They are inherently complicated or intricate, in that they have factors such as the number of parameters affecting the system or the rules governing interactions of components of the system; (ii) they are rarely completely deterministic...the systems are predisposed to unexpected outcomes (so-called “emergent behavior”)** (Foote, 2007).

- **Complexity starts when causality breaks down** (Editorial, 2009).

- **Roughly, by a complex system I mean one made up of a large number of parts that interact in a non-simple way. In such systems, the whole is more than the sum of the parts, not in an ultimate, metaphysical sense, but in the important pragmatic sense that, given the properties of the parts and the laws of their interaction, it is not a trivial matter to infer the properties of the whole** (Simon, 1962).

To shade in the sketch we have drawn with the above descriptions, we sample a few relevant features of complex systems:
<table>
<thead>
<tr>
<th>Complex System Characteristic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedback Loops</td>
<td>When an element of a complex system acts, its action causes changes in other connected actors/elements, and these changes comeback, whether directly or indirectly, to affect the original element.</td>
</tr>
<tr>
<td>Non-Linearity</td>
<td>In complex systems, effect is not always proportional to cause, and the effects of causes are not necessarily a function of the proximity between the locations of cause and effect.</td>
</tr>
<tr>
<td>Interdependency</td>
<td>With complex systems, simple, definite, and deterministic relationships of cause and effect are unusual. Instead, an effect has several direct or indirect causes, which are also themselves caused by several direct or indirect factors.</td>
</tr>
<tr>
<td>Dynamism &amp; Adaptivity</td>
<td>Elements in a complex system, and the qualities of their interactions, are often changing, even if the change is sometimes so subtle as to be perceived only if a large time scale — say, decades — is considered.</td>
</tr>
<tr>
<td>Counterintuitivity</td>
<td>With complex systems, the rule of cause and effect are not always what our minds suggest whether in terms of intensity or proximity or relevance.</td>
</tr>
<tr>
<td>Path Dependence</td>
<td>In a complex system, when a certain path is taken, or when a certain interaction has continued and evolved, another path that could have been taken is permanently shut-off and the elements of the interaction cannot have a second go at interacting in a different manner.</td>
</tr>
</tbody>
</table>
We can add some color to this emerging picture of a complex system by contrasting a non-complex system with a complex system. For a non-complex system, we take from classical physics the system that relates force, mass and acceleration. A force of one newton is the force required to make a mass of one kilogram accelerate at one meter-per-second-squared. If we wanted to make the same mass move at two meters-per-second-squared, all we would have to do is simply increase the force to two newtons. According to the laws of classical physics, what happens when we keep the mass constant and double the force to two newtons is consistent and predictable: the object’s acceleration doubles. A complex (social) system is not consistent and predictable in this manner — something we see in a contrasting example: an attempt in the 1960s to alleviate economic depression in Boston, a major American city. In that attempt, four programs were implemented to reduce the level of depression: the creation of jobs either through direct employment by the government or by transporting the unemployed to suburban job locations; the creation of skill-training programs for those who earn little; the provision of federal subsidies to the city; and the construction of low-cost housing (Forrester, 1971). The result of these inputs was not a decrease in economic depression as our intuition might predict; instead, it was an increase in depression, caused fundamentally by an excess of low-cost housing (Forrester, 1971). In particular, existing legal and tax structures incentivized the retention of old buildings; if these buildings were industrial buildings, their decline corresponded with a decline in employment opportunity, and if they were residential buildings, their decline lead to an influx of low-income populations; the continued availability of low-cost housing continued to attract the low-income groups at a rate that outpaced that at which jobs were being created, thus forcing the standard of living down and dissuading further immigration; income dropped, and residential buildings fell into disrepair and abandonment, which meant that these buildings could not be used for industrial purposes, and that if somehow the city rebounded, these buildings were ready to receive a new population that would recreate the starting dynamic (Forrester, 1971).

To further etch in our minds the picture of a complex system, we take an example
— well explained by Groff (2013) — that is particular to education, the system we are ultimately interested in. Yet another manifestation of the decades-long hankering for reform in the American education system, the No Child Left Behind Act of 2001 (NCLB) was expected to, among other things, improve performances of students in primary and secondary schools by raising achievement standards and tying the provision of federal funds to the achievement of the higher standards. Schools were required to meet a standard called Adequate Yearly Progress (AYP), measured by State Education Agencies (SEA) through the use of standardized tests. Schools that did not make AYP for five years could, in addition to losing funding, be closed and reopened as public charter schools, have their teachers and principals replaced, be turned over to be run by contractors, or be taken over by their SEA. Although policymakers expected this law to serve as a stick that educators would want to avoid by teaching students better, Groff (2013) posits a plausible scenario where feedback loops in the system might lead to poorer teaching. First, Groff (2013) imagines struggling schools with poor student performance and suboptimal student-teacher ratio prior to NCLB — schools would not have started out in a good position to make AYP. If due to the confluence of these struggles and other factors, these schools students did not measure up to AYP for a given number of years, the schools would have had their federal funding reduced, leaving them with less to operate with. These schools might have then chosen to, as is typical, make their reduced resources work by combining classrooms and increasing the number of students taught per teacher. This increased student-teacher would have lead to poorer teaching quality, the very result NCLB was designed to counteract. Moreover, this would have been a particularly paradoxical result given that low-income and minority students, who are a major target of NLCB, would have been more likely to be in the sort of poor schools to have been affected by this dynamic. A paradox brought into relief when we consider that a meta-analysis by the Center for Public Education revealed that smaller classes, especially in grades K-3, can raise academic achievement, with a class size of 18 students per teacher provides the best outcomes, and that minority and low-income students achieve at higher levels when put in small classes in primary grades. (Groff,
2013; Center for Public Education, 2007)

We all navigate life using mental models of cause-and-effect and action-and-reaction. Unfortunately, our mental models are often intuitive and easy to use in part because they are simple, inaccurate and imprecise. These models are of limited usefulness when far-reaching and consequential issues in education are to be considered, issues that cannot be adequately described in terms of simple, defined causal relations like that which connects force, mass, and acceleration, issues that are better described by the sort of interactions we saw among actors and actions in the NCLB or City of Boston examples. We have shown here and continue to show next why and how we might replace our simple mental models with a complex systems’ one.
3.2 Influences on Education as a Complex System

Now that we have seen what it means for a system to be complex, we can consider education in particular as a complex system by looking at some of the moving forces behind the actors and actions in the education system. The important moving forces behind actors and actions in the education system are often sociocultural, political, economic, and/or pedagogic. Of course, these four categories are neither sharply demarcated nor exhaustive. In fact, a motivating force that seems like it belongs to a particular category when considered from a particular position may seem like it fits better with a different category from a different position. Nonetheless, looking at actors and actions in the education system through the admittedly wide lens of these categories should further persuade about the validity and importance of considering education as a complex system, and should sketch out the outlines of the fuller and more precise treatment of complexity (and disparities) in the education system that is to come in the next section.

