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What Happens When Schools Become Magnet Schools?

A Longitudinal Study of Diversity and Achievement

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American Institutes for Research

The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Contract ED-04-CO-0025/0013 to the American Institutes for Research. The views expressed herein do not necessarily represent the positions or policies of the U.S. Department of Education. No official endorsement by the U.S. Department of Education is intended or should be inferred.

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Acknowledgments

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Disclosure of Potential Conflicts of Interest

The research team for this study consists of key staff from American Institutes for Research. The organization and key staff members do not have financial interests that could be affected by findings from the study. None of the members of the Technical Working Group, convened by the research team to provide advice and guidance, have financial interests that could be affected by findings from the study.

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Executive Summary

Magnet schools hold a prominent place in the history of education reforms in the United States. Best known for offering unique programs or curricula to attract students from outside a school's neighborhood, many magnet schools started off as neighborhood public schools but converted with the goals of increasing student diversity and achievement. These goals remain important to policymakers and educators today, so there is interest in understanding what happens to converting schools, including those funded under the U.S. Department of Education's Magnet School Assistance Program (MSAP).

This report describes the results of a descriptive study of 21 MSAP-supported elementary schools. The study collected data on these schools for several years before and after their magnet conversion, to see how their student body composition and academic achievement changed over time. The group of schools contained 17 that converted to become what might be called "traditional" magnet schools and another 4 that converted to become "destination" magnet schools.

Traditional Magnet Schools: Typically begin as lower performing schools serving higher proportions of students from low-income households or minority racial/ethnic groups than their districts; they are expected to recruit students who are higher achieving and more economically advantaged than the neighborhood students, or more likely to help the school achieve racial/ethnic diversity.

Destination Magnet Schools: Typically high-performing schools serving higher proportions of economically advantaged or nonminority students; they are converted to magnets to serve as a destination for students from outside the neighborhood, who frequently attend struggling schools, are lower achieving, more economically disadvantaged, and more likely to be from minority racial/ethnic groups than are the neighborhood students.

Key findings on the schools using the two conversion approaches include:

- **When measured against district changes, both types of magnet schools experienced some changes in diversity in the expected direction.** Over the conversion period (i.e., from before to after conversion) the traditional magnet schools reduced the concentration of students from minority racial/ethnic backgrounds relative to their districts, but there was no change in the concentration of economically disadvantaged students. Conversely, destination magnet schools increased their concentration of economically disadvantaged students relative to their districts, but had no change in the concentration of racial/ethnic minority students relative to their districts. Changes in diversity in the converting magnet schools were measured "relative to their districts" because the main way a school can change its composition is to attract students attending other schools in the district.
- **Achievement in the traditional magnet schools was higher after conversion, outpacing district changes in English language arts (ELA) but not in mathematics; achievement in destination magnet schools did not change, while their districts**

improved over the conversion period. The changes in average student achievement could be due to increases (traditional magnet schools) or decreases (destination magnet schools) in learning by students who were in the schools both before and after conversion. But they could also be due to shifts in the types of students—higher achieving (traditional magnet schools) or lower achieving (destination magnet schools)—who came to the schools after conversion. As an example, if the economically disadvantaged students who were recruited to the destination magnet schools after conversion were lower achieving than the students who would normally attend those schools, the new students would lower average test scores in these just-established magnet schools.

- **There is not evidence that magnet conversion itself played a role in the study schools' diversity or achievement, with the exception of the decline in the concentration of minority students in traditional magnet schools.** To assess whether the observed changes might have been produced by magnet conversion, changes in the magnet schools were compared to what would be predicted had they not converted. Predictions were made based on changes in neighborhood elementary schools in their districts that did not convert. If the changes were similar to what would be predicted, it would be harder to make the case that conversion was a factor in the magnet school changes. For almost all of the outcomes examined (minority racial/ethnic composition, disadvantaged student composition, and achievement), there was no significant difference between the changes in the magnet schools and the changes that would be predicted if they had not converted, except for the decrease in the minority student concentration in the traditional magnet schools relative to their districts. This promising result for the traditional magnet schools is not conclusive, however, because other factors (not just those that could affect neighborhood schools) cannot be ruled out.

The Key Features of Magnet Schools and Theory of How They Might Improve Outcomes

The key features of a magnet school are a specialized curriculum (e.g., performing arts or mathematics and science programs) or instructional method (e.g., open classrooms or team teaching), and enrollment that is open to students from outside the school neighborhood or attendance zone. The specialization in curriculum or instructional method is hypothesized to affect a school in two ways (Steel and Levine 1994). First, it is a vehicle to change the makeup of the student body, by attracting students from outside the school's neighborhood who are different from students already attending the magnet school—in terms of their race/ethnicity, socioeconomic status, or academic achievement. Second, the specialized curriculum or teaching method can provide a focus for teacher professional development and collaboration and therefore improve the learning environment, in turn boosting student achievement.

However, the specific paths by which this theory of action might result in increased student diversity and increased achievement depend on the characteristics of the neighborhood school before it converts and the types of students it is likely to recruit. As noted earlier, there are two common models of conversion to whole-school magnets supported through MSAP grant funds—the "traditional" approach and the "destination" approach. Both types were included in the study, though their outcomes were assessed separately.

How the Study Examined Change in Magnet Schools

The study relied mostly on student administrative records collected by and for the district and state. These records contained data on student characteristics, academic achievement, school assigned based on neighborhood of residence, and school attended for all elementary students in each district, typically for the two years before conversion and the four years after conversion. However, because of differences in when and how state academic assessments were conducted, the number of years and grades varied by district. To take the difference in tests into account, all scores were put into a common metric; in essence, each student's mathematics and ELA score was standardized to show how well he or she performed relative to students in the same grade across the district that year.

This study examined the changes that occurred in the 21 magnet schools from pre- to post-conversion. There are several limitations to the study's approach. First, the design and methods of the study cannot measure the impact of the conversion to a magnet school, and can only provide suggestive, but not conclusive, evidence that conversion may have played a role in the changes in diversity or achievement that the magnet school attained. Second, although some MSAP converting schools may have set goals for improving diversity for specific racial/ethnic groups (e.g., increasing the proportion of Latino students but not African-American students), the study grouped all students from minority racial/ethnic backgrounds together. Thus, the study might have examined some changes in diversity that were not a focus of the schools' efforts.

Research Questions and Methods

This study addressed three questions:

Did the composition of neighborhood students and students from outside the neighborhood in the magnet schools change after conversion?

Both traditional and destination magnet schools were expected to attract more students from outside the neighborhood after conversion, and the outside students were expected to be different from the neighborhood students on various characteristics. To assess whether this happened, the proportion of students from outside the neighborhood in the study schools before conversion was compared to the proportion afterwards. Then the characteristics of students from outside the neighborhood were compared to the characteristics of neighborhood students—the proportion from racial/ethnic minority groups, the proportion who were economically disadvantaged (i.e., eligible for the federal free and reduced-price lunch program), and the average standardized test scores after conversion. Finally, since there were students from outside the neighborhood already in the magnet schools prior to conversion, an additional step examined whether the differences between the students from outside the neighborhood and the neighborhood students were greater after conversion.

Did the diversity in the magnet schools increase after conversion, and is there any evidence that it was related to conversion?

The study focused on diversity with respect to the proportion of minority students and students from disadvantaged backgrounds. The analysis proceeded in two steps.

- *Describing changes in magnets and their districts.* As a first step, the pre- to postconversion change in magnet schools was compared with the change in the districts (including all elementary public schools) in which they were located. The goal of this analysis was to determine whether magnet schools changed in the anticipated direction relative to any overall change in their districts, and if so, how large the changes were.

- *Investigating the role of magnet conversion.* After comparing the change in diversity in magnet schools to the change in their districts, a second analysis investigated whether magnet conversion might have played a role in any changes in diversity in magnet schools. To rule out other factors that might explain the observed change, the changes in magnet school student composition were compared to what would be predicted based on the changes in neighborhood schools that did not convert (i.e., schools that primarily served students within their neighborhood, excluding other magnets and charters). In this analysis, the change in other neighborhood schools represents a "counterfactual"—in other words, the change in other neighborhood schools represents what would have changed in magnet schools if they had not converted. (This is known as comparative interrupted time series analysis, and the methods are described in Appendix F.2.2.)

Did the achievement in the magnet schools increase after conversion, and is there any evidence that this was related to conversion?

A primary goal of magnet conversion is to improve the achievement in the schools. As in the analysis of diversity, the analysis proceeded in two steps.

- *Describing changes in magnets and their districts.* First, the study examined whether the average mathematics and English language arts (ELA) achievement in the magnet schools was higher after conversion, by comparing the test scores of students attending after conversion to the test scores of students who were in those same grades in the years before conversion.

