

Exploring Factors for High School Success in Middletown School District

Ryan Breen, Ellen Chang, Michelle Rosen, and Suet Ning Wong

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Introduction

In this study we analyze the correlation between a variety of factors and student success in Middletown public schools. We followed the 2012, 2013, and 2014 graduating cohorts of Middletown High School, analyzing the effect that redistricting policies, as well as race, income, and elementary school resources, had on their high school success. Our study was proposed by the Middlesex Coalition for Children in response to a number of questions about the achievement gap and other success factors in Middletown public schools.

The achievement gap is a phenomenon of consistent disparities in school success between students of different income levels, races, and geographical areas across the United States (NAEP 2015). We set out to research what factors contribute the most to this disparity in Middletown. We focused on the redistricting and busing of elementary students as a result of the Connecticut Racial Imbalance Law, which states that “a school

is considered imbalanced if its minority enrollment is more than 25 percentage points above or below that of the district as a whole” (Lohman 2010). Because Middletown’s eight elementary schools (Bielefield, Farm Hill, Lawrence, Macdonough, Moody, Snow, Spencer, and Wesley) have frequently been on the brink of “racial imbalance,” the district has re-assigned a number of students to new schools over the past 15 years. This has resulted in students being “bused” from their neighborhood elementary school to other elementary schools within the district (see Literature Review for more on Busing).

Policy makers nation-wide have made a variety of assumptions about the effect that this experience has on students, but the Middlesex Coalition for Children wanted a study done that focused specifically on Middletown. Accordingly, we examined busing, as well as income, race, opportunity level, and elementary school resources, to determine whether busing was a significant factor that impacted high school success. We looked at the fourth and twelfth grade records of three graduating classes to track the trajectory of students, using GPA, attendance records, and post-graduation plans as indicators of success.

The results of our study present an inconclusive picture of busing in Middletown. The data used in this report were plagued with inconsistencies, missing data points, and duplicate information due to factors we could not control. We cleaned the data to the best of our ability, but throughout our analysis we found many conflicting trends among bused populations in Middletown. Race and income were found to be influential on student success in Middletown, but our results, based by small sample sizes, made it difficult to draw any firm conclusions.

Unfortunately, the students we were most interested in (low-income, students of color) were often missing in the administration's records. Students who dropped out or switched schools were difficult to track, and it may be that a large portion of those students came from these demographics. Ultimately, our study may be most useful in creating a framework that would allow a comprehensive study to be performed in the future, if precise data could be obtained.

Possible Factors Affecting Students' Academic Performance: A

Literature Review

There are two categories of factors that we looked at in relation to the achievement gap. The first category is structural factors, those that are embedded in the systems of school districts, local governments, and local economies. We specifically looked at busing programs, elementary school resources, and opportunity level. The second is individual factors, those that are unique to each student. In this category, we focused on race and ethnicity, and students' family income.

Structural Factors

Busing

Busing programs redistribute school populations within or between school districts by sending selected students to schools other than their school of closest proximity. *Brown v. Topeka Board of Ed.* (1954) mandated the desegregation of schools,

therefore many of these programs in the past were enacted in response to racial imbalance in neighborhoods, to change racial demographics of schools. We wanted to explore the effects of busing on students' high school success, but there is a noticeable lack of relevant studies on busing and associated anti-segregation school programs.

Students of color are disproportionately involved in busing programs, with the majority being Black from lower-income families and/or low-opportunity areas (Angrist et al. 2004). It is important to question if these students are positively impacted by busing programs. Determining the full impact of busing on students' performance, however, can be difficult, as most past studies compare bused and non-bused students who attended the same school (Angrist et al. 2004), rather than comparing bused students with non-bused students who attended school in their original district. In the first scenario, the captured effect is that of different students' backgrounds rather than the impact of attending a school in another neighborhood or district.

It is unclear whether performance discrepancies between bused and non-bused students at the same school are due to past exposure to different school environments (cultural capital) or access to more educational resources (material capital) before being bused. Dominant cultural capital, as described by Carter (2003), encompasses social behaviors and knowledge typically associated with White middle and upper-middle socioeconomic class and social groups. It is generally assumed that being around this type of cultural capital, present in the host schools of busing programs and presumably absent from a student's closest neighborhood school, may be "learned" and co-opted by

bused students for success within the school system and in their post-grad lives (Carter 2003).

An examination of Boston's Metropolitan Council for Educational Opportunity program (METCO), established in 1966 by the Massachusetts Board of Education to decrease racial isolation and close opportunity and achievement gaps, demonstrates this phenomenon. Angrist et al. found that METCO students, bused from underperforming urban districts in Boston to surrounding school districts in more affluent suburbs, generally continued to perform lower on state standardized tests than their White non-METCO peers. This lack of significant impact on improving student academic and testing performance emerges in studies of more recent racial integration programs (Angrist et al. 2004).

Several important considerations of the impact of racial balance/integration programs via busing have not been thoroughly looked at. Whereas there is a decent number of studies on the impact of these programs on bused students' standardized test performance, little material exists on the impact on other measures of student success and achievement, such as high school GPA. Surprisingly, Connecticut has adopted state-mandated racial balance quotas based on busing, despite the relatively small amount of research on the topic.

Elementary school resources

Moving into other structural factors, we wanted to explore elementary school resources, an area with contested importance and conflicting results. Measure of resources usually include real resources of classrooms such as teacher education, teacher

experience, teacher-pupil ratio; financial capital such as expenditure per student and teacher salary; and others such as administration and facilities. Hanushek (1997) found that there is no overall significant relationship between a school's resources and student performance, even in more rigorous studies that compared students' current performance to prior performance.