Sociocultural influences on the American education system flow from the American people and American culture. In the realm of the sociocultural are the ideas and practices of the American people regarding what is and what ought to be. These ideas and practices may be explicitly accepted or — more likely — subliminally absorbed. One good way to see evidence of the sociocultural forces that move in the education system is to ask: what has been, what is now, and what should be the purpose of education in America? Classical studies on the sociology of education suggest at least three broad frameworks to think about the purpose of education: structural functionalism, interpretive analysis, and critical approaches (Wotherspoon, 2009). Structural functionalism, championed by figures such as Emile Durkheim and Talcott Parson, emphasize education’s role as a way to integrate people into different social roles. Seen in this way, schools do not merely transmit knowledge; they, in industrial democracies like the United States, also maintain the social order by shaping personalities with different values by using different sticks and carrots like grading, granting credentials, and sundry selection processes. The values schools pursue are often in tandem
with the goals — like political order and scientific advancement — of the broader society. For industrial democracies, these would be values like formalism, competition, achievement orientation in work, merit-based performance, conformity, deferred gratification, and obedience to authority (Wotherspoon, 2009). Seen through this structural functionalist framework, the purpose of education in America has evolved, from the Colonial Era through the Industrial Revolution, the Cold War, 20th century Globalization, and today’s Knowledge Economy, to sample a few prominent periods. Across these eras, educational institutions have been used to prepare the young for democratic citizenship, to train the populace in economically beneficial and contemporary relevant skills, and to promote social integration. So, for example, the earliest schools were created to provide training in Latin and the Bible for aspiring clergy. As industrialization set in, a demand for workers meant a need for schools to provide vocational training; therefore, both the U.S. government and institutions of higher education evolved to meet this need. During the decades of the Cold War, with its startling leaps in scientific progress and technological invention, a panic set in about a failing education system and how that posed a national security risk. This prevailing national sentiment was most notably distilled in A Nation at Risk, the popular 1983 report of the National Commission on Excellence in Education. One response to this panic of the late 20th century was an emphasis on, privilege of, investment in Science, Technology, Engineering and Math (STEM) education. And in today’s school reform approach that stresses setting of standards and measurement of impact, a common argument used to justify such approach is the need to make America competitive in the current globalized, knowledge-based economy. Still inspired by the structural functionalist framework, we might ask a few questions about what the role of education ought to be: should colleges only admit and go on to certify students that are more or less already well-prepared, or should they be committed to admitting students with minimal regard to prior preparation while committing themselves to doing the hard work of training those they admit; should a college, in addition to being a place for learning, also be a place for individualistic competition and ranking, and the acquisition of social capital and prestige? Whether we are tracing the history of
the purposes of education in American society, or contemplating alternative purposes for our present time, we perceive that the tricky thing about sociocultural forces is how seductively self-evident they are, how easily tempted we are to accept them as a given and not question how they arise, or what alternatives exist for them. They represent the assumptions we take for granted, their causes and effects as elusive to our cursory observation as the invisible molecules of the air we breathe.

The domain of the political (not to be mistaken for politics) covers situations in which the wills and desires of two humans (or more concretely, two groups of humans) clash. Seen in this manner, the political is inevitable, and pleas to abjure the political perhaps reflect a misunderstanding of the political for mere politics, a naive refusal to accept the human condition as fundamentally contentious, or a reflexive and unwitting definition of the apolitical as nonthreatening and already accepted notions. To name a few obvious but pertinent examples: the 1964 Civil Rights Act was a political act; the series of court decisions on the constitutionality or lack thereof of affirmative action have been political acts; and the referendums by residents in several states to ban affirmative action have also been political acts. For a different illustration of the clash of wills and desires that is the political, we could examine school standards, and how they are chosen and measured. The Common Core Standards are the latest attempt to set national education standards in the United States and produce tests to measure compliance with these standards. These standards were agreed upon through collaboration among a consortium of policymakers, academics, and educators. Yet, these standards have remained controversial since they were first announced, with different constituencies decrying them from particular perspectives: for some parents, it makes working on homework with their children an exasperating and knotty task; for some teachers, it stifles the creativity of young children; for some observers, the assembly of interests that developed the standards is enough reason to be suspicious of the goals it is designed to accomplish. Despite these disagreements about the suitability of the Common Core Standards, somehow, a decision must be made about what to teach, how to teach it, and how to measure what has been taught. That is, if we think of education as a journey, then the mix of policymakers and scholars
that crafted the Common Core Standards have set, for good or for ill, a destination children in America are supposed to journey towards. As a testament to the strength of political forces, the forces that played out in setting this destination, and how they played out, have effects that continue to ricochet through the education system writ large.

The pedagogic sphere covers ideas and practices (from technology, neuroscience, psychology, and other relevant fields) on how to teach and how to learn. A recently popular example of a pedagogic influence on the education system is the spread in the use of technology in learning. In particular, Massive Open Online Courses (MOOCs) have become ubiquitous in the last decade and have had a noticeable influence on curriculum design and classroom structure. Massive Open Online Courses (MOOCs) are lessons offered (typically free or low-cost) on the Internet to millions of people distributed all over the world. They are distinguished by their large scale, their embrace of all users, and their delivery over the web. Hundreds of thousands of users typically sign up for individual MOOCs, tens of thousands typically complete MOOCs and earn a certificate, and hundreds of courses are offered, even if just counting the biggest MOOCs like Udacity, Coursera, and edX (Ho et al., 2014; Roberts, 2015). Indeed, there is evidence of year-on-year growth in the use of MOOCs (Ho et al., 2014). While some observers think MOOCs will continue to dramatically change education delivery and consumption, and others dismiss them as the latest fad in an education system that periodically produces new fixations, few disagree that MOOCs will have some sort of impact. In fact, the scale of the reach of MOOCs has caused the most optimistic to predict that in the near future MOOCs will upend the existing system of higher education, decoupling the provision of knowledge from the bestowing of credentials and prestige. Others have gone as far as to suggest that a radically different (more personal, more effective, and more scalable) education of the future based on the interconnectedness that technological solutions like MOOCs engender. Even a cursory consideration of these possibilities immediately raises questions about some of the sociocultural and political issues we raised earlier. One such question might be through what avenue America might pursue social cohesion if the school of
the future is a cellphone in the palm of a teenager? Even in the absence of an answer to this and other such questions, we expect that pedagogical forces from MOOCs will continue to evolve into the future, in part because due to their size and technical design, MOOCs are a rich source of fine-grained data on education (Breslow et al., 2012). This means that researchers are able to mine data as granular as individual clicks on the learning platforms and use these to answer interesting questions on what contributes to effective learning both online and on-campus (Breslow et al., 2012). No one can say for certain where these questions will lead, or even the options we might consider; therefore, being open-eyed about the presence of formidable pedagogical forces and their potential to collide with other forces in the education system remains important.