- *Investigating the role of magnet conversion.* To examine whether conversion may have played a role in any observed changes in achievement, the year-to-year achievement gains of students from the neighborhood before and after conversion were compared to what would be predicted based on the gains of similar neighborhood students in neighborhood schools that did not convert. (The methods used for this comparative interrupted time series analysis are described in Appendix F.4.2.) This analysis focused only on the traditional magnets for two reasons. Their neighborhood student populations—typically higher minority, more economically disadvantaged, and lower achieving—are of the greatest policy interest. In destination schools, the policy interest is the lower performing students from outside the neighborhood, and there are better approaches to examine the outcomes of students who transfer into schools, including methods based on lotteries. However, there were too few students from outside of the neighborhood transferring to destination magnets to apply these methods reliably.

Outcomes for Conversion Magnet Schools

Most magnet school principals reported that they had fully implemented major components of their magnet programs by the third year of the grant (over 90 percent) and that they had experienced little problem building staff support (69 percent). Less than a third of MSAP directors reported that they experienced student recruiting difficulties due to competition from other choice schools (30 percent). The key issues related to outcomes are whether the converting magnet schools attained the improvements in diversity and achievement that motivates the MSAP program and whether their outcomes changed in ways that mirror—or set them apart from—neighborhood public schools in their districts that did not convert.

Traditional Conversion Magnet Schools

The traditional magnet schools served a somewhat larger share of students from outside their neighborhood after conversion, but these students were similar to the neighborhood students on a variety of characteristics.

The share of students who were from outside the neighborhood rose by 5.8 percentage points (from 21.0 percent before conversion to 26.8 percent afterward), which equates to about one additional student in each class. However, after conversion, proportionately more of the outside students were economically disadvantaged—not advantaged, as would be expected based on the theory of action (an increase from 65.4 percent of outside students to 71.2 percent). Either the outside students who were at the schools before conversion became poorer or those the magnet schools recruited after conversion were poorer, or both. On average, after conversion, similar shares of students from inside and outside the neighborhood were from minority racial/ethnic groups (84.0 and 84.4 percent, respectively) or economically disadvantaged (73.8 percent and 71.2 percent, respectively). The achievement of both student groups was also similar after conversion (about the 44th percentile in ELA and 48th percentile in mathematics for both student groups). Therefore, the neighborhood students were not exposed to higher achieving peers after conversion.

Relative to their districts, there was less concentration of students from minority racial/ethnic backgrounds in the magnet schools after conversion, and the conversion may have played a role.

Describing changes in magnet schools and their districts. The schools that became traditional magnet schools initially served a higher proportion of minority students (84.5 percent on average) relative to their districts (64.1 percent; Exhibit ES.1). But while the proportion of minority students enrolled in the converting schools stayed the same after conversion, the proportion in the district grew by about 2 percentage points (from 64.1 percent to 66.3 percent). These changes brought the composition of the magnet schools more in line with that of their districts, reducing the concentration of minority students in the magnet schools relative to their districts.

Investigating the role of magnet conversion. Results indicate that conversion may have helped close the racial/ethnic gap between the schools and their districts, as expected for this type of conversion approach. After conversion, the racial/ethnic composition of magnet schools was more like their districts than the predicted composition based on neighborhood schools that did not convert.

Exhibit ES.1. Concentration of Racial/Ethnic Minority Students in Traditional Magnet Schools (Average Across Schools)

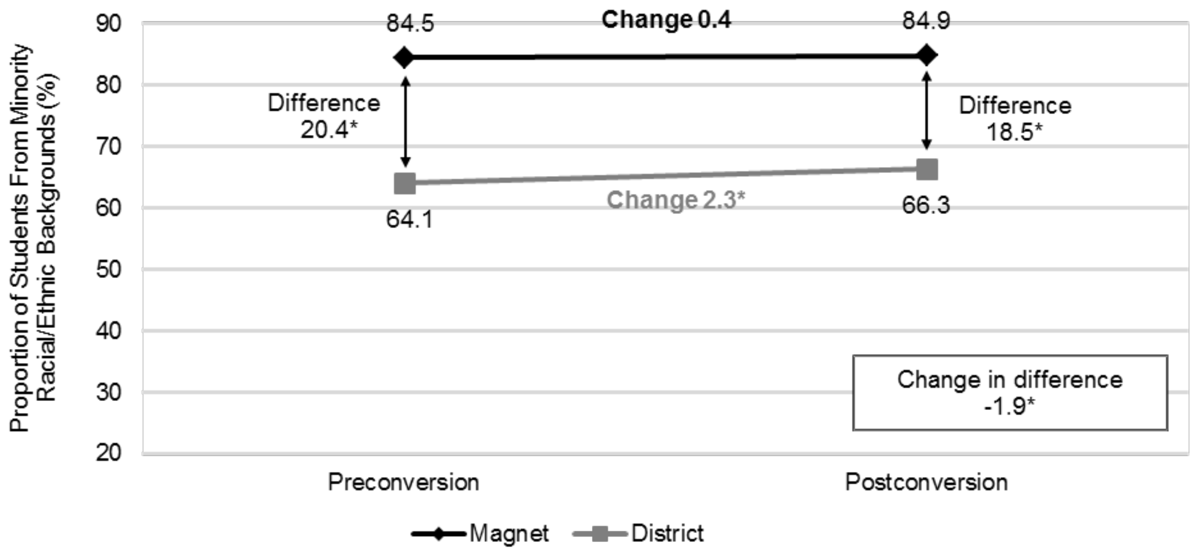


EXHIBIT READS: Before (pre-) conversion, the average proportion of minority students in the magnet schools (84.5 percent) was 20.4 percentage points higher than the proportion in their districts (64.1 percent). From pre- to post-conversion, there was no statistically significant change in the magnet schools' proportion (0.4 percentage points), while the proportion in their districts increased by 2.3 percentage points. As a result, after (post-) conversion, the magnet schools' average proportion (84.9 percent) was 18.5 percentage points higher than the proportion in their districts (66.3 percent)—a significant change in the difference between the magnet schools and their districts of -1.9 percentage points. This change represents a reduction in the concentration of minority students in the magnet schools relative to their districts.

NOTE: See Appendix F for methods used for calculations and significance tests. *N* = 17 schools in 10 districts. Results include all students: neighborhood students, students from outside the neighborhood, and students missing neighborhood status. District proportion is based on students in all schools in the district. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure. See appendix Exhibit I.4 for additional detail.

SOURCE: District administrative data.

Relative to their districts, the concentration of economically disadvantaged students in the traditional magnet schools was unchanged after conversion.

Describing changes in magnet schools and their districts. The converting schools initially served a higher proportion of disadvantaged students (71.4 percent) relative to their districts (46.1 percent; Exhibit ES.2). Over the conversion period, the magnet schools and their districts experienced similar increases in the share of their students who were economically disadvantaged (2.8 and 3.9 percentage points, respectively). Thus there was no change in the concentration of economically disadvantaged students in the magnet schools relative to their districts.

Investigating the role of magnet conversion. Results suggest that conversion was not related to changes in the socioeconomic gap between the magnet schools and their districts. The socioeconomic composition of magnet schools was not closer to their districts after conversion than the predicted composition based on neighborhood schools that did not convert.

Exhibit ES.2. Concentration of Economically Disadvantaged Students in Traditional Magnet Schools (Average Across Schools)

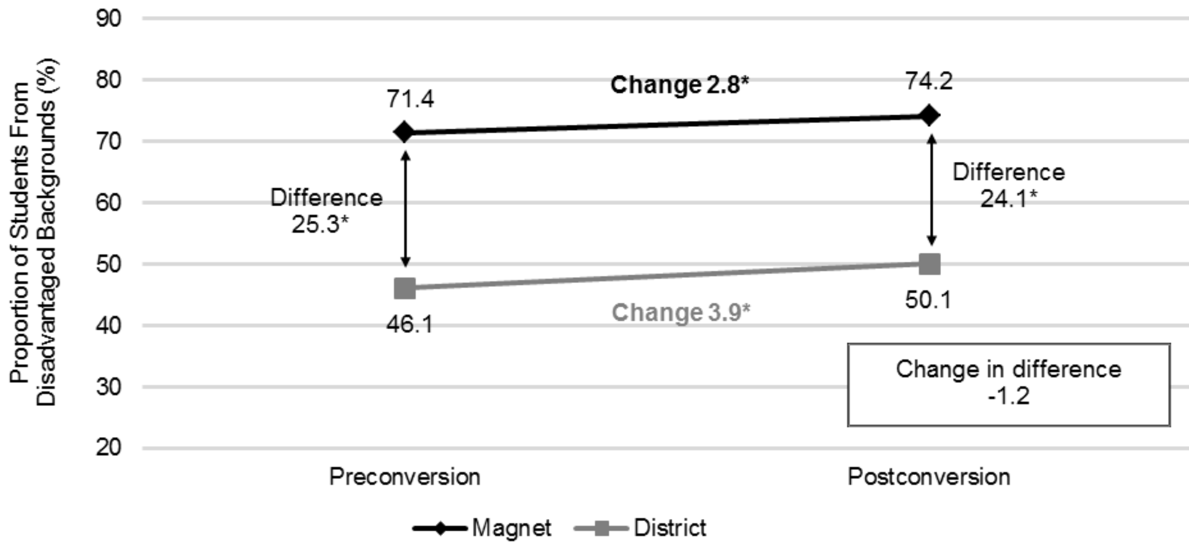


EXHIBIT READS: Before (pre-) conversion, the average proportion of economically disadvantaged students in the magnet schools (71.4 percent) was 25.3 percentage points higher than the proportion in their districts (46.1 percent). From pre- to post-conversion, the average proportion of disadvantaged students in the magnet schools and their districts increased by similar amounts (2.8 and 3.9 percentage points, respectively). As a result, after (post-) conversion, the magnet schools' average proportion (74.2 percent) was 24.1 percentage points higher than the proportion in their districts (50.1 percent)—a non-significant change in the difference between the magnet schools and their districts of -1.2 percentage points. While the magnet schools were 1.2 percentage points closer to their districts after conversion, this change is not statistically different from zero, and thus does not represent a reduction in the concentration of disadvantaged students in the magnet schools.