A meta-analysis of school resources by Greenwald et al. (1996) contends, however, that some longitudinal studies or research controlling for socioeconomic factors show that there is an effect. They found that resources such as expenditure per student, teacher experience, teacher qualification, and smaller class sizes are positively related to student achievements.

Because there seems to be a lack of conclusive evidence on the direct effects of school resources, we wanted to chart school resources in Middletown elementary schools with high school success to see if any correlations were present in the district.

Opportunity Level

Opportunity level is a metric that presents a comprehensive measure of the health of a community and the ability of its residents to obtain success. It is predicated on the belief that one's surroundings can greatly affect the outcomes of residents in a community and is calculated using three types of indicators: educational, economic, and residential (Gaul 2015).

Studying the importance of surroundings in childhood success, Chetty, Hendren, and Katz (2016) recently showed that providing housing assistance for low-income families in areas with less poverty improved the future earnings of children by 30%, if the

child moved into the area between the ages of 4-12. Another study by Chetty and Hendren (2015) demonstrated a strong correlation between a child's adult earnings and their local area, claiming statistically significant causality between the two variables. There is some debate about the causality of neighborhoods alone: Sanbonmatsu et al. (2006) posits that educational environment, rather than residential environment, is the main source of attainment differences among children, outside of familial characteristics.

Individual Factors:

Race and Ethnicity

Previous studies have shown that there is often an achievement gap between students of different races, in particular between Black and White students and Latino and White students. Many researchers have observed that disparities begin in early education and persist through high school graduation, college attendance, and labor force participation in early adulthood (Rumberger & Willms 1992). With this gap in mind, researchers have set out to explain why this phenomenon exists.

One possible explanation is the “discipline gap” that exists between children of different races. Gregory, Skiba & Pedro (2010) suggest that the disproportionate suspension and expulsion of Black, Latino, and American Indian children causes these students to fall behind. They posit that this could be a result of a number of factors affecting actual behavior — for example, a higher percentage of minority students living in high crime/violent neighborhoods — but the researchers also documented many instances of minority students being singled out for behavioral infractions more often than their White peers. This implies that minority students are singled out for breaking

rules at a higher rate than their White peers, despite similar amounts of self-reported misbehavior. Because suspensions also tend to act as catalysts for further misbehavior, this cycle could contribute to long-term achievement gaps between students of different races.

Another explanation is that parent involvement may affect elementary school children's achievement. Lee & Bowen (2006) set out to explain the achievement gap by exploring five different types of parent involvement and the difference in average involvement of different races. Overall, the study found that increased parent involvement led to higher child achievement in school, often leaving low-income families at a disadvantage because of busier schedules and lack of access to information and resources. Again, because of the tight correlation between race and class, parents of minority students are thus less likely to have high involvement with elementary school students.

As one would imagine, the quality of school also plays an important role in the achievement gap between White and minority groups, and school quality is closely tied to race (Fryer & Levitt 2004). Fryer & Levitt found that student performance between different races was identical upon entering kindergarten, and only began to vary through the course of schooling. Here we begin to see the influence of individual and structural factors on each other, which can occur when dealing with complex issues of success and education.

Students' Family Income

As previously noted, race and income are often linked in America and just like race, family income has long been one of the strongest factors in determining a student's success (Mayer 2010). One of the central reasons that income can impact a student is the financial barrier associated with living within the "attendance boundary" for an elementary school or middle school. High resource elementary schools often lie in areas where the cost of living is higher, reflected in more expensive housing options and fewer opportunities for low-income families to thrive (Boggs 2015).

Family income can also have more indirect effects on a child's eventual success in school, stemming most frequently from developmental issues associated with poverty. Studies show that the health risks, stresses, and environments associated with poverty tend to have a negative impact on a child's cognition and eventual success in school (Jensen 2009). Social and emotional instability can be a result of adverse conditions surrounding families in poverty, where children have measurably less access to safe, stable environments, caregivers and personalized enriching activity (Jensen 2009). Children in poverty are also exposed to significantly more *chronic* stress, which refers to high stress sustained over time (Jensen 2009). Chronic stress may stem from overcrowded or substandard housing, unsafe neighborhoods or exposure to violence inside and outside of the home, and can actually affect a child's developing mind, possibly even depleting brain regions associated with judgment making (Cook & Wellman 2004), and the ability to learn (Vythilingam et al. 2002).

Methodology

Study Sample

Our study sample consists of three groups of students from the Middletown Public Schools. We collected data on the graduating classes of 2012, 2013, and 2014 at two junctures: when the students were in fourth grade in the academic years 2003-2006 and their respective twelfth grade years. We requested and received the student database information from the records department of the Middletown Superintendent's office. No names were used in this study, and students were identified with ID numbers, issued by Rediker Software and/or State Assigned Student Identifier (SASID) numbers to protect privacy and confidentiality of the students in question.

Our study required that we obtain consistent data for the cohorts in fourth grade and twelfth grade so that the sets could be merged and studied. This proved to be difficult and a large number of students were lost because of data inconsistencies and missing information. We received four datasets of student characteristics for each of the studied cohorts. Two were fourth grade characteristics and the other two were twelfth grade characteristics (see table in Appendix for details). **Table 1** and **2** show the original number of individuals in each dataset and the final number of usable individuals for the current study.