Finally, economic factors that affect the education system touch on those issues that relate to resource provision and allocation. Keeping in mind the theme of complex systems, with their dynamism and feedback loops, we could consider the decision-making on how resources are allocated to K-12 school districts as indicative of consequential economic forces in the education system. By this we mean the choices made about how much money will be contributed to the education system through taxes, how much of this contribution will come from local or state or federal taxes, and which geographical/political units will benefit from which taxes. In America today, the average school district is primarily funded by local taxes. This means that enclaves of the prosperous can allocate more towards education than neighborhoods of the indigent can. Extant choices notwithstanding, the provision and allocation of resources conjure contending ideas of what is fair, if fairness is, for example, the provision of equal resources to every district, the provision of the resources necessary for each district to achieve specified outcomes, or the free rein to each district to collect and provide as much resources as it might desire to. Not only do provision and allocation of economic resources raise questions about fairness, they also raise questions about the influence of politics on economic and pedagogic choices, like was the case with the federal Race to the Top Program. Race to the Top is a program through which the federal government provided money to only those states that pursued its
policy goals, including goals for standards and assessments, which several states tried to achieve by adopting the controversial Common Core Standards. In another case of politics influencing the economic choices, several state governments, as part of reacting to the Great Recession, cut funding for the public higher education system (Mitchell, Palacios, & Leachman, 2014). Some of these state government also prodded schools in their systems to prioritize majors that have immediate, tangible results on the state economy through jobs over majors that be edifying in a more intangible sense (Rifkin, 2012). Whether it is K-12 funding, or the Race to the Top program, or higher education funding in the post-Great Recession era, economic forces show their stark power to determine options to be considered, priorities to be privileged, and choices to be rewarded or sanctioned.

Seen one way, if the education system represents the nucleus in the classical model of the atom, these categories of influences that we have surveyed represent the revolving electrons exerting forces on the center. The goal in this subsection has been this: if we are to make the argument for education as a complex system — a task we will complete in the next subsection — a good place to start is by examining the sort of influences (on actions and actors) that are exerted in the education system. Furthermore, the objective here has been to illustrate not just the existence but also the interdependence of these forces. We have not attempted to give answers to all the questions raised by the presence of these forces; instead, we have contented ourselves with making their existence and essence explicit.
Figure 3-1: The Education System Modelled as an Atom with Multiple Spheres of Forces
3.3 Complexity: A Near View

In the introduction to this thesis, we quoted Justice Antonin Scalia's comments, which were in tandem with the mismatch hypothesis and its cascading effect. But Justice Scalia's comments do not merely lead us to assess affirmative action's potential unanticipated harmful effects on minority students. If we dig further, Justice Scalia's comments also lead us to ask how it is that minority students knock at the door of selective schools with a level of preparation so low that affirmative action becomes inevitable if a sufficient number of minority students are to be admitted. (American College Testing, 2014; U.S. Department of Education, National Center for Education Statistics, 2013a). The knowledge of education as a complex system that we have built thus far will here help us answer this question. If we, guided by this understanding of education as a complex system, consider American society to see where we might find answers to our question, we find that a broad swath of American education, nay American politics and American civic ethos writ large, are implicated: from racial and economic disparities in access to and quality of early childhood education, to the higher rates at which Black and Hispanic students attend poor high schools (with under-prepared teachers and non-rigorous classes) because of inequitable funding of high schools; from the paucity of Black and Hispanic members of faculty, which contributes to a lack of academic mentors and role models, to stereotype threat, the anxiety which minority students feel about confirming racial stereotypes of their intellectual capacity, and which research shows affects Black students’ academic performance; from Historically Black Colleges and Universities (HBCUs) remaining underfunded despite them graduating the majority of Black scientists and engineers to the income disparities and economic constraints that limit the sorts of support that parents of Black and Hispanic can provide for their children's education. For us to have any chance at answering the question Justice Scalia’s comments lead us to pose, we must probe closely these probable factors.

To start, we know that minority students face stereotype threat, the “risk of confirming, as self-characteristic, a negative stereotype about one’s social group”
(Steele & Aronson, 1995). Steele and Aronson (1995) show that when given a test, Black students perform worse than White students when told that the purpose of the test is to assess their intellectual ability, but perform just as good as White students when told that the test is not diagnostic of their intellectual ability (Steele & Aronson, 1995). The authors attribute this difference in performance to the effect on Black students of common stereotypes of Black people as intellectual inferior. These stereotypes could dampen Black students' academic performance (on academic tests, like the SAT, for example) through a variety of mechanisms including distraction, or withdrawal of effort. This stereotype threat discovered by Steele and Aronson has been replicated in different academic settings and for different stereotypes of different minority groups (Schmader, Johns, & Forbes, 2008).

We also know that in America's high schools, Black and Latino students (and students from other minority ethnic groups) have less access to the resources they need for future college and career success. For instance, according to a report by the U.S. Department of Education Office for Civil Rights, “a quarter of high schools with the highest percentage of Black and Latino students do not offer Algebra II; a third of these schools do not offer chemistry”; yet, these classes that are needed to be competitive for college (U.S. Department of Education Office for Civil Rights, 2014a). According to the same report, while Black and Latino students represent 40% of enrollment in schools offering gifted and talented programs, they only represent 26% of students enrolled in gifted and talented programs (U.S. Department of Education Office for Civil Rights, 2014a). And, along a similar vein, even though Black and Latino students make up 37% of students in America's high schools, they make up only 27% of students enrolled in a one or more Advanced Placement (AP) course, and 18% of students that earn a qualifying score of at least 3 on an AP exam (U.S. Department of Education Office for Civil Rights, 2014a). In fact, not only do Black and Latino students face a lack of access to challenging course work, they are also more likely to attend schools with higher concentrations of first-year teachers and uncertified teachers (U.S. Department of Education Office for Civil Rights, 2014b).

Another issue implicated is early childhood education. Despite research that
shows the beneficial effects of participation in high quality early childhood care and education programs on children’s mental and social development, children from Hispanic families and children from families with low socioeconomic status are less likely to be enrolled in center-based early childhood programs (Institute of Medicine, 2000; Federal Interagency Forum on Child and Family Statistics, 2014). And despite research that shows that children’s early language skills are predictive of their future literacy skills, and that participation in quality early learning increases future likelihood of graduation, future likelihood of enrollment in college, and future earnings, poor Latino, and Black children participate in preschool at lower rates than White children, and Black children are the most likely to attend low-quality programs (Department of Education, 2015). Sadly, and expectedly, these disparities are reflected in an achievement gap as early as kindergarten for poor, Black and Hispanic children (Department of Education, 2015; Economic Policy Institute, 2015).

The paucity of minority members of faculty is another issue. According to data from the National Center for Education Statistics, in 2013, among full-time professors in degree-granting post-secondary institutions in the United States, 4% were Black, and 3% were Hispanic, even as the percentage of doctoral degrees awarded to members of these groups rose from 4.1% in 1976 to 7.8% in 2012 for Blacks, and from 1.8% in 1976 to 6.1% in 2012 for Hispanics (U.S. Department of Education, National Center for Education Statistics, 2015a, 2013b). This dearth of minority faculty contributes to a less welcoming culture for minority students in Predominantly White Institutions (PWIs), and fewer avenues for mentorship for minority students. Such an atmosphere might, in turn and in a vicious cycle, contribute to less persistence of minority students in the pipeline to the professoriate (Slaughter, Ehrenberg, & Hanushek, 2004; Zambrana et al., 2015).