NOTE: See Appendix F for methods used for calculations and significance tests. *N* = 11 schools in seven districts. Results include all students: neighborhood students, students from outside the neighborhood, and students missing neighborhood status. District proportion is based on students in all schools in the district. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure. See appendix Exhibit I.8 for additional detail.

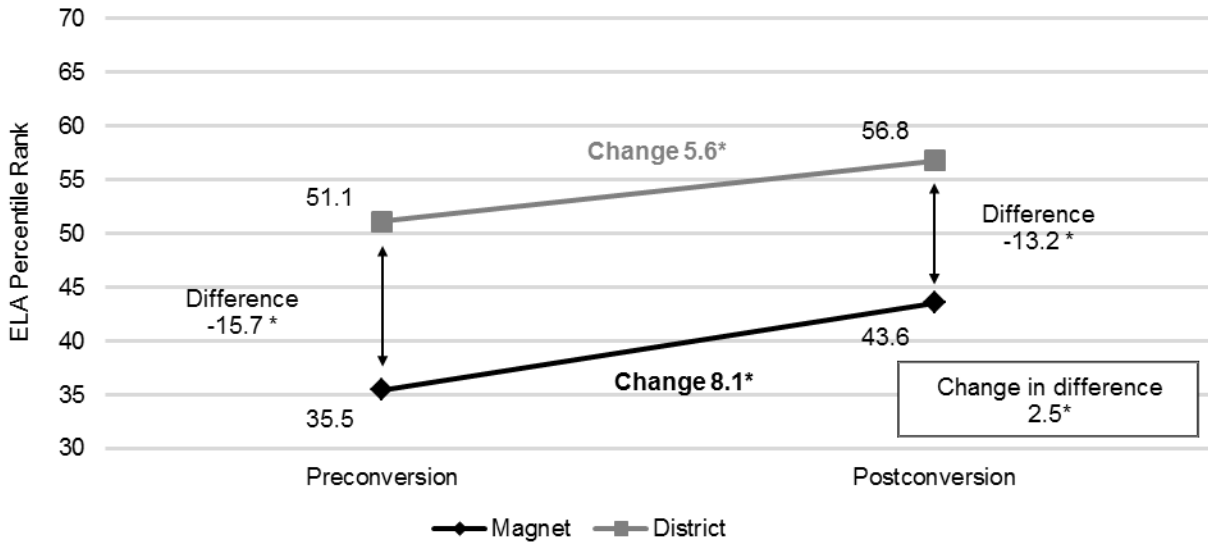
SOURCE: District administrative data.

Achievement in the traditional magnet schools improved after conversion, outpacing district improvement in ELA but not in mathematics; however, there is not evidence that the conversion played a role in improving the achievement gains of neighborhood students, the population of policy interest.

Describing changes in magnet schools and their districts. ELA achievement in both the converting magnet schools and their districts overall improved after conversion, with the increase for the magnet schools greater by 2.5 percentile points (Exhibit ES.3). Magnet schools' mathematics achievement also improved by 2.0 percentile points more than in the magnet schools' districts, though the average mathematics test score increases in the magnet schools and their districts are considered statistically similar.

Investigating the role of magnet conversion. Results give little reason to conclude that conversion was a factor in the change in achievement in magnet schools. The changes in annual achievement gains for neighborhood students in magnet schools were similar to what would be predicted had the schools not converted.

Exhibit ES.3. Achievement in Traditional Magnet Schools and Their Districts (Average Across Schools)



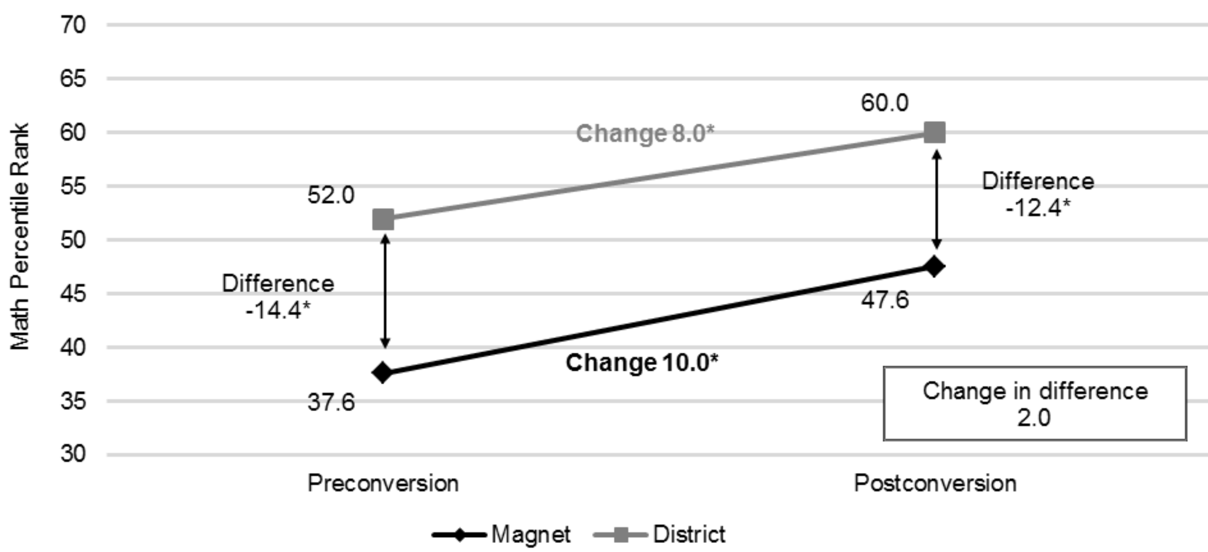


EXHIBIT READS: The average ELA achievement in the magnet schools increased by 8.1 percentile points from before (pre-) conversion (35.5 percentile) to after (post-) conversion (43.6 percentile). The average ELA achievement in their districts increased by 5.6 percentile points from pre-conversion (51.1 percentile) to post-conversion (56.8 percentile). Therefore, the magnet schools increased 2.5 percentile points more than their districts (an 8.1 percentile point increase in the magnet schools compared to a 5.7 percentile point increase in their districts)—a statistically significant change.

NOTE: See Appendix F for methods used for calculations and significance tests. *N* = 17 schools in 10 districts. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure. See appendix Exhibit I.12 for additional detail.

SOURCE: District administrative data.

Destination Conversion Magnet Schools

The destination magnet schools also served a somewhat larger share of students from outside their neighborhood after conversion, and these students were different from the neighborhood students in ways consistent with theory.

The share of students who were from outside the neighborhood rose by 7.3 percentage points (from 34.2 percent before conversion to 41.4 percent afterward). Before conversion, the students attending the schools from outside the neighborhood were similar to the neighborhood students in terms of race/ethnicity. After conversion outside students were more likely than neighborhood students to be members of minority racial/ethnic groups (by 2.5 percentage points) and economically disadvantaged (by 5.9 percentage points). Similarly, before conversion the academic achievement of students from inside and outside the neighborhood was similar, but afterwards the academic achievement of outside students was 5.0 percentile points lower than that of neighborhood students in mathematics (but similar in ELA). Together these changes suggest that the destination magnet schools attracted the minority, economically disadvantaged, and lower achieving students that they were theorized to attract, giving these students from outside the neighborhood exposure to higher achieving and more economically advantaged students.

Relative to their districts, the concentration of minority students in destination magnet schools was unchanged after conversion.

Describing changes in magnet schools and their districts. The schools that became destination magnet schools initially served the same share of students from minority racial/ethnic groups as their districts overall (71.6 percent and 72.0 percent, respectively; Exhibit ES.4). The proportion of these students enrolled in both the converting schools and their districts grew similarly after the conversion (by 3.3 and 1.8 percentage points, respectively), so there was no change in minority-student concentration in the magnet schools relative to their districts.