Table 1. Original Number of Students for Each Dataset by Cohort.

	2012	2013	2014
Original Number in Elementary Dataset 1	570	663	718
Original Number in Elementary Dataset 2	413	418	416
Original Number in High School Dataset 1	574	574	299
Original Number in High School Dataset 2	299	348	340

Table 2. Final Number of Usable Cases After Combining All Four Datasets by Cohort Using Identification Numbers (RedikerID and/or SASID).

Column1	2012	2013	2014	Total
Final Number of Usable Cases	159	239	199	576

This is the final number after excluding 643 individuals from 2012, 1282 from 2013, and 758 from 2014 due to inconsistencies in data (see Appendix for details).

The final 576 students represent all the individuals we were able to track for the entirety of their time in Middletown schools. This does not necessitate that all of these students stayed in the Middletown Public School System between the two observation points, as some may have left and re-entered the district. This is a limitation in our study because it may mean that educational environment differed for some students' middle school years if they transferred in or out of the district in between our two observation

points. However, by looking at three different cohorts we sought to expand our sample size and reduce the impact of outliers and individual variability overall.

Despite our best efforts, the small sample size resulting from data holes and inconsistencies prevented us from reaching clear conclusions about these students and the impact of busing. Discrepancies stemming from changed data systems and perhaps incomplete record-keeping exist between the fourth grade and twelfth grade data resulting in differing class sizes, duplicate students with identical Rediker IDs but different personal information, lack of signifying information, missing data on students who did not complete high school, information left blank for some students, and more. This strongly impacted the conclusions we were able to draw from our data. However, we were able to construct a methodology that would be useful in exploring questions of student high school success and the existence of an achievement gap in Middletown public schools, given access to the needed data. Additionally, while the data we present from our study should be looked at critically given its inherent issues and lack of statistical significance, it still is suggestive of certain conclusions. (See Appendix for details on data issues.)

Defining Variables

Structural Variables

Bused vs. Non-bused

We looked at whether bused students bused fared better or worse in high school than their peers who lived in similar neighborhoods but were not bused. Again, these are students who were bused to comply with Middletown's Racial Imbalance Plan.

Generally, it is better to have a large and equal sample size between groups that are being compared. However, since there are fewer students in the bused group than the non-bused group, this resulted in an unequal sample size between the two groups. Furthermore, due to data inconsistencies and transiency of students, our sample sizes for both groups were significantly reduced, a limitation that may have affected our results. This is presented in detail in **Table 3**.

Table 3: Number of Bused and Non-Bused Students Missing Twelfth Grade Data.

	No High School Data	Has High School Data	Total
Non-bused	699 (58.84)	489 (41.16)	1188 (100)
Bused	174 (78.03)	49 (21.97)	223 (100)
Busing Status Unknown*	426 (98.16)	8 (1.84)	434 (100)
Total	1299 (70.41)	546 (29.59)	1845 (100)

The numbers in parenthesis are percentages.

*For some students busing status was unknown due to lacking address information, inconsistent data, or ambiguous placement on the map with school redistricting information we used to determine students' busing status (more information about mapping students is in the Appendix).

School Resources

To explore the effects of school resources on the achievement gap, we generated a scale of resource levels to rank the elementary schools. We used data from the Connecticut Strategic Reports (Cedar Reports) that are mandated from schools every year through the state to determine the resource level of all elementary schools. These are essential “report cards” for individual schools, tracking the number of students qualifying

for free and reduced lunch, racial makeup of the schools, number of students, computers, and more.

From these reports we culled six different indicators that we thought were most significant in determining the “resources” of a school: 1. average years of teacher experience in Connecticut; 2. average class size; 3. teacher attendance; 4. percentage of teachers with Master’s Degree; 5. percentage of teachers trained as mentors, assessor, or cooperation teachers; 6. percentage of certified staff assigned to the same school the previous year. Many of these indicators are centered on the teachers, the primary means of education in a school, and we noticed immediately that these indicators separated the schools into different levels of resources¹ (see Appendix for details). The resulting school rankings are as follows from lowest to highest: Macdonough, Lawrence, Bielefield, Moody, Farm Hill, Wesley, Spencer, and Snow. The lowest three were categorized into the “low-resourced group” (Macdonough, Lawrence, and Bielefield)².

Opportunity Level

We also wanted to study the effects of students’ residential neighborhood opportunity on the achievement gap and compare bused students living in low opportunity level neighborhoods to non-bused students also living in low opportunity level neighborhoods, to further study the effects of busing. We obtained the opportunity levels of all neighborhoods that students were living in at the time through the Open

¹ Other information was not included in our current study because they did not vary significantly among the eight schools. For example, the number of students per computer was not included for this reason.

² Note that the low-resourced schools identified in the current study is based on information in the years 2003-2006 and does not reflect current levels of school resources in the Middletown elementary schools.

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Communities Alliance opportunity map (Gaul 2015). The map divides Middletown into areas of low, moderate, and high opportunity based on a complex mixture of data about unemployment, property values, and general life chances. We mapped each student on this opportunity map, and assigned each student a corresponding opportunity level based on where they lived, ranging from 1 (low) to 3 (high).