Staying on the theme of the sorts of environments in which minority students thrive, we could consider Historically Black Colleges and Universities (HBCUs). Black graduates of HBCUs are markedly more likely to have felt supported while in college and to be flourishing after college than black graduates of non-HBCUs (Seymour & Ray, 2015). And, in his research comparing the outcomes of Black
students at HBCUs and PWIs, Walter Allen notes that “on predominantly White campuses, Black students emphasize feelings of alienation, sensed hostility, racial discrimination, and lack of integration. On historically Black campuses, Black students emphasize feelings of engagement, connection, acceptance, and extensive support and encouragement” (Allen, 1992). Allen concludes percipiently that “consistent with accumulated evidence on human development, these students, like most human beings, develop best in environments where they feel valued, protected, accepted, and socially connected” (Allen, 1992). In addition to the intuitive psychosocial benefits they provide, HBCUs produce significant educational outcomes; for example, even though only 8.5% of Black undergraduates attend HBCUs, and even though HBCUs award only 16.7% of bachelor’s degrees and 17.8% of science and engineering bachelor’s degrees to Black students, nearly a third of Black science and engineering doctorate recipients from U.S. universities earned their bachelor’s degrees from HBCUs — in fact, of the top ten baccalaureate-origin institutions of Black STEM doctorate recipients, nine are HBCUs (National Science Foundation, National Center for Science and Engineering Statistics, 2015). Despite these successes at educating Black students, HBCUs are still underfunded compared to PWIs (Gasman, 2010; Sav, 2000; Lee & Keys, 2013a). This inequity in funding, combined with other issues (like their serving predominantly unprepared, low income, and first-generation students), contributes to the low graduation rates associated with HBCUs (Lee & Keys, 2013b; Gasman, 2013; Johnson, Bruch, & Gill, 2015).

**Income inequality** is perhaps the most involved factor indicted in race-based education disparities. America has become more economically unequal in the last 3-4 decades (Saez & Zucman, 2014; Urban Institute, 2015). But, as with many other social phenomena in America, the effect of this inequality is disproportionately virulent on minority populations. While in 1963, the average wealth of non-White families was $117,000 lower than the average wealth of White families, by 2013, the average wealth of Black families, just like the average wealth of Hispanic families, was lower than the average wealth of White families by over $500,000 (Urban Institute, 2015). In particular, White families were on average seven times wealthier than Black fami-
lies, and six times wealthier than Hispanic families (Urban Institute, 2015). Looking at medians paints a similarly distressing picture. While the median White household held wealth of $111,146 in 2011, the median Black household held wealth of $7,113, and the median Hispanic household wealth of $8,348 (Demos: Institute for Assets & Social Policy, 2015). This means that the typical Black family held only 6% of the wealth of the typical White family, and the typical Hispanic family held only 8% of the wealth of the typical White family (Demos: Institute for Assets & Social Policy, 2015). Among the factors that contribute to these disparities in wealth are historic and continuing discrimination in housing policies, labor polices, and returns to education (Demos: Institute for Assets & Social Policy, 2015). Of course, since on average non-White households hold only a fraction of the income and wealth of White families, they are on average unable to afford excellent private schools or expensive preparation for standardized tests to the extent that White families can.

![Wealth Accumulation and the Racial Wealth Gap in 2011](image)

**Figure 3-2: Wealth Accumulation and the Racial Wealth Gap in 2011**


Lastly, there is one more personal factor worth considering: parenting. According to data from the Center for Disease Control (CDC), since 2012 the yearly percentage of children born to unmarried women has been greater than 70%, with an all time high of 73% in 2012 (Child Trends Data Bank, 2011). The 2012 number for Hispanics is 53.2%, and the similar for Whites is 29.0%, with the overall rate in the United States in 2012 being 41.0% (Hamilton, Martin, & Ventura, 2013). With
research showing that children born out of wedlock are more likely to be raised in single-parent households, live in poverty, have low educational attainment, have lower income, and struggle with socio-emotional problems, a convincing case can be made for the contribution of this preponderance of out-of-wedlock births in Black and Hispanic communities to the racial achievement gap (Child Trends Data Bank, 2011). Now, according to one analysis, a closer look at the numbers tells us that one reason why the percentage of children born to unmarried Black women has risen so high is that married Black women now give birth at a way lower rate than they used to (Coates, 2013). Beyond this counterargument however, another possible explanation for these high levels of out-of-wedlock births in minority communities is the impact of criminal justice policies on these communities. According to data from the U.S. Census Bureau and the Bureau of Justice Statistics, in 2010, a Black person was 6 times as likely to be incarcerated as a White person, and a Latino person was about 3 times as likely, with even more pernicious outcomes for men of color in their thirties (Glaze, 2011; Wagner, 2011; The Sentencing Project, 2016). Taken together, if the presence of two parents in a household is necessary for the sort of psychosocial development needed for academic success, and minority households are typically without two parents in part because of criminal justice polices that disparately incarcerate people of color, the impact on minority educational outcomes — both immediately and down the line — of this nexus of factors, simply follows as a matter of logic.
Figure 3-3: People in U.S. Prisons in 2014, by race/ethnicity

Source: The Sentencing Project

Figure 3-4: Imprisonment Rate per 100,000, by gender/race/ethnicity

Source: The Sentencing Project
3.4 Simple Solutions in a Complex Education System: A Thought Experiment with System Dynamics

Now, although closely considering all these factors helps us understand what might be responsible for the racial education achievement gap, this is not sufficient. The added step that would truly ignite our understanding is contemplating how these factors interact with different policy options when unleashed together. To see clearly this interplay, we turn to system dynamics and its causal loop diagrams, together, tools for tracing the interrelationship among the different elements of a complex system. Developed in the 1950s by Jay Forrester at Massachusetts Institute of Technology (MIT) to help corporate managers understand complex industrial processes, system dynamics is a computer-aided method used to understand the (non-linear) changes over time in the actors and actions of complex systems, and to design and analyze policies for these systems. System dynamics has been used in this way for social, ecological, health, and industrial systems, among others. For example, Ghaffarzadegan and Larson (2014), in their Five Vicious Cycles paper, take a systems approach and a system dynamics model to consider the interconnected social, behavioural, and medical variables that affect posttraumatic stress disorder (PTSD) (Ghaffarzadegan & Larson, 2014). They also illustrate the interaction among these individual and social variables using a causal loop diagram that shows the barriers to effective interventions and the resulting policy implications (Ghaffarzadegan & Larson, 2014). System dynamics has also been used for different areas of the education system. Mital et al. (2014) use system dynamics and agent-based modelling to create framework for modelling a school as a complex system, while Altamirano and van Daalen (2004) develop a system dynamics model of primary and secondary education in Nicaragua to assist the national ministry of education there to investigate the impacts of different policy decisions on high school coverage and literacy (Mital, Moore, & Llewellyn, 2014; Altamirano & van Daalen, 2004). Shaffer reviews the literature on the use of systems
thinking in distance education before presenting an initial system dynamics model of distance education and calling for the building of a standard model of distance education; and Groff (2013) analyzes system dynamics and its practical application in the US education system, before using system dynamics, through a case study of the US state of Rhode Island, to explore the underlying dynamics of the current US educational system (Groff, 2013; Shaffer, 2005). This variety of uses of system dynamics serve as a testament to its performance and promise as a tool for analyzing and designing policy. It is this performance and promise we pursue here in using system dynamics for a different sort of contemplative policy analysis. Compared to these uses of system dynamics to study education systems, our approach here is different because it draws from a wider pool — the domains of the sociocultural, economic, pedagogic, and political — in explaining dynamic behaviour and racial disparities in the education system.