Investigating the role of magnet conversion. The results indicate that conversion was not related to changes in the racial/ethnic gap between the magnet schools and their districts. The changes in magnet schools were similar to what would be predicted had the schools not converted.

Exhibit ES.4. Concentration of Racial/Ethnic Minority Students in the Destination Magnet Schools (Average Across Schools)

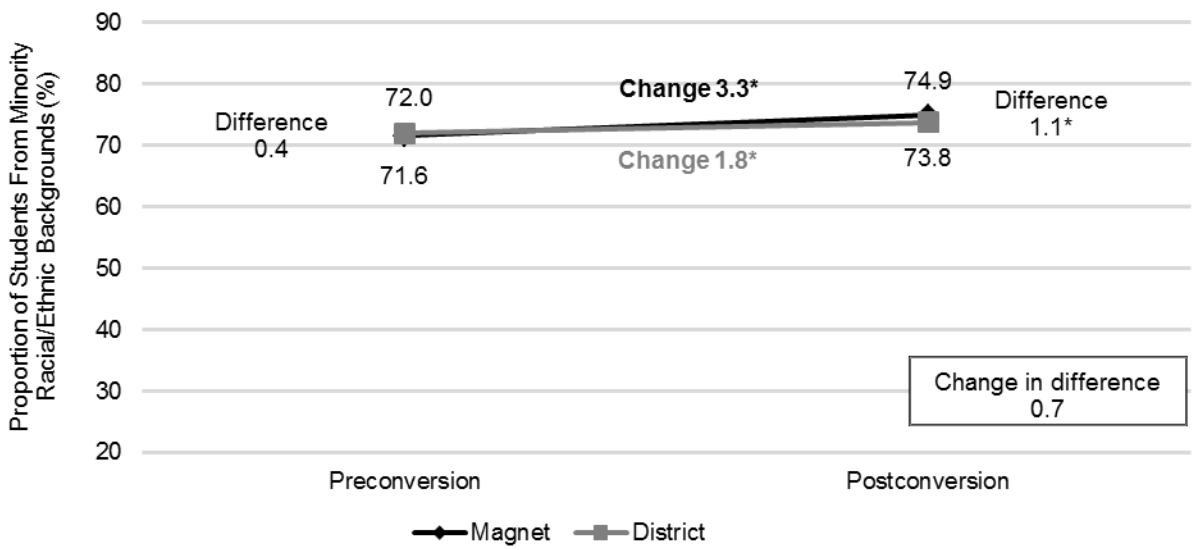


EXHIBIT READS: Before (pre-) conversion, the average proportion of minority students in the magnet schools (71.6 percent) was 0.4 percentage points lower than the proportion in their districts (72.0 percent). From pre- to post-conversion, there was a statistically significant increase in the magnet schools' proportion (3.3 percentage points) and in the proportion in their districts (1.8 percentage points). As a result, after (post-) conversion, the magnet schools' average proportion (74.9 percent) was significantly higher (1.1 percentage points) than the proportion in their districts (73.8 percent), but the change in the difference between the magnet schools and their districts (0.7 percentage points) was not significant.

NOTE: See Appendix F for methods used for calculations and significance tests. *N* = four schools in three districts. Results include all students: neighborhood students, students from outside the neighborhood, and students missing neighborhood status. District proportion is based on students in all schools in the district. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure. See appendix Exhibit J.4 for additional detail.

SOURCE: District administrative data.

Relative to their districts, the concentration of economically disadvantaged students in the destination magnet schools was higher after conversion, as might be expected, but there is not evidence that the conversion was a factor.

Describing changes in magnet schools and their districts. The schools that became destination magnet schools initially served a smaller proportion of disadvantaged students (25.0 percent on average) than their districts (38.1 percent; Exhibit ES.5). Although both the magnet schools and their districts overall served a larger share of these students after conversion, the increase was greater for the converting magnet schools (6.8 percentage points) than for their districts (3.0 percentage points). These changes brought the composition of the magnet schools more in line with that of their districts, or, in other words, increased the concentration of disadvantaged students in the magnet schools relative to their districts. This result is consistent with the theory of action for destination schools.

Investigating the role of magnet conversion. The share of disadvantaged students in magnet schools was predicted to become less like their districts overall after conversion, based on changes in neighborhood schools that did not convert; in fact, they became more like their districts. These opposite trajectories created a difference between the destination magnet and what would be predicted had they not converted that was just short of being statistically reliable according to standard benchmarks.[1] This suggests that something other than districtwide factors might have played a role, and the conversion to a magnet school is one hypothesis for that result.

Exhibit ES.5. Concentration of Economically Disadvantaged Students in the Destination Magnet Schools (Average Across Schools)

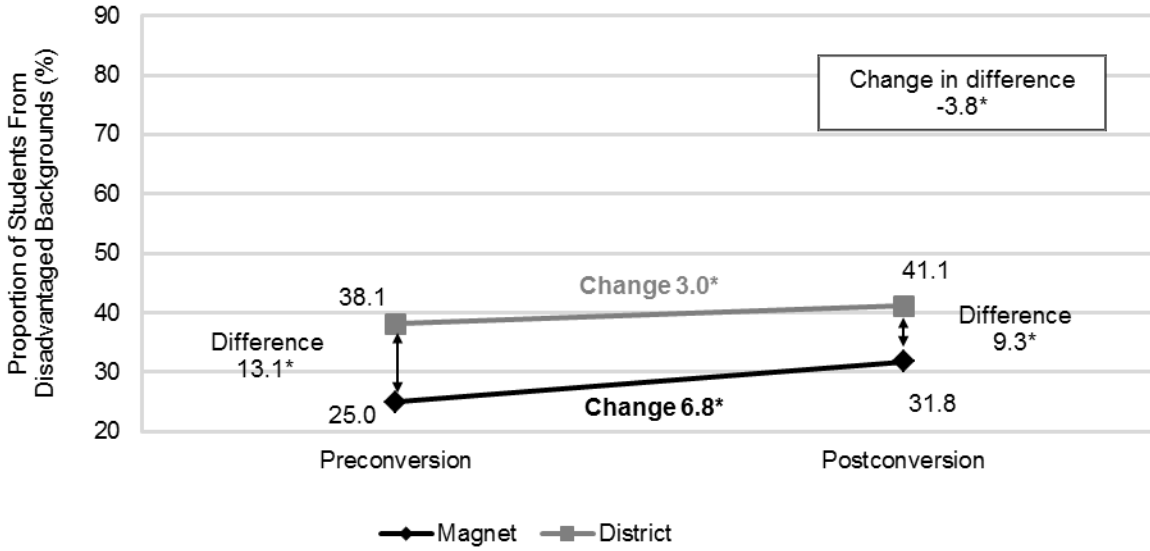


EXHIBIT READS: Before (pre-) conversion, the average proportion of economically disadvantaged students in the magnet schools (25.0 percent) was 13.1 percentage points lower than the proportion in their districts (38.1 percent). From pre- to post-conversion, the average proportion of disadvantaged students increased significantly in the magnet schools (6.8 percentage points) and their districts (3.0 percentage points). As a result, after (post-) conversion, the magnet schools' average proportion (31.8 percent) was 9.3 percentage points lower than the proportion in their districts (41.1 percent), which was a significant change in the difference between the magnet schools and their districts of -3.8 percentage points. This change represents a significant increase in the concentration of disadvantaged students in the magnet schools relative to their districts.

NOTE: See Appendix F for methods used for calculations and significance tests. *N* = four schools in three districts. Results include all students: neighborhood students, students from outside the neighborhood, and students missing neighborhood status. District proportion is based on students in all schools in the district. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure. See appendix Exhibit J.8 for additional detail.