Individual Factors

Race and ethnicity

We wanted to compare non-White students who were bused to non-White students who were not bused in order to see whether busing makes a difference in the racial achievement gap. Race and ethnicity is self-reported information by student families. It should be noted that the data can reflect issues commonly related to self-reporting of race and ethnicity. For example, different families of similar racial and ethnic backgrounds may self-identify differently on the survey, and it is especially complicated for families of mixed race or ethnicity. Options available to indicate race at the time data were generated were American Indian, Asian, Black, White, and Hispanic. Although it is important to study each racial group separately, due to a small sample size we categorized the individuals into White and non-White groups.

For the purposes of our study we excluded Asian students because previous studies do not show a large achievement gap between Asian and White students, whereas there are noticeable achievement gaps between Black and White students as well as Hispanic and White students (see Literature Review). Because only a small proportion of the students were Asian students, it did not reduce our sample size greatly (30 Asian

Americans were excluded and we had a final number of 546 students). Therefore, following in line with previous studies, we decided to focus mainly on the achievement gap between Black/Hispanic and White students.

Free and Reduced Lunch Status (F/R Status)

In order to examine the achievement gap according to student household income, we used free and reduced lunch status as an indicator of student household income. Students in need of financial aid may receive either free or reduced-price lunch at their schools. We also wanted to see if busing has any effect by comparing differences in low-income bused students to low-income non-bused students.

In previous studies free and reduced lunch status has been considered an imperfect method of determining a student's household income (Snyder 2015). Paying full price for lunch does not necessarily mean a student is of high income; it is still possible the student is below the ALICE level of poverty³, or the student's family has not submitted the requisite paperwork. However, there was no other way to indicate students' income levels other than lunch status. Students were categorized into either free and/or reduced status or paid status, as reported in the datasets we received.

Indicators of High School Success

Our method of determining success among high school students utilized three different indicators: students' post-graduation plans, high school average GPA, and senior year attendance. These are generally agreed upon as standard indicators of success for high school students in the literature.

³ ALICE level of poverty is above the federal poverty line of \$24,30 ("Federal Poverty Level" 2016) but below the livable wage of \$50,000 ("ALICE" 2014).

Post-Graduation Plans

Post-graduation information was self-reported and categorized into two groups: college and non-college. Within the non-college group, students reported military, workforce, trade/technical school, and unsure. While these show great variability and ideally should be looked at individually, we grouped them together due to the small sample size resulting from unreported post-graduation plans and inconsistent data (final number: 416 students).

GPA

GPA was measured on a scale from 0 to 100.00. This variable was only available for the 2012 cohort because Middletown High School changed its system after this year. GPA for the following years are only available on individual student transcripts, which were unobtainable. This limited our analysis significantly by reducing an already small sample size (final number: 143 students).

Senior Year Attendance

Senior year attendance was measured as a percentage of days of attendance out of days of enrollment. This variable was available for the classes of 2012 and 2013 but not for 2014. For 2014, we received two different datasets on attendance for each student that were inconsistent with one another, therefore we did not include this variable in our analysis for that year (final number: 300 students).

Additional Variables

Our current data only allowed us to look at students who had completed high school. We were also unable to obtain data on whether students who left the school

system graduated high school elsewhere because Middletown Public Schools does not keep track of these students. Additionally, since these data were collected for twelfth grade students only, students who left prior to grade twelve were not included in our analysis.

Statistical Analysis

All statistical analyses were performed using Stata software package to identify any achievement gaps in individual and structural factors.

Logistic regressions⁴ were performed to investigate the effects of our studied structural and individual factors on students' college attendance. Linear regressions⁵ were similarly performed to investigate the effects of our studied structural and individual factors on high school GPA and attendance. P-values less than 0.05 were considered significant and between 0.05 and 0.10 were considered marginally significant, which suggests studied factors may have an impact on the achievement gap.

Effects of Busing on the Achievement Gap

Our central question was whether students' busing status affects the high school achievement gap. Specifically, we explored whether students who were bused to a school in a neighborhood other than their own have better high school outcomes than similar students who were not bused and living in the same neighborhood. Because we did not

⁴ Logistic regressions are used when the dependent variable (the outcome variable, e.g., post-graduation plan) is categorical (either yes or no).

⁵ Linear regressions are used when the dependent variable (GPA and attendance) is continuous (0-100 scale).

have a large enough sample size, we compared bused students who attended all schools to non-bused students who attended low-resourced schools (Macdonough, Bielefield, and Lawrence). We chose to compare bused students to non-bused students from low-resourced schools because we wanted to have a control group for bused students, essentially simulating what the experience of bused students would have been had they not been relocated to another school. Because most of the bused students observed would have otherwise attended a low-resourced school, we chose this as a comparison group to ensure our data were not skewed by students who had attended high resource elementary schools.

Results

Identifying Trends

We investigated each structural and individual factor by performing descriptive analyses to identify any trends indicating an achievement gap in Middletown. We caution the reader, once again, that all data we report below should be taken with a large grain of salt, as the data problems we have described may have distorted our analysis.

Structural Factors

Elementary School

We found that, for the majority of students in our study, high school GPA, senior year attendance, and post-graduate plans were similar for students who had attended any elementary school with the notable exception of students at Macdonough. Macdonough had the lowest mean high school GPA of 75.32 compared to the range of 80.06 to 84.27

for the other schools, as well as the lowest student attendance with an average rate of 90.93%. Noticeably, Macdonough also had the lowest percentage of students attending college after graduation (see **Table 4**).

Table 4: Mean High School GPA, Mean Attendance Rate and Reported Post-Graduate Plans for Each Elementary School.