To consider how the forces in education as a complex system, which we have outlined so far, might interact with different policy proposals, we start by giving ourselves a time horizon of about 30 years to close the racial education achievement gap. To make our goal concrete, we choose to focus in particular on the relative absence of minority students at selective public institutions. Today, the rate at which Black students are present in these institutions is about half the rate for all students. So, to have, in 30 years from now, minority students present in selective universities at a rate commensurate with their presence in the population, one intuitive place to make a policy change is equity in school funding, especially in early childhood education. This is at first intuitive because common sense about education would suggest that amount of funding should positively correlate with level of academic achievement. That is, all else being equal, the more money we spend on schools, the more educated students should be on aggregate. The problem with this is that first, all else is rarely ever actually equal; second, even with studies that try to separate out and measure the effects or lack thereof of school funding on educational outcomes, there is no consensus on the presence or absence of effects; and third, we know enough about complex systems so far to not swallow whole common sense thinking regarding
causes and effects. So we trudge on with our thought experiment nonetheless.

![Figure 3-5: Percentage of students at 4-year public institutions who attend elite research universities, by race/ethnicity](source)

The end of a policy to create equity in school funding would ostensibly be that a child born to parents living in a place like Lexington, Massachusetts (median household income of $137,000, 75.5% of population White), can have as good a chance of starting life with the firm first foot of a good education as a child born to parents living in Baltimore, Maryland (median household income of $42,000, 63.7% of population Black) (United States Census Bureau, 2014). While the point has been made before, it bears repeating, not the least because arguments of simple cause-and-effect are so easy to reach for that we often unwittingly and reflexively superimpose them on concepts they do not apply to: the conclusion to draw from this thought experiment on the effects of equity in funding is not that if today, we somehow equalized school funding across the United States, all disparities in educational outcomes will be removed. No, the conclusion to draw is that while equity in funding may be a necessary condition for removing racial disparities in educational outcomes, it is unlikely that it a sufficient condition, and it is in part the interaction among several necessary conditions that this section focuses on. For example, another compelling
necessary condition our study thus far has revealed is the importance to academic accomplishment of a home culture supportive of education.

Equity in funding likely involves increasing funding to underfunded communities by taking funding away from some place else. Since we are looking for large scale effects over a long period of time, an obvious tool to effect such a proposal is the federal government. So, next, our thought experiment leads us to ask what are some plausible obstacles and reactions, both ideological and practical, we will face to a proposal of equity in funding, whether achieved through this particular tool or through alternate means? One obstacle is that because America's founding political and constitutional traditions and America's federal mode of government privilege the devolution of power to constituent units like state and local governments, the federal government is unlikely to be an effective vehicle for our end. So, as a workaround, we might consider starting at a level removed from the federal level. If we choose to start with a state like Massachusetts, we will need to convince the legislators of counties like Barnstable with median home values around $357,000 to vote for legislation that takes away an advantage that their constituents currently have: the permission to raise funds above the minimum per-pupil spending stipulated by the state for each school district and spend that money only for schools in their locality (Bankrate, 2016). That is, if we propose legislation to collect education taxes across the state, to allocate the taxes on an equal per-pupil basis to each district (after adjusting for local conditions like cost-of-living), and to disallow localities from raising more than their allocation to spend only on their locality, we likely will not get a lot of support from parents who lose the chance to put their children as far ahead as possible in an increasingly competitive society. This is a repudiation we can expect even before we consider plausible legal challenges to such legislation, a not unlikely outcome given the omnipresence in facets of American life of an ethos of individual determination and limited government.

The point here, and the dilemma we end up in, is perhaps more clearly shown with a crude illustration. Assume there is a certain selective school X with ten seats available every year to admit the ten best educated students. And suppose the
definition of equal opportunity we accept is the one that says if every child gets the same quality (public) education, then they have been given a fair chance by society to develop their natural talent and perhaps end up at this selective school X, which has a reputation for showing the way to broad flourishing — social, intellectual, economic, political — for its students. If we accept that the amount of funding a public school gets is even weakly positively correlated with the quality of education it can provide, then we should also accept that allowing certain schools to be better funded means that students that attend those schools get a better education, which in turn means that these students that attend the better funded schools have a better (unfair) chance than students that don’t attend the better funded schools to end up at selective school X. Yet, the simple solution of equalizing funding does not seem achievable, nor is there any certainty that even if it were achieved, it would make a large enough difference.

To have, in 30 years from now, minority students present in selective universities at a rate commensurate with their presence in the population, another intuitive policy change to make is to, starting now, gradually allow in more minority students into these selective universities — in other words, a more aggressive form of affirmative action, the policy that in part motivated this thesis. As before, we ought to consider the plausible obstacles and reactions, both ideological and practical, to this proposed policy. The first problem we run into is something we saw from our treatment of education as a complex system in the previous section, and something we learned from our interviews with several administrators at selective schools: there are not currently enough qualified minority students (by measures like standardized tests, high school GPAs, and AP classes) coursing through the education system to make this a practical policy option. But what if we choose to ignore the dearth of talent and instead, pursuing this policy of aggressive affirmative action, make our standards flexible enough to admit the number of minority students we desire. This simple solution — aggressive affirmative action — propped up as it is by a disregard for practical barriers like the paucity of minority talent does not exist only as a figment of our thought experiment. The Texas Ten Percent Plan, a workaround for the Hopwood
decision, which made the use of race in making admissions decisions illegal, is cut from
the same cloth as this proposed simple solution. In Texas, high schools are typically
segregated; that is, in certain schools, the bulk of students are Black or Hispanic,
and in other schools, the bulk of students are White, with not many schools having a
balance among different races. To create a diverse university system despite Hopwood,
the Texas Ten Percent Plan takes advantage of this demographic distribution and
mandates that students in the top ten percent of their graduating class at any Texas
high school automatically get admission to the state university system. This solution,
simple as it is, does not deal with the issue of the relative academic rigor of different
high schools and the questions that raises: for instance, what happens to a student
who, having graduated at the top of his class in a school that is one of the least
challenging in the state, finds himself admitted to University of Texas, Austin, one
of the state flagships, where he might be bottom of the distribution with respect
to academic preparation? Here, we come up against the predicted consequences of
the mismatch hypothesis — academic failure if underprepared students get admitted
to selective institutions — and might have to live with a Pyrrhic victory: getting
minority students admitted in the large numbers desired but losing the educational
flourishing that is inarguably more important.