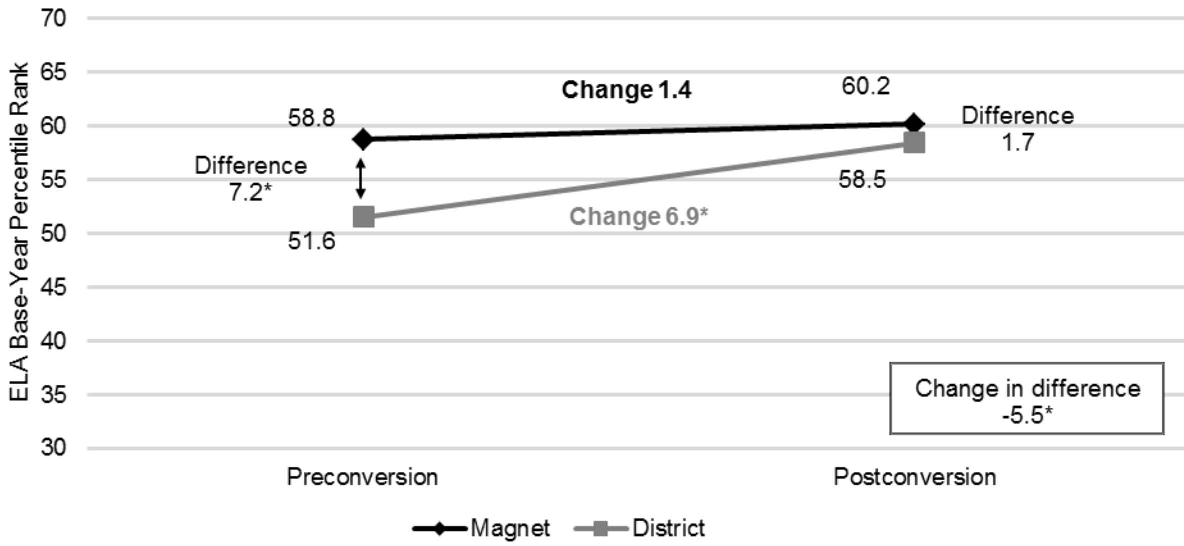
SOURCE: District administrative data.

Achievement in destination magnet schools was unchanged after conversion, whereas achievement in their districts improved.

Describing changes in magnet schools and their districts. The magnet schools started out higher achieving in ELA than their districts (59th percentile compared to 52nd percentile; Exhibit ES.6) and their districts improved by 5.5 percentile points more than the magnet schools. The magnet schools also started out higher achieving in mathematics (58th compared to 52nd percentile) and the districts improved by 5.1 percentile points more than the magnet schools, but this difference was just short of being statistically reliable.

[1] The difference between the actual change in the destination magnets and the change predicted based on that of the neighborhood schools has a *p*-value of .066, just larger than a *p*-value of less than 0.05 that would be needed to be statistically realiable at convential levels.

Exhibit ES.6. Achievement in Destination Magnet Schools and Their Districts (Average Across Schools)



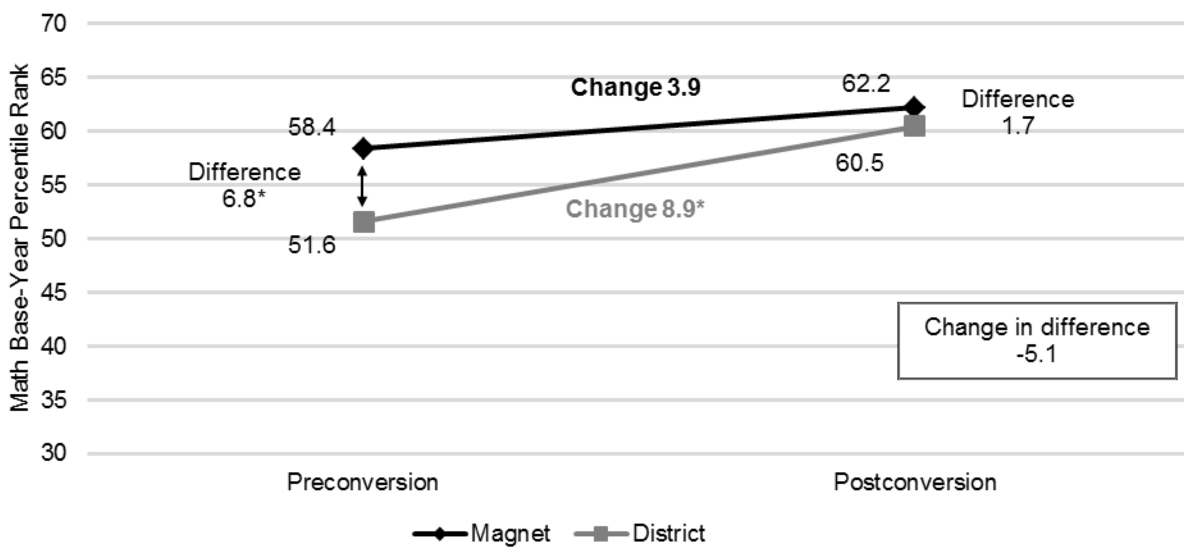


EXHIBIT READS: The average ELA achievement in the magnet schools did not significantly change (increase of 1.4 percentile points) from before (pre-) conversion (58.8th percentile) to after (post-) conversion (60.2nd percentile). The average ELA achievement in their districts increased significantly, by 6.9 percentile points from preconversion (51.6th percentile) to postconversion (58.5th percentile). Therefore, the districts increased 5.5 percentile points more than the magnet schools (a 1.4 percentile point increase in the magnet schools compared to a 6.9 percentile point increase in their districts)—a statistically significant change.

NOTE: See Appendix F for methods used for calculations and significance tests. *N* = four schools in three districts. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure. See appendix Exhibit J.12 for additional detail.

SOURCE: District administrative data.

Chapter 1: Introduction

Magnet schools hold a prominent place in the history of education reforms in the United States. Best known for offering unique programs or curricula to attract students from outside a school's neighborhood, many magnet schools started off as regular neighborhood public schools but converted with the goals of increasing student diversity and achievement. Because these goals remain important to policymakers and educators today, interest continues in whether conversion magnet schools have been able to achieve these goals. This descriptive report describes the results of a study of 21 elementary schools supported through the Department of Education's (ED's) Magnet Schools Assistance Program (MSAP), following them for several years after their magnet conversion to see how their student body composition and academic achievement changed over time.

Magnet Schools and the MSAP Program

Magnet schools first emerged in the early 20th century, with districts establishing competitive-admission magnet schools to provide a rigorous curriculum for their highest achieving students (Finn and Hockett 2012; Steel and Levine 1994).[2] Although this tradition still exists, many more magnet schools were established by districts in the 1960s and 1970s to promote desegregation and encourage parents to keep their children in the district's public schools rather than placing them in private schools or moving to the suburbs (Blank, Levine, and Steel 1996). More recently, magnet schools have become a way for districts to provide school choice. Magnet schools are one of the many options provided to parents so that they can select a school to meet their children's educational needs and interests. Current estimates suggest that there are about 2,700 magnet schools across the United States, which is less than 3 percent of all public schools (Keaton 2012).[3]

Federal support for magnet schools dates to the 1970s, when Congress authorized funds under the Elementary and Secondary Education Act (ESEA) to support school districts attempting to desegregate, including the establishment of magnet programs (Steel and Levine 1994). After a short gap in federal grants for magnet school implementation, Congress established the current MSAP in 1984 specifically to fund magnet schools "designed to bring students from different social, economic, ethnic and racial backgrounds together" (34 C.F.R. § 280.1 [2000]) and improve educational quality (see also Steel and Levine 1994).

Today, the MSAP program continues to support the development of magnet school programs and has three main goals:

- **Promoting Diversity.** MSAP funds are intended to improve diversity by changing the mix of students attending schools receiving MSAP support. Historically, diversity in

[2] Early examples include San Francisco's Lowell High School, Boston Latin School, Chicago's Lane Tech, and the Bronx High School of Science.

[3] The number of magnet schools reported in Keaton (2012) comes from the Common Core of Data (CCD), which reports information from states that identifies which schools are magnet schools.

terms of race and ethnicity was emphasized over that of socioeconomic status, but the characteristics and measures used to assess schools' success in meeting the diversity goal have broadened with legal challenges to using race-conscious assignment for students.[4] In conjunction with this shift, in the 2004 grant year (from which some study schools were drawn), MSAP began to emphasize race-neutral language in describing objectives for promoting diversity.

- **Enhancing Achievement.** All MSAP magnet schools are expected to undertake curricular and instructional reforms that substantially bolster students' academic achievement and career, technological, and professional skills.
- **Expanding Choice.** Beginning in the 2004 grant cycle, MSAP included a third goal: expanding school options within districts. In particular, MSAP grantee districts were to focus on expanding public school choice to students who attend low-performing schools (Office of Innovation and Improvement 2004).

Theory of Action: How Conversion of Neighborhood Schools to Magnet Schools Could Improve Student Outcomes

The key features of a magnet school are a specialized curriculum (e.g., performing arts or mathematics and science programs) or instructional method (e.g., open classrooms or team teaching), and enrollment that is open to students from outside the school neighborhood or attendance zone.[5] The specialization in curriculum or teaching method is hypothesized to affect the school in two ways (Steel and Levine 1994). First, it is the vehicle to change the makeup of the student body, by attracting students from outside the school's neighborhood who are different from students already attending the magnet school—in terms of their race/ethnicity, socioeconomic status, or academic achievement. Second, the specialized curriculum or teaching method can provide a focus for teacher professional development and collaboration, and therefore has the potential to improve the learning environment and instruction, in turn boosting student achievement for all students.

However, the specific path by which this theory of action might result in increased student diversity and achievement depends on the characteristics of the neighborhood school before it converted. There are two models or approaches, both supported through MSAP grant funds. Because these two models start with schools in different situations, and the schools are expected to recruit different types of students and have different target populations of policy interest, it is important to differentiate between them.