	GPA		Attendance		Post-Graduation Plans		Total
	Number	Mean	Number	Mean	Non-College	College	
Macdonough	11	75.32	20	0.9093	5 (19)	22 (81)	27
Lawrence	14	83.13	30	0.9313	5 (10)	45 (90)	50
Bielefield	10	82.63	37	0.9301	6 (13)	39 (87)	45
Moody	23	80.06	39	0.9249	5 (7)	62 (93)	67
Farm Hill	27	80.38	47	0.9173	2 (3)	60 (97)	62
Wesley	28	84.27	53	0.9245	5 (7)	70 (93)	75
Spencer	19	81.36	42	0.9323	3 (5)	56 (95)	59
Snow	17	82.01	42	0.9315	3 (7)	41 (93)	44
Total	149	81.41	310	0.9258	34 (8)	395 (92)	429

The numbers in parenthesis are percentages.

Opportunity Level

We found that mean GPA and mean high school attendance rates were similar for students from different opportunity neighborhoods (see **Table 5**). However, the percentage of students attending college after high school graduation from low

opportunity neighborhoods is notably lower at 86%, compared to the mean of 92%. It should be noted that this trend as well as Macdonough’s lower success levels could be a function of household income, which has been demonstrated in many studies to be a predictor of academic success (see the Literature Review).

Table 5: Mean High School GPA, Mean Attendance Rate and Reported Post-Graduate Plans for Students from Different Opportunity Neighborhoods.

	GPA		Attendance		Post-Graduation Plans		Total
	Number	Mean	Number	Mean	Non-college	College	
Low	40	80.83	81	0.9226	15 (14)	92 (86)	107
Moderate	51	81.38	109	0.9189	8 (5)	139 (95)	147
High	58	81.84	120	0.9342	11 (6)	164 (94)	175
Total	149	81.41	310	0.9258	34 (8)	395 (92)	429

The numbers in parenthesis are percentages.

Individual Factors

Race and Ethnicity

Our data indicate mixed results for high school success among White and non-White students. While average attendance rates are similar for both groups at 92.69% and 92.48%, the mean GPA is much higher for White students compared to non-White students (see **Table 6**). However, contrary to what we expected, the proportion of non-White students attending college is much higher at 95% compared to 88% for White students. It should be noted that this result might be due to our uneven sample sizes between non-White and White students.

Table 6: Mean High School GPA, Mean Attendance Rate and Reported Post-Graduate Plans for White and Non-White Students.

	GPA		Attendance		Post-Graduation Plans		Total
	Number	Mean	Number	Mean	Non-college	College	
Non-White	52	77.51	171	0.9269	13 (5)	244 (95)	257
White	96	83.4	138	0.9248	21 (12)	150 (88)	171
Total	148	81.33	309	0.9260	34 (8)	394 (92)	428

The numbers in parenthesis are percentages.

Student Family Income

We found that for all measured indicators of high school success, low-income students performed worse than their peers. They had a lower mean high school GPA, lower mean attendance rate, and a lower rate of attending college after high school (see Table 7).

Table 7: Mean High School GPA, Mean Attendance Rate and Reported Post-Graduate Plans for F/R and Non-F/R Status Students.

	GPA		Attendance		Post-Graduation Plans		Total
	Number	Mean	Number	Mean	Non-College	College	
Non F/R status	103	82.79	224	0.9291	20 (6)	301 (94)	321
F/R status	43	77.88	81	0.9171	14 (14)	88 (86)	102
Total	146	81.35	305	0.9260	34 (8)	389 (92)	423

The numbers in parenthesis are percentages.

In terms of the structural factors we investigated, students who attended different elementary schools have overall similar high school success, except for Macdonough, which has the lowest rates for all three measures. The results for students from different opportunity level neighborhoods are likewise similar, but students who lived in low-opportunity neighborhoods are less likely to attend college. In terms of individual factors, the comparison between non-White and White students showed mixed results, with White students having higher GPA but less likely to attend college than their non-White peers. Income comparisons show the clearest trends, as low-income students perform the worst across all three measures.

Statistical Analysis

To better understand the effects of the structural and individual factors we were studying, we performed regressions as described in our methodology.

Structural Factors

School Resources, and Opportunity Level

None of the structural factors were statistically significant in relation to high school success. This may indicate that none of these factors impact student success, although the lack of significance may also be a result of small sample sizes in our data set. This is also in line with our above findings that overall high school success is similar for students who attend different elementary schools and live in different opportunity level neighborhoods.

Individual Factors

Race and Ethnicity

Race and Ethnicity appeared to play a role in high school success, and we observed some marginally significant differences between White and non-White students when high school success was measured by average GPA and post-graduation plans (see **Table 8**), although there were no differences in grade 12 attendance. As mentioned, White students were less likely on average to go to college (**Table 8 A and B**)⁶ but more likely to achieve a higher GPA (**Table 8 C and D**) than their non-White peers. Again, this may indicate an actual trend among these high school students, but could also be a function of the drastically different sample sizes between the group studied for GPA and the group studied for post-graduation plans. The number of observable cases for each factor changes, and these conflicting results may highlight those inconsistencies.

Student Family Income

Student family income also appears to be linked to high school success, as we found a marginally significant relationship between higher income and higher GPA, as well as higher income and more frequent post-graduation college enrollment. This only occurred when school resource was removed from the regression, because that variable was shown to have no correlation in high school success, and removing would reduce the bias of our results (**Table 8 B and D**). No significant effect was measured for grade 12 attendance during these tests

⁶ Race was coded non-White = 0 and White = 1 while post-graduation plan was coded non-College = 0 and College = 1. A negative coefficient indicates that race and post-graduation plan have a negative relationship. If the student is White (moving in one direction), the student is likely to be non-College (moving in the opposite direction).