Finally, this discussion of hypothetical polices is of course not exhaustive, existing
as it does against a backdrop of complex forces we discussed earlier in this chapter.
So, we turn to the causal loop diagrams of system dynamics models to illustrate both
how the policies proposed might interact hypothetically and how other forces we know
of but did not acknowledge in this section might affect that interaction. Causal loop
diagrams are a tool from systems dynamics modelling that help us how the different
variable in a system affect and are affected by one another. The fundamental unit of a
causal loop diagram is a link originating from one node and ending at another, where
the two nodes represent two variables, and the link means a change in one of the
variables is associated with a change in the other. Links are described with positive
or negative signs at the ending nodes, where positive signs mean that an increase (or
decrease) in the variable at one node is associated with an increase (or decrease) in
the variable at the other end, and negative signs meaning an increase (or decrease) in the variable at one node is associated with a decrease (or increase) in the variable at the other end. When several links join one to another in a causal loop diagram, they form a loop, which can either be reinforcing or balancing. Although we do not explore either of them here to keep our illustration simple, with reinforcing loops, a variable changes (increases or decreases) and then this change is propagated through the loop in such a manner that it returns to this variable as the same type of change on the variable (increase or decrease), and with balancing loops, a variable changes (increases or decreases) and then this change is propagated through the loop in such a manner that it returns to this variable as a different type of change on the variable (decrease or increase).

With these explanations in mind we can explore our use of causal loop diagrams to illustrate the complexities in our hypothetical policies. Some variables in our causal loop diagram — and they are all closely informed by our discussion in this thesis so far — include political factors like a climate supportive of affirmative action, economic factors like income inequality, and social factors like parental involvement in education. So, for example, we expect that an increase in economic opportunity and prosperity will mean an increase in a political climate supportive of affirmative action, which will mean a more aggressive use of affirmative action, which will positively affect our eventual goal of having more students from racial minority groups graduate from selective institutions. Also, we expect that an increase in economic opportunity and prosperity will make policy options like equity in education funding (especially early childhood education) more likely, which will make minority students in the K-12 system more likely to succeed, which will in turn make them more likely to be admitted to and to graduate from selective schools. We could go on, but our initial description of a causal loop diagram means that other causal links between different factors can be more easily understood. Besides, our goal here is not to fully simulate the complexity of the education system; instead, it is to employ the tools of system dynamics modelling — in particular, the illustration of causal loop diagrams — to understand the complex consequences of policies in education. What is more
important to acknowledge here is that beyond how basic causal loop diagrams might seem for illustrations, their real power comes when they are used as a stepping stone to design actual system dynamics models. The usefulness of such a model is especially promising because many of the variables identified in our causal loop diagram have been operationalized and measured by political scientists, psychologist, economists, and other social scientists. This means that in a fuller treatment, the interrelationship among the different variables of our complex model of education can be represented by appropriate mathematical equations, which can then be empirically tested with data.

Figure 3-6: Illustrative Causal Loop Diagram
Chapter 4

Policy Conclusions: No Silver Bullets
For my belief is that if we live another century or so — i am talking of the common life which is the real life and not of the little separate lives which we live as individuals — and have five hundred a year each of us and rooms of our own; if we have the habit of freedom and the courage to write exactly what we think; if we escape a little from the common sitting-room and see human beings not always in their relation to each other but in relation to reality; and the sky, too, and the trees or whatever it may be in themselves; if we look past Milton's bogey, for no human being should shut out the view; if we face the fact, for it is a fact, that there is no arm to cling to, but that we go alone and that our relation is to the world of reality and not only to the world of men and women, then the opportunity will come and the dead poet who was Shakespeare's sister will put on the body which she has so often laid down.

Virginia Woolf, A Room of One's Own
As worthy intellectual endeavors often do, this work started because of an earnest curiosity, because of a sense of bemusement at how, as regular as clockwork, educational outcomes of minority students — in particular Black and Hispanic students — were often far poorer than the rest of the population's. Wherever we looked, whatever we looked at, we could see evidence of the gap between the educational outcomes of minority students and the outcomes of the rest of the population. We could see it in SAT scores and ACT scores, in high school graduation and college retention, in admissions to elite schools and in matriculation into STEM PhD programs. In fact, save for the caution we took, we would have gotten comfortable assuming — even before we had data to know one way or the other — that for any given measure of academic achievement we encountered, students from minority ethnic groups would achieve at levels way lower than the population average.

We existed in this state of befuddlement until we got reintroduced to the work of Jamie Escalante — foremost — and David Laude. Just when we were about to drown in the deluge of measures reinforcing the idea of minority underachievement, we rediscovered floating nearby two existence proofs of academic excellence. Our reaction to this was first scholarly relief and next further curiosity: how did Escalante and Laude achieve the results they achieved, we wondered. Escalante took a small class of underachieving Black and Hispanic students from a poor East Los Angeles neighborhood to national renown with outstanding performance in the difficult AP Calculus exams. Laude took a group of students statistically predicted to struggle and drop out of the University of Texas Austin and helped them transcend those expectations and succeed academically. In trying to answer the question of how Escalante and Laude achieved what they achieved with their students, we found ourselves returning again and again to several themes: both men were uncommonly dedicated to their students' success; both had autonomy to design the interventions they believed would work; both men set high expectations for their students and waited long enough to see their methods succeed. Enthralled by this duo's success, we searched around for other examples of such success, albeit ones that worked at a larger scale. We became interested in larger programs that achieved similarly outstanding
results, using similar principles, for a larger group of students, for a longer period of time.

That is how we came by the two education intervention programs we studied here: MIT Summer Research Program (MSRP) at MIT and Meyerhoff Scholars Program at UMBC. MIT has been the school that provides the second highest number of Black students for STEM PhDs among Predominantly White Institutions (PWIs) and MSRP has been sending minority students to top doctoral STEM programs for decades. Today, MSRP does this by providing a summer long experience for about 50 students to conduct research with MIT faculty, get mentorship on research and graduate life from MIT graduate students, and get information and preparation on applying to competitive graduate programs from a host of people that know a thing or two about that. For its part, Meyerhoff, has a program experience whose participants are five times more likely to have graduated from or be currently attending STEM PhD programs than a comparable group of students. To achieve this, it recruits high-achieving high school students and immerses them — starting in the summer before college — in a culture of high expectations, psychosocial enrichment, academic and research preparation, and self-affirmation. Together, both programs have served several thousands of students over at least three decades.

With these two programs, then, we could take a closer look, to see if and how the principles we had teased out (from studying Escalante and Laude) were applicable to a larger group of students over a longer period of time. These are in part the questions this thesis sought to answer, and the answer to the former question is a qualified “yes”. The pervasiveness of our motivating problem — the racial education achievement gap — means however that we cannot be satisfied with only the knowledge that programs like Meyerhoff and MSRP, large programs that they are compared to the one-man efforts of Laude and Escalante, can close the racial education achievement gap in their own little ways. To do more than the worthy little that these programs do now and close the gap appreciably, we need more programs like them, or at least more of what these programs do even if outside of structures like education intervention programs. How to address this challenge of scale is what we turn to now.
Individual-inspired programs like Laude's and Escalante's

College-based intervention programs like MSRP and Meyerhoff

What solution(s) achieve similar results on a large scale?