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[4] Rulings against race-conscious strategies culminated in 2008 guidance from ED's Office of Civil Rights that "strongly encourages the use of race-neutral methods for assigning students to elementary and secondary schools." (Office for Civil Rights "Dear Colleague" letter dated August 28, 2008; no longer publically available).

[5] In districts with more than one school for the same level of education (e.g., elementary schools), officials typically establish geographic areas around each school to define the households whose children will be assigned to or can automatically attend the school.

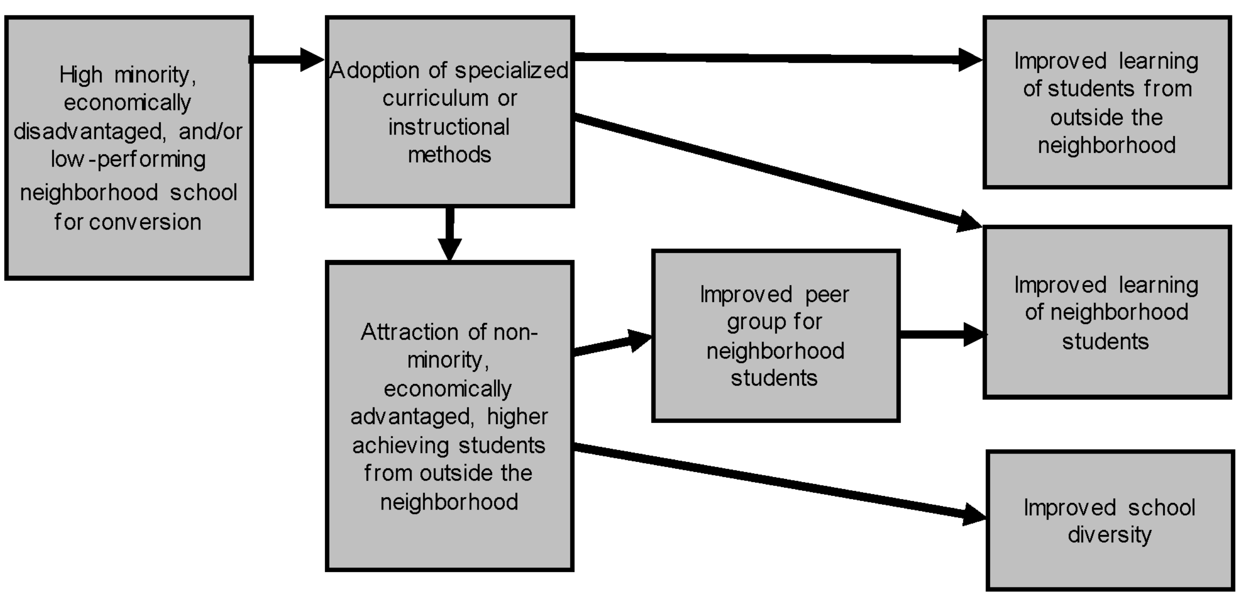
The Traditional Magnet Model

One long-standing approach is for a low-performing neighborhood school that is serving students from low-income households or minority racial/ethnic groups to convert to a magnet school by adopting a specialized curriculum or instructional method (Exhibit 1.1). It is hoped that this change will enable the school to attract students of racial or ethnic groups different from the students who live in the school's neighborhood or attendance zone, as well as students who are more economically advantaged or higher achieving.

Both the new students attracted to the school from outside the neighborhood and the neighborhood students could benefit from the school's specialized curriculum or instructional method. If the recruitment of new students is successful, the hypothesis is that there will be a "spillover" effect. The higher achieving students from outside the neighborhood will contribute to higher teacher expectations. This, combined with the new students' presumed stronger academic motivation, will lead to improvements in the behavior and achievement of the neighborhood students (Bloom et al. 2004; Christenson et al. 2004). In addition, more economically advantaged students might bring with them parents who are able to more effectively advocate for ongoing improvements in the converted schools (Stevenson and Baker 1987). Finally, the race or ethnic diversity of students drawn from outside the neighborhood could support student learning by exposing all students in the school to a wider range of life experiences and opinions than they would otherwise have (see, e.g., Harris 2010).

In this approach to magnet conversion, the main goal is to improve the outcomes of the neighborhood students who would ordinarily attend the low-performing school. These students are typically low achieving and from low-income households and are the focus of most federal policy concern. The newly recruited students are also expected to benefit from the match between their interests and the schools' specialized curriculum and instruction, as well as from the improved learning environment in the magnet school.

Exhibit 1.1. Theory of Action for Conversion of a Traditional Magnet School

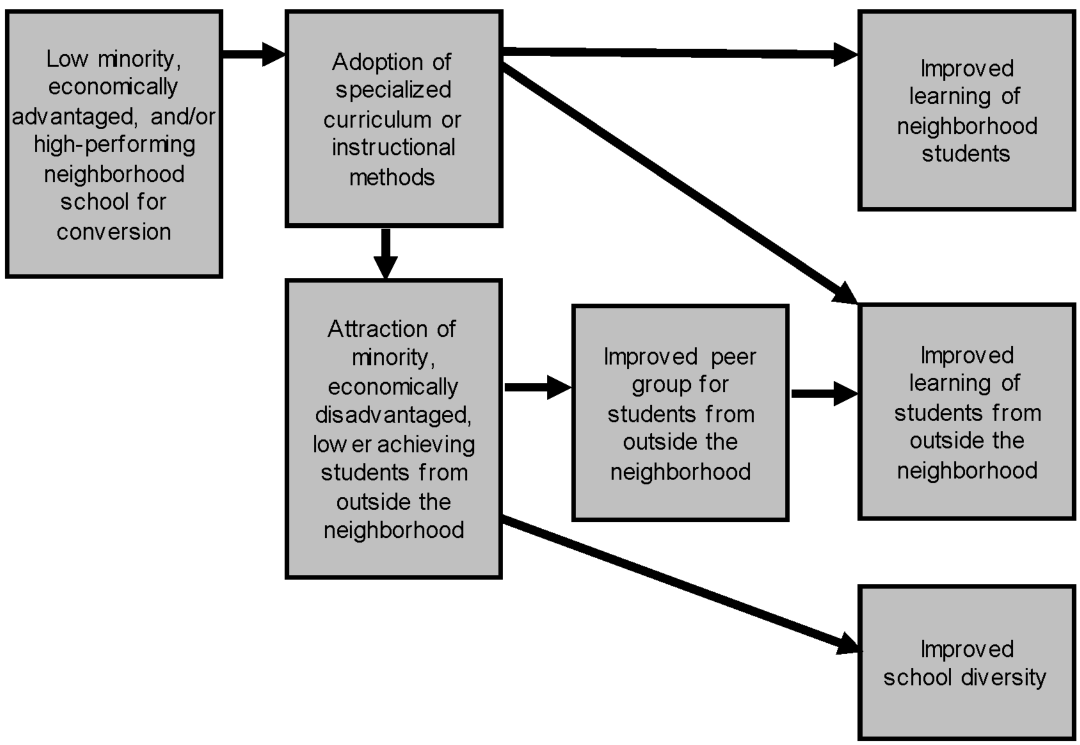


The Destination Magnet Model

Another approach is to convert a relatively high-performing school, often serving relatively low-minority and higher income student populations, to a "destination" magnet (Exhibit 1.2).[6] Like the traditional magnet schools, destination magnet schools are expected to adopt a specialized curriculum or instructional methods. The hope is that adopting the curriculum will make the school an opportunity or "destination" for students from outside the neighborhood, who frequently attend struggling schools, are lower achieving, more economically disadvantaged, and more likely to be from minority racial/ethnic groups than are the neighborhood students.

Like the process for traditional magnet schools, the adoption of a specialized curriculum or instructional methods is expected to improve the learning of both neighborhood students and students from outside the neighborhood. In addition, under the destination model, the students from outside the neighborhood are expected to benefit from attending school with advantaged peers from the neighborhood. It is the outcomes for students from outside the neighborhood that constitute the primary policy interest for destination schools.

Exhibit 1.2. Theory of Action for Conversion of a Destination Magnet School



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[6] Destination schools are typically relatively low-minority, economically advantaged, and/or high-performing schools compared with other schools in their district. They may, however, not necessarily be low minority, economically advantaged, or high performing compared with all schools in their states or nationally. Destination schools should not be confused with the competitive-admission schools mentioned earlier, such as Boston Latin, which are highly selective and typically do not have designated neighborhood students they are required to enroll.

Why This Study?