Table 8. Factors Affecting Achievement Gap.

A. Race Affects Post-Graduation Plans.

	Coefficient	P-Value
Busing Status	-0.39	0.59
Residential Opportunity Level	0.51	0.45
Gender	0.91	0.03**
Race	-0.72	0.08*
School Attended	0.01	0.30
Free and Reduced Lunch Status	-0.63	0.15

*Marginally significant ($0.05 < p < 0.10$)

**Significant ($p < 0.05$)

Number of observations: 416

B. Race and Household Income Affects Post-Graduation Plans without Holding School Attended Constant.

	Coefficient	P-Value
Busing Status	-0.13	0.85
Residential Opportunity Level	0.70	0.28
Gender	0.98	0.02**
Race	-0.76	0.06*
Free and Reduced Lunch Status	-0.73	0.09*

*Marginally significant ($0.05 < p < 0.10$)

**Significant ($p < 0.05$)

Number of observations: 416

C. Race Affects High School Average GPA.

	Coefficient	P-Value
Busing Status	1.56	0.59
Residential Opportunity Level	2.36	0.42
Gender	4.06	0.01**
Race	4.32	0.03**
School Attended	0.04	0.50
Free and Reduced Lunch Status	-3.23	0.13

**Significant ($p < 0.05$)

Number of observations: 143

D. Race and Household Income Affects GPA without Holding School Attended Constant.

	Coefficient	P-Value
Busing Status	1.89	0.5
Residential Opportunity Level	2.61	0.36
Gender	4.26	0.01**
Race	4.24	0.03**
Free and Reduced Lunch Status	-3.51	0.09*

*Marginally significant ($0.05 < p < 0.10$)

**Significant ($p < 0.05$)

Number of observations: 143

Effects of Busing on the Achievement Gap

Since we observed an achievement gap when looking at race and student income, we further investigated whether busing had an effect on the achievement gap within these two factors by comparing bused and non-bused students. *Due to our small sample size, no statistically significant results were found*, but the following results describe general trends seen in our data.

Low-Income Bused vs. Low-Income non-Bused

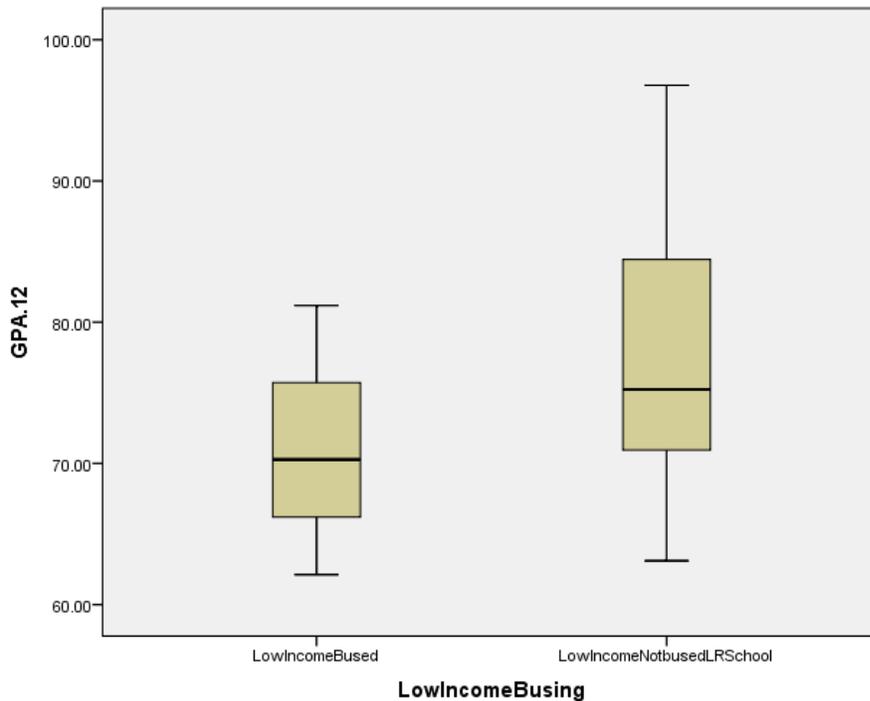
Low-income bused students were less likely to go to college (see **Table 9**) and had a lower mean GPA (see **Figure 1**) compared to low-income non-bused students who attended low-resourced schools. These results suggest — given significant methodological problems — that low-income students who were not bused have better successes in high school.

Table 9. Low-Income Bused and Non-Bused and Post-Graduation Plans.

	Low-Income Bused	Low-Income non-Bused	Total
Non-College	3 (21.4)	6 (14.6)	9 (16.4)
College	11 (78.6)	35 (85.4)	46 (83.6)
Total	14	41	55

Numbers in parenthesis indicate percentage of students.

Figure 1. Low-Income Bused and Non-Bused Students and GPA.



Left: low-income bused students

Right: low-income non-bused students who attended low-resourced schools.

The bolded line in the box indicates mean GPA and lines extending out represent the range.