Figure 4-1: The Problem of Scaling Success
4.1 Policy Recommendations

1. Valuing Teaching and Mentorship with Student-Centered Postdoctoral Fellowships

Whether through singular actors like Laude and Escalante, or through programmatic actors like MSRP and Meyerhoff, we know that for students to flourish academically, they need, among other things, a surrounding structure fiercely and intimately dedicated to making them flourish. In Laude’s case, that meant creating a separate class for the students that struggled and giving them the dedicated attention they needed. It also meant assigning mentors to these students to help their mental development. For Escalante, this meant knowing his students parents and grandparents, knowing the challenges his students faced at home, working at odd hours and in uncomfortable spaces to achieve academic success. Marika told us, regarding the MSRP coordinator when for her cohort, “I talk to her probably once every two months, just to kind of clarify my thoughts, because I know she cares about me, and she cares past that summer, like she wants to make sure like I am good, like when I applied for graduate school, she was running the phones here trying to figure out like why y’all playing with her application, like she’s...they are advocates for you, so and they are not, you know quiet about it, about the fact that they are working on your best behalf, you know your interest...they want you to grow, they want you to get something out of it. so, yeah, the end of the nine weeks, I was like oh my God, like he wasn’t lying, he [her friend, Kenny] was serious about this whole change of life thing.” In a similar fashion, Jorah told us about the personal dedication the Meyerhoff staff showed in wielding their relationships at different institutions to provide alternate options for him when he faced repeated failure in accomplishing his career goals.

What is important here is not the personal sacrifices these individuals and programs made. What is important is the mindset that made those sacrifices conceivable. It is a mindset that takes as singularly preeminent the flourishing
of each individual student. And it is a mindset that is only possible because these individuals and programs often dealt with a handful of students. To have more of the sort of successes these individuals and programs molded, we need to spread across our universities a similar mentality, an emphasis on teaching and nurturing each student to blossoming. There are concrete steps we can take to start this cultural shift. For instance, evidence shows that way more STEM PhDs are being produced than the STEM academy can reasonably reabsorb via faculty positions (Xue & Larson, 2015). Instead of leaving these talented individuals to languish in academia’s postdoctoral purgatory, we should deflate the oversupply of talent for academic jobs by incentivizing these individuals away from tenure-track academia towards a different sort of academic work.

With a mind in particular on PhD graduates with desires to teach and mentor students, we should create student-centered postdoctoral fellowships in lieu of today’s research-focused postdoctoral fellowships. Laude’s actual chemistry class had about 500 students. From this group, he selected the 50 most susceptible to focus attention on. There were other vulnerable students in that class of 500 of course, but there was a limit to how many Laude, being just one individual, could work with. This policy proposal would mean that with the dedicated attention of a few chemistry student-centered postdoctoral fellows, combined with mentorship provided by other current students, we can recreate, in a handful of new cohorts of about 50 students, the conditions that allowed Laude be successful with the students he worked with. We can repeat this for other large STEM areas that students have historically struggled in, like physics and mathematics, and across several of the largest state universities. To recruit these fellows, we need to offer incentives like salaries competitive with private sector research positions and commensurate with the training of a Doctor. Remembering the lessons from successful programs like MSRP and Meyerhoff, we will also need to make sure that the group of student-centered postdoctoral fellows is diverse with respect to important social indicators like race, gender and social economic status. Also, we will need enough of them to ensure that we can
form several small cohorts since, as indicated by the individuals and programs we have studied, intimacy contributes to the success of interventions, and we do not want that intimacy compromised by us choosing to instead form a few large cohorts. Beyond the number of fellows needed to keep a program successful, we can expect other sorts of logistical challenges. And to counter the predictable logistical problems of having several small education intervention programs in a university, we should keep logistical support as a central function provided through the university. Of course, all these will cost a lot of money — one of the programs we studied costs about $10,000 per student to run — and it will require a significant shift in the thinking and culture about what is important in a university, but given what we have seen about education as a complex system, we should not find surprising the heft of the changes required.

2. Acknowledging the Plausibility of Mismatch with Mismatch-Aware Affirmative Action

If the goal is to increase the number of minority students graduating from selective colleges — and that is the goal here — the question cannot be about whether or not affirmative action is a necessary tool — it is inevitable, at least in the immediate term, that it is — but only about in what ways affirmative action be used that captures its benefits and mitigates its shortcomings. One shortcoming is mismatch hypothesis, which, while not a settled theory, seems compelling. The idea of the mismatch hypothesis is that students who are underprepared with respect to the average preparedness level of a class will struggle academically because instruction is geared towards the average preparedness level expected of the class. To anyone who has spent enough time in an education system designed around classes with dozens of students and hours of depersonalized instruction, this idea is more than plausible. Admitting mismatch is at least compelling is understandably politically fraught for supporters of affirmative action since any acknowledgement of the plausibility of mismatch
is seen — reasonably — by these supporters as them giving too much to opponents that reject affirmative action as a matter of principle, not merely on the grounds of its consequences. And on consequences, the counterintuitiveness of the mismatch effect — affirmative action, which is supposed to open doors to academic success, can lead to academic failure — is consistent with the notion of unanticipated consequences for actions, a notion we have now learned to expect from the education system when it is viewed as a complex system. Yet, since colleges must use affirmative action if they are to keep diversity today, one policy change that keep affirmative action and diversity but stave off the academic failure predicted by mismatch is something we call mismatch-aware affirmative action: a policy that replaces the current accept-and-abandon model of affirmative action with one that acknowledges the plausibility of mismatch and in anticipation of mismatch provides interventions before or upon matriculation.

What should these interventions look like and in what ways should they be implemented? These interventions can come in different designs as far as there is evidence of the designs’ effectiveness. For example, while it is commendable that large state universities like University of North Carolina Chapel Hill and Pennsylvania State University are now replicating the Meyerhoff model, universities that cannot for whatever reason replicate the whole model can choose instead to borrow from the principles of Meyerhoff’s Summer Bridge. Summer Bridge is set up to provide an environment of high expectations, academic preparation, and self affirmation to a group of high achieving students. But there is no reason why this model cannot be applied to provide reinforcements to students that are expected to struggle.

One hiccup worth addressing is the extent of institutional support for a proposal like this, a proposal that marks a dramatic change for some universities in how they handle education. With Meyerhoff, there is the near-guarantee of institutional support through the person of one individual — the program was conceived by, midwifed by, and has as a chief advocate, the current school
president, Freeman Hrabowski, an educator with a strong track record in mentoring and educating minority students successfully. This means that the sort of institutional shenanigans that would have derailed an effort like Meyerhoff at another university were likely tempered at UMBC and replaced with a corollary of institutional support. That said, it is not important that support for an initiative like the one we propose is inspired mainly through one individual; it is only important that a university considering adopting this proposal recognizes the need to create institutional support, one way or another. Also and necessarily, for this model of preemptive intervention to work, colleges will have to acknowledge that they sometimes admit students whom they can predict will struggle academically, instead of the current pablum that every student admitted is exceptional and poised for success. At the same time, in considering this proposal, colleges will be right to be worried about the consequences of labelling some students as not up to scratch from the get go, especially since minority students today already feel stigmatized as academically inferior because of a perception that they are undeserving affirmative action admits. Nonetheless, this should not detract from providing necessary help to the students that need it; instead, such a tarring culture should be remolded, something we come back to in our next policy recommendation.