Despite the widespread presence of different types of magnet schools in the United States and growing interest in their outcomes, there is limited evidence about their effectiveness based on studies using rigorous designs.[7] Previous research has had drawbacks:

- Most studies have not distinguished among different types of magnet programs, which could obscure their outcomes or impacts. Prior research has not separated traditional from destination magnet conversions, or new, elementary, schoolwide conversion magnet schools from other magnet approaches (i.e., schoolwide programs versus individual programs within a school; new programs versus mature ones; magnet elementary schools versus magnet high schools). Because of this lack of distinction, previous studies cannot provide information about the outcomes of any particular approach.
- Some studies have combined the results for neighborhood students and students from outside the magnet neighborhood or focused solely on new students drawn by the magnet program. However, the hypotheses behind magnet conversion suggest that each group of students is affected differently by magnet conversion.
- Some studies have been limited to individual districts, providing less confidence that the results apply to other locations.
- Overall, the research has yielded mixed results. Although some studies have found positive effects for magnet programs, others have found negative effects or no effect.

This study addresses some of the limitations of the previous research. It separately describes the outcomes for schools following the destination approach and schools following the traditional approach. It focuses on neighborhood elementary schools that convert to whole-school magnets. It separately describes what happens to the schools overall as well as the two groups of students that they serve (neighborhood students and students from outside the magnet neighborhood) in terms of diversity and achievement. Finally, this study includes 21 magnet schools in 11 districts across the United States.

This study is, however, not without its own limitations. The most rigorous evaluation method would involve randomization (e.g., randomly assigning some schools to convert to magnet schools and others to serve as controls or randomly assigning some students to attend conversion magnet schools and others to attend neighborhood public schools).[8] But because this study examines conversion schools already funded by the MSAP under the standard MSAP application process, random assignment of schools or students was not feasible. Instead, the study used a statistical approach to compare changes in diversity and achievement in conversion magnet schools to changes in other neighborhood schools in their districts that did not convert. Although

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[7] A thorough review of the literature on magnet schools and achievement can be found in Christenson et al. (2004), which reviews 11 studies of magnet schools and achievement. A review by Ballou (2009) provides more recent evidence from eight studies, five of which use an evaluation methodology that is considered rigorous.

[8] Although random assignment of schools might be possible in principle, historically, MSAP has provided grants for specific schools that districts choose to convert. And although admission of students by lottery might be feasible, none of our study schools had more applicants than available spaces, preventing the use of lotteries.

findings from these statistical models provide additional information about the relationship between magnet conversion and changes in diversity and achievement, they are not conclusive evidence of the effectiveness or lack of effectiveness of magnet school conversion.

Also, although some MSAP converting schools set goals for improving diversity for specific racial/ethnic groups (e.g., increasing the proportion of Latino students but not African-Americans), the study grouped all students from minority racial/ethnic backgrounds together. Thus, the study might have examined some changes in diversity that were not a focus of the schools' efforts.

Organization of the Report

The remainder of this report describes the study methods and findings in more detail.

- Chapter 2 describes how MSAP-funded schools and districts were selected for the study and the analytic approaches used to examine them.
- Chapter 3 puts the study's conversion magnet schools into context, describing factors that could have influenced how school diversity and achievement may have changed in the schools as they converted.
- Chapter 4 describes the MSAP-funded conversion activities in study magnet schools. This chapter explores the type and the extent of magnet conversion implemented, which, like context, may affect diversity and achievement.
- Chapter 5 reports the results for traditional magnet schools, including whether they attracted students from outside the neighborhood and improved in diversity and achievement, and whether such changes in diversity and achievement might be attributed to magnet conversion rather than other factors. Chapter 6 reports the corresponding results for the destination magnet schools.
- Finally, Chapter 7 discusses variation in results across study schools and suggestions for future work to better understand outcomes for magnet schools.

Chapter 2: The Study Schools and Methods

Examining how public schools change when they convert to become magnet schools requires a group of converting schools to observe. Because the study aimed to describe what happened to the schools' diversity and student achievement, and also to see whether the conversion could have played a role in those outcomes, schools meeting specific criteria were needed, along with extensive data on the schools and their students. This chapter provides an overview of the criteria for selecting the study schools, a description of the districts and schools included, a discussion of the data collected, and an overview of the analysis methods used. Additional details are provided in Appendices A through F.

Selection of Districts and Schools

The study sought to assess the changes that occurred in a recent set of MSAP districts and schools. At the time the study began, the 2004 and 2007 MSAP grant cycles were the most recent, and schools were selected from both cycles in order to meet the study's target sample size of at least 13 schools.[9]

The study focused on magnet schools that were elementary, "schoolwide" conversions.

The sample of districts and schools was selected to meet several criteria to facilitate the planned analyses. First, the study sample included only elementary schools. Elementary schools were selected because they were the most common type of magnet school conversion among MSAP grantees.

Second, the sample was restricted to schools that had adopted "schoolwide" magnet programs; that is, magnet programs serving all students in the school. It excluded programs serving only some students in a school. These programs-within-a-school were excluded because the number of students in a school participating in these programs was potentially too small to support analysis.

Third, the schools selected were "new" magnet conversions rather than schools that were already magnet schools when they obtained MSAP support. The analysis approach involved comparing schools before and after they became magnet schools, which would not have been possible with pre-established magnet schools.

Finally, the sample was limited to schools that served neighborhoods whose student attendance boundaries did not change during the study period. The goal of the study was to compare school diversity and student learning before and after conversion and to investigate whether magnet

[9] For a discussion of the approach taken to estimate the number of schools needed (also called statistical power calculations), see Appendix F.2.2.3.1. Although a minimum of 13 schools was needed, the study recruited as many schools as possible and was ultimately able to include 21 in the analysis.

conversion might have played a role in any change that was observed. If the boundaries of the neighborhood served by the school changed over that period, it would be difficult to determine whether changes in outcomes were related to the conversion or to the changes in the boundaries. In the 2004 and 2007 funding cycles, MSAP supported a total of 119 elementary, schoolwide magnet school conversions in 41 districts.

Twenty-one magnet schools in 11 districts were able to provide detailed records on student characteristics, achievement, and school assignments.

The sample was limited to schools in districts that could provide the data needed for the study, including:

- Individual students' race/ethnicity, socioeconomic background (eligibility for free or reduced-price lunch), and achievement, because these are the key outcomes of magnet conversion.[10]
- Whether students lived in the school's neighborhood or outside the neighborhood, in order to focus separately on each student group.
- Consistent measures and ways of recording students' characteristics and achievement by the district for the years included in the study, to enable the measurement of change over the period before and after conversion.
- Data for students in all elementary schools in the district. The analysis involved two steps—first comparing conversion magnet schools to their districts as a whole, and then comparing them to other neighborhood schools that did not convert (i.e., schools that primarily served students within their neighborhood, excluding other magnets and charters).

After reviewing information and/or speaking with representatives of the 41 potentially eligible districts, the study found that 21 conversion magnet schools in 11 districts among the MSAP grantees met the study's stable neighborhood boundary and data requirements. All 21 schools and their districts were included in the study sample (See Appendix A for more on sample selection).[11] In each of these 11 districts, there were only one or two converting magnet schools

[10] In this study, "economically disadvantaged students" are defined as students who are eligible for a free or reduced-price lunch. Students are eligible if their family income is below 185 percent of the poverty line. Information on eligibility was not available for three districts (six schools) that were, nevertheless, included in the sample. For one district (two schools), the lack of information was known prior to the decision to include it in the study. As planned, this district was not included in the analysis of economic disadvantage, but information on parent education was available and was used as a substitute for free or reduced-price lunch as a control variable in the analysis of achievement. For two districts (four schools), information on free and reduced-price lunch was provided but later found to be unreliable. See Appendix F.4.2.1 for more information.

[11] All districts and schools that met the study criteria and provided the required data were included in the study. While 22 study magnet schools were selected for the study, two were located in the same building and had been one school prior to conversion. These two co-located schools were treated as one school in the analysis. Three schools in two districts were selected from the 2004 funding cycle, and 19 schools in 10 districts were selected from the 2007 funding cycle. One district contained two study magnet schools selected from the 2004 funding cycle and two other study magnet schools selected from the 2007 funding cycle.

included in the study, but at least 10 other neighborhood elementary schools that did not convert. (See Exhibit 2.1, which lists the districts included in the study, using anonymous codes to distinguish them.)

Exhibit 2.1. MSAP Grant Years and Numbers of Public Elementary Schools Served by Study Districts

District	MSAP Grant Year	Study Magnet Schools	Neighborhood Public Schools
A	2004	1	169
B (2004)	2004	2	14
B (2007)	2007	2	14
C	2007	1	15
D	2007	3	78
E	2007	1	163
F	2007	3	15
G	2007	2	74
H	2007	1	22
I	2007	1	65
J	2007	2	91
K	2007	2	18
Total		21	724†

† Numbers of neighborhood public schools from District B were counted only once in this total.

NOTE: Two conversion magnet schools located in the same building that had been one regular neighborhood school prior to conversion are counted as one school in this table.

SOURCE: District administrative data.

Study districts, like MSAP districts overall, were larger, were more urban, and served a higher share of minority students than districts nationwide.