Non-White Bused vs. Non-White Non-Bused Students

Busing appears to have no obvious effect on high school performance among non-White students, with similar mean GPAs 74.15 for non-White bused students and 74.86 for non-White non-bused students who attended low-resourced schools (see **Figure 2**). Contrary to what we found regarding low-income students (given the typical link of income to race) non-White bused students were *more* likely to go to college than non-White non-bused students who attended low-resourced schools (see **Table 10**). However, it should be noted that there are only eight non-White bused students while there are 68 non-White non-bused students, so that could skew our data, as 100% of the non-White

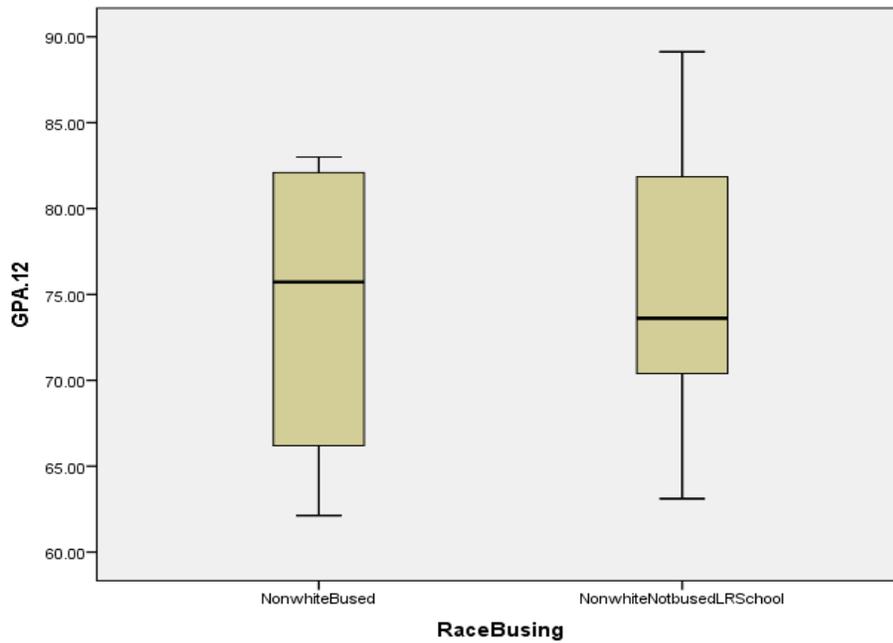
bused students attended college. If these data were to be replicated with reliable and sufficient data, it would provide stronger support for busing as a way of reducing the achievement gap than we are able to verify given our data gaps.

Table 10. Non-White Bused and Non-Bused and Post-Graduation Plans

	Non-White Bused	Non-White non-Bused	Total
Non-College	0 (0)	4 (5.9)	4 (5.3)
College	8 (100)	64 (94.1)	72 (94.7)
Total	8	68	76

Numbers in parenthesis indicate percentages.

Figure 2. Non-White Bused and Non-Bused and GPA.



Left: non-white bused students

Right: non-white non-bused students who attended low-resourced schools.

The bolded line in the box indicates mean GPA and lines extending out represent the range.

Limitations

There are several limitations inherent in our project. While performing statistical analyses is helpful in gaining perspective of issues present in the community that may contribute to achievement gaps in education, they may over-generalize trends in opportunity, access, and performance, and the data do not provide explanation as to why these trends are present. In reducing students into categories of racial background, free and reduced lunch status, and neighborhood opportunity levels, individual differences in experience, personality, and ability are unaccounted for. For example, issues with grouping students into these categories becomes apparent when defining school “success” and the meaning we attribute to it. Success, as defined in our study by GPA, attendance, and post-graduation trajectories, follows normalized notions of success in society.

What is not recognized in this definition of success is success in nonacademic areas, such as the arts, sports, and other interests. Though we do not discuss these forms of success in our report, we acknowledge they may be significant, either to an individual or as markers of group performance and overall high school “success.” The only way we could measure these non-academic markers is if they contributed to a student's acceptance into college, in which case they would appear tangentially in our results. Further, “success” does not necessitate happiness, either in high school or later in life. Students may have been “unsuccessful” in high school by our definition, and may still have felt content with their state of being, “unsuccessful” students in high school may have gone on to be “successful” by these narrow terms or other terms later in life, and

students who were successful in high school may not necessarily be “happy,” nor do anything to contribute to their communities in positive ways.

On a similar note, a quantitative study of the impacts of busing in elementary schools on high school success rates does not account for the nuances of individuals’ educational experiences. Due to time constraints, privacy regulations, and an ultimate objective to obtain information on broader patterns present in the Middletown schooling system, we decided not to conduct interviews with individuals who had been part of the busing program in elementary school following the 2000 redistricting and prior to the 2010 redistricting. With our report void of these personal perspectives, we lack insight into how experiences of busing may have impacted students psychologically, whether they felt comfortable and welcomed in the school they attended, or the ways that students’ personal and familial situations may have affected their performance and thus overall success in school.

Because we did not have data on students’ performance and demographics between our years of study, we did not take into account potential differences in levels of access to school resources and experience, as we assumed a majority of students in our cohort remained in the Middletown public school system for most or all of their secondary education. Regardless, students may have experienced different levels of access in this interim period between fourth and twelfth grade. These possible discrepancies in student experience most likely can be attributed to course-tracking programs within Middletown’s public middle school and high school, attending magnet or private middle and/or high school for some amount of time, or transiency, which is the

trend of students flowing in and out of the Middletown School District to other, typically neighboring, districts.