3. Remolding Universities’ Cultures to Support Success for Minority Students

The last and arguably most important of our suggestions is also the most intangible. Beyond setting high expectations, beyond giving information, beyond providing preparation, the one other quality all the models of success we have encountered so far share is an unmistakable belief in the worth of every student. Not a belief of the hollow sort declaimed through public relations statements. No, in these examples, students did not have to question their worthiness, and those that did were quickly disabused of such perceptions whether through
discussions with those who worked them or from experiencing the activities
designed for them. Several of our interviewees in fact ascribed their successes
and feelings of wholeness in intervention programs to the presence of other stu-
dents just like them around them. One interviewee in particular, a student at
MIT, averred that the Black Graduate Students Association (BGSA) at MIT
recreates the sort of affirming safe space that the programs of our case study
deliberately conjure to induce academic success. What these insights coalesce
into is not necessarily one exact policy recommendation. Instead, it coalesces
into a suggestion that universities consider the subliminal cultural messages
they disseminate, about who is worthy and who is not, and the effects these
messages can have. The presidency of President Barack Obama, for example,
sends an uplifting message to millions of Black boys and girls about what is
possible and what is worthy. If in fact the minority students who end up at
selective institutions will blossom and graduate and contribute to closing the
racial education achievement gap, they need the nourishment of an affirming
culture. Imagine a Black student with aspirations to the professoriate who daily
walks along the corridors of different departments at her school and observes
that invariably professors, past and present, do not look like her. This sort of
message absorbed uncritically might — not unreasonably — lead her to believe
that professorships are not for people like her. Just as a teacher might teach
to the median student, a culture is oriented towards its predominant mem-
bbers. The assumption it makes and the priorities it sets, if not deliberately
checked, default to the preferences of its dominant members. Watching out for
this cultural blind spot in the administration of a university is the crux of this
recommendation.
4.2 A Final Word on Complexity and Chaos in the Education System

Granted that with the racial education achievement gap, cause and effect is often difficult to untangle, a simple thought experiment might starkly, if simplistically, explain the issue. Take two populations, population A and population B. Also take that the factors that result in educational outcomes for these two populations are either inherent in them — these we call "internal factors" — or inculcated in them by their environment — these we call "external factors". Suffice to say that relevant external factors will include at least the pedagogic, the social, the educational, and the economic, and that relevant internal factors fall along the lines of qualities that come inerded in the populations, like intellectual ability. If these internal and external factors cover all that is relevant to producing educational outcomes, and if the internal and external inputs are the same, the educational outcomes should necessarily be similar. And if the educational outcomes are dissimilar for these two populations, then either the internal or the external factors are different. This means that wherever we find a different educational outcome, we ought to be able to trace its existence to the existence of one or more different educational (internal or external) inputs. We also ought to be able to crowscheck by demonstrating to ourselves that these inputs which differ are actually relevant to educational outcomes. Said another way, when a group of learners are guided through a course of educational instruction with accompanying support, the impact of the instruction should be, all else being equal, similar for individual students and subgroups of students. In America today, the educational outcomes of children of different races are not the same because all else is not equal. For a very long time, all else has not been equal. Understanding and correcting this discrepancy is why we have embarked on this thesis.

We started this thesis by identifying two phenomena: the troubling and pervasive racial education achievement gap — especially its manifestation on college campuses — and the controversial question of the place of affirmative action in American education. We then introduced college-based education intervention programs, asking as
our central question how these programs can be used to both keep racial diversity and close the racial education achievement gap on America’s campuses. To answer this question, we turned to two programs — the Meyerhoff Scholars Program at UMBC and the MIT Summer Research Program at MIT — that have successfully nurtured minority students for academic excellence, where in this case, we looked to excellence at earning STEM PhDs (from selective institutions). Taking a case study approach, we wanted to illustrate, through the designs of the programs and the experiences of their participants, the conditions that foster academic excellence in minority students. And from the results of our case study, we hoped to learn what might be done to engender the sort of (education) system-wide excellence that is needed to close the racial achievement gap and maintain diversity on America’s college campuses. While the results of our case study revealed some important factors necessary for academic success among minority students, we urged caution in jumping from the revelations of our case study to a conclusion that on their face, the factors revealed, if embraced widely, are sufficient to create systemic improvements. To make our case for caution, we theorized that the education system is best understood as a complex system, with interlocking forces of the political, economic, pedagogic, and sociocultural kind. To make this complexity clear, we illustrated potential interactions in the system using the causal loop diagrams from system dynamics modelling. Finally, informed by the richness of our new understanding of education as complex system, we proposed three policy recommendations to improve not just the presence of underrepresented minority students at selective institutions, but, more importantly, their thriving.

Education is one of those concepts about which countless aphorisms have been written. We have been told that “it is not the filling of a pail, but the lighting of a fire”; that “it is the most powerful weapon which you can use to change the world”; that “it is life itself”. After we allow that aphorisms must be reductive, we recognize the kernels of truth in these simple ideas. We recognize how important education, formal or informal, is to the social, economic and political flourishing of an individual and a society. Despite this recognition, we do not have to look very far before we encounter stories of educational failure, evidence of lives of unfulfilled
potential we are sure could have been different if the educational system worked right. In the United States, these stories of wasted promise — sometimes submerged in test scores and admission rates, in retention rates and graduation statistics — often feature certain groups more often: racial minorities, women, the poor, those who do not have a history of education in their family. Notwithstanding the ubiquity of such stories, we know systemic education dysfunction and its consequences are neither inevitable nor unassailable. We know this because of the examples of both individual and institutional brilliance we have explored here. Yet, what we desire is systemic excellence. But to achieve systemic excellence, we should not expect any easy solutions. After all, a complex system is defined in part by its aversion to silver bullet solutions, a notion soundly covered by Larson and Murray in their paper, *STEM Education: Inferring Promising Systems Changes from Experiences with MIT BLOSSOMS* (Larson & Murray, 2016). For while education intervention programs, as we have studied them here, and our recommended policies, which are inspired by what we understand about education intervention, can be additive or corrective, they are not designed to transform a whole educational system. If the goal is to make a difference for one, a hundred, or a thousand students, then perhaps we can replicate existing successful models, or take up some of our preceding recommendations, to make such a transformation. But if the goal is to make systemic change that would affect the lives of hundreds of thousands or millions of students, then we should expect that the forces to be moved are entrenched, the efforts needed are gargantuan, the time horizon is far out, and the approaches to be taken simultaneously are varied. In this sense then, we should expect that making the sort of systemic changes that will close the racial education achievement gap will be a little like playing Whack-A-Mole: just when we will think have one solution pinned down, another dimension of the problem will spring up. This, from a complex systems perspective, should not be unnerving, only humbling. If there is one sentiment that captures this spirit of chaos and complexity, it is this: whenever, in those ever-present conversations about the travails of the American education system and the disparities it carries, one party to the conversation utters the popular reductive statement of the form “the problem is
X (where X is one thing), and all we have to do is Y (where Y also is one thing)," that party would be leaving out a lot of what is known and intractable about the American education system and the disparities in it. History suggests that great change comes with corresponding upheaval. The undeniable progress of Black people in the United States from the pre-Civil Rights Era to today is the direct result of great social and political upheaval. Transformative laws like the 1964 Civil Rights Act were passed. A progressive Supreme Court ruled on Brown v. Board of Education. A realignment in the political affiliations of different regions of the country followed. It would be naive of us to expect anything other than great changes for the great racial education achievement gaps to be closed.
References


pushing-graduates-specific-majors-wrong-essay.