Conclusion

The presence of large holes in the data has prevented us from reporting conclusive results. Because so many students were difficult to track, especially low-income and bused groups, the central core of the research was compromised, and any claims could be misrepresentations or wholly erroneous. As we moved through analysis, we were frequently met with conflicting results, like the finding that White students had a higher average GPA than minority students in the district, yet in the same data set minority students were more likely to go to college. These results likely stem from issues of data, and the problem of tracking students who frequently move in and out of different schools, or withdraw from attendance entirely.

A few notable findings may indicate the presence of some trends, but further research would be necessary to cement these findings or report on root causes of the achievement gap in Middletown. Our study of low-income students did find that bused children were less likely to attend college than their non-bused peers attending low-resource schools. This finding could indicate that low-income students who are bused from their neighborhood school, perform worse academically, despite being relocated to a school with more qualified teachers and smaller class sizes. This would confirm the idea that busing can be a negative academic experience for students, though the sample bias inherent in our study renders this only a hunch, again requiring further study to

solidify. In conflict with these results, however, we found that students from low-opportunity neighborhoods performed better when bused, suggesting the opposite: that students from struggling neighborhoods might benefit from busing programs. (We noted above that this may merely be a result of survivor bias and strange patterns inherent in our data.) And we found contrary evidence regarding race and college: non-White bused children were *more* likely to go to college than non-White non-bused children, although, again, this was based on a very small sample size.

The results lead to more questions than answers and most of the potential findings are frustrated by the presence of inconsistencies. One of the central issues that we frequently ran into was acquiring well maintained and consistent information on students within the district. Because of state-mandated database changes, the digital systems used to track students have been replaced within the last few years in Middletown, making it increasingly difficult to find cohesive profiles for students who moved through the district's public schools. Coupled with the recent change in standardized tests in the district, it was very difficult to piece together a view of the district and its evolution over the past decade. Moving forward, we would recommend that extra care be taken to maintain the data sets of these students, so that future projects might be able to successfully analyze school populations in order to better address the inequalities and issues in the Middletown school district. With that in mind, it may be possible in the future to replicate the methodologies of this study with a more precise sample of Middletown students to better understand the trends and patterns of education in the district.

Having set out to study the factors affecting high school success, the lack of quantitative evidence, although frustrating, certainly does not indicate a lack of systematic patterns of success in Middletown. Even in our limited results, the presence of higher GPA among White than non-White students, and the trend of low-income students attending college less frequently than their peers indicates that further study could prove insightful in exposing some of the root causes of success and lack thereof in Middletown. These factors do not work in isolation from each other, and understanding the interplay between race, class, and school environment in Middletown could lead to increased performance district-wide, and perhaps allow resources to be allotted to the students most at risk of dropping out or underachieving throughout Middletown.

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Appendix

Data Preparation

For the 2012 cohort we excluded individuals lacking elementary school information (311), attending schools outside Middletown Public School District (11), having duplicate RedikerIDs (4), having inconsistent elementary and facility code data (29), and lacking college attendance data (288). For the 2013 cohort we excluded individuals lacking elementary school information (865), having duplicate RedikerIDs (64), having inconsistent elementary and facility code data (1), and lacking college attendance or senior year attendance data (352). For the 2014 cohort we excluded individuals lacking elementary school information (270), attending schools outside Middletown Public School District (11), having duplicate RedikerIDs (118), lacking identification number (1), having inconsistent elementary and facility code data (4), and lacking college attendance data (354).

Table 11. Variables for Each Dataset.

Elementary Dataset 1	Elementary Dataset 2	High School Dataset 1	High School Dataset 2
Student Address	Resident Town	Grade	Resident Town
Gender	Facility Code	Address	Facility Code
Race	Race	Race	Free and Reduced Lunch Status
School Attended	Gender	Post-Graduation Plans	Days of Membership
	Grade	GPA*	Days in Attendance
	Free and Reduced Lunch Status		Days in Absences

*GPA was only available for 2012.

School Resources

We collected data from Connecticut Strategic School Profile Reports for 2003-2006 for each elementary school in the Middletown Public School District. We took the average class size, average years of teacher experience in Connecticut, percentage of teachers with a Master’s degree, percentage of teachers trained as mentors, assessors or cooperation teachers, and percentage of certified staff assigned to the same school the previous year. We averaged these numbers over the three years studied and created a composite score for each school's resources, making sure to normalize variables so that they were in the same range for comparison.

This gave us a numerical ranking for each school, allowing a quantitative assessment of comparative resources between facilities based on the metrics above. This scalar variable was then used to run analysis as a measure of school resource.

Mapping Student Addresses

Using student addresses we were able to generate data on which students were bused. Stevemorse.com was used to convert individual student addresses from the Grade 4 data to longitudinal and latitudinal coordinates. ArcMap 10.3.1, part of ArcGIS geospatial programming software, was used to geolocate and visualize individual students' addresses for each of our three cohorts.

A color-coded map from the Middletown redistricting committee of post-2000, pre-20120 redistricting in Middletown was converted to pdf format and then georeferenced (matched geographically) to a map of Connecticut on the ArcMap software. The same process was used to add and geolocate a map of Opportunity Level in Middletown.

Geolocated student addresses were then overlaid on the 2009 redistricting map and the opportunity map. We were then able to determine which students were bused from their respective local elementary school districts by visually locating and identifying the students who resided in areas that were marked as redistricted, or bused, streets on the redistricting map. Similarly, we were able to record the opportunity levels of individual students' residential areas by using the overlaid 2009 Open Communities Alliance opportunity map to locate which opportunity area each student lived in.