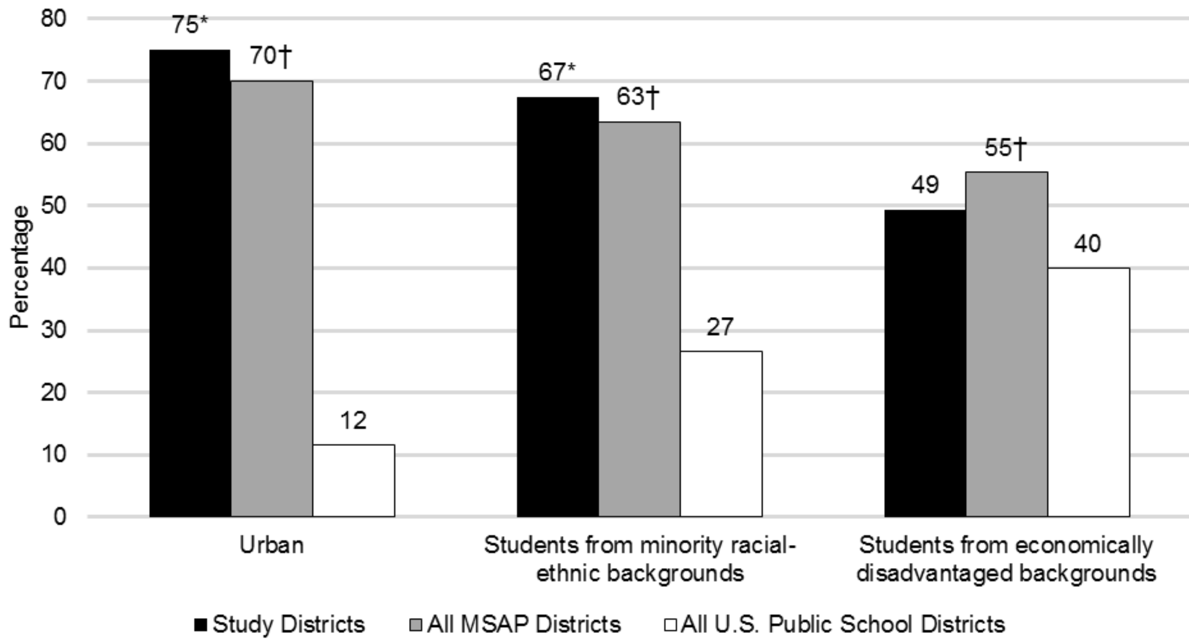
Although the districts in the study were not chosen to be representative of all districts that receive MSAP funding or of all districts in the United States, it is important to understand how they are different or similar. These comparisons provide some boundaries for using the study findings in a larger context, even though the results cannot be generalized to the MSAP program as a whole.[12]

[12] All comparisons were made in the year before conversion: in the 2003–04 school year for the 2004 cohort and in the 2006–07 school year for the 2007 cohort.

- Study districts were similar in size to MSAP districts (100 percent and 78 percent, respectively, with more than 10,000 students) but larger than U.S. public school districts overall (6 percent with more than 10,000).[13]
- Study districts, like all MSAP districts, were mostly urban (75 and 70 percent respectively), whereas only a small percentage of districts in the United States were urban (12 percent; Exhibit 2.2).
- The proportion of students from minority racial/ethnic backgrounds in study districts was similar to all MSAP-funded districts (63 and 67 percent respectively) and both were significantly higher than the proportion in all U.S. public school districts (27 percent; Exhibit 2.2).
- The proportion of students from economically disadvantaged backgrounds in study districts (49 percent) was also similar to all MSAP-funded districts (55 percent) and all U.S. public school districts (40 percent); however, the proportion in all MSAP-funded districts was significantly higher than in all U.S. public school districts (Exhibit 2.2)
- The 12 districts included in the study, as well as MSAP schools, represented all four U.S. regions.

[13] One study district containing magnet schools from both funding cycles is represented twice in background exhibits to display the differing context for 2004 and 2007 funding cycle magnet schools in this district. Hence, the count of districts here, and in other exhibits when noted, is 12 rather than 11.

Exhibit 2.2. Proportion Urban and Average Proportion of Minority and Disadvantaged Students Served by Study Districts, All MSAP Districts, and All U.S. Public School Districts



NOTE: *N* = 12 for sample districts with District B represented twice in the data, once for the 2004 and once for the 2007 MSAP funding cycles. For all MSAP and all districts nationally, percentages in the exhibit are a weighted average of the 2003–04 and 2006–07 percentages, where the 2003–04 percentages were weighted 2/12 for the two 2004 funding cycle study districts represented in the exhibit, and the 2006–07 percentages were weighted 10/12 for the ten 2007 funding cycle districts represented in the exhibit. * All study districts significantly different from all U.S. public school districts ($p < .05$); + All study districts significantly different from all MSAP districts ($p < .05$); † All MSAP districts significantly different from all U.S. public school districts ($p < .05$).

SOURCE: Common Core of Data 2003–04 and 2006–07.

Classification of the Study Schools as Traditional or Destination Magnet Schools

As described in Chapter 1, the theory of action is somewhat different for traditional and destination schools. Thus, the analysis was conducted separately for schools of each type. Data on achievement levels and student characteristics before conversion were used to classify each of the 21 study schools as either a traditional or destination magnet school, though schools did not always fit neatly into the categories.

- A school was classified as a ***traditional magnet school*** if, prior to conversion, its average achievement in ELA and in mathematics were both *below* the district average, and the proportion of students in the school from minority backgrounds and the proportion from disadvantaged backgrounds were both *above* the proportion for the district as a whole. Fourteen schools met all four of these criteria. Three additional schools that met three of the four criteria were also classified as traditional.[14]

[14] The percentage of students from economically disadvantaged backgrounds was not available for six schools. On the basis of their other characteristics, all six were classified as traditional magnet schools.

- A school was classified as a ***destination magnet school*** if, prior to conversion, its average achievement in ELA and in mathematics were both *above* the district average, and the proportion of students in the school from minority backgrounds and the proportion from disadvantaged backgrounds were both *below* the district proportion. No school met all of these criteria; however, four schools that met three of the four criteria were classified as destination.

Using this approach, 17 of the 21 conversion magnets included in the study were classified as traditional magnet schools, and 4 were classified as destination magnet schools (see Appendix A.5 for more details).

Data Collected for the Study

To conduct the analysis (discussed in detail below), the study relied primarily on student administrative records collected by the district for state reporting purposes and obtained directly from district offices. These records contained data on student characteristics, academic achievement based on state assessments, and neighborhood of residence for all elementary students in each district. Typically, the data obtained included all elementary students enrolled in each district during the two years before conversion and the four years after conversion.[15] However, because of differences in when state assessments were offered, the number of years and grades used in the study's analyses varied by district (Exhibit A.3).[16] Although the availability of data on students' status as a neighborhood or out-of-neighborhood student was a criterion for inclusion of districts and schools in the study, for 6.0 percent of the student records in the sample, residency information was missing. In 2.0 percent, it was possible to impute the information using data for that same student from other years, leaving 4.0 percent of records in the analysis dataset missing residency information.[17] The final dataset used in the analysis contained one record for each student for each year during the study period that the student attended a school in the district—about 1,500,000 student records in all (see Appendix A.3 for more detail).

The study also gathered information from other sources to put the magnet conversions in context and describe magnet implementation.

[15] The official MSAP grant period is three years: 2004–05 through 2006–07 for the 2004 funding cycle and 2007–08 through 2009–10 for the 2007 funding cycle. Because of delays in awarding the 2007 MSAP grants, the districts in the study sample were permitted to continue implementation activities using remaining grant funds, and the study continued to collect student data, through the 2010–11 school year. The study also collected data from districts in the 2004 MSAP funding cycle for one or more years after the end of their three-year grant period. Accordingly, the study was able to track composition and achievement outcomes for four (rather than three) years after conversion in all but one district. The exception was for District B in the 2007 funding cycle: changes in the administrative data collected by the district prevented the analysis from being extended to the fourth post-conversion year.

[16] For details on state assessments see Appendix A.

[17] For details on determining students' neighborhood of residence and the method used to handle missing neighborhood information, see Appendix B.2.

- Systematic interviews were conducted with MSAP directors in 2011 in all 11 districts; the directors were asked for retrospective information on district improvement policies and on study magnet schools, including information on difficulties schools might have had in student recruitment and retention (see Appendix C for details). Magnet school principals were surveyed to obtain information on the conversion magnet schools, including magnet conversion components and implementation timelines (responses were received from all but one principal; see Appendix D for details).[18]

- Information on student characteristics and other characteristics of schools and districts was collected from additional existing data sources, including those maintained by ED (school-level data from the ED*Facts* system based on state annual performance reporting and the National Center for Education Statistics' CCD), as well as state education department websites (see Appendix E for details).

Examining Change in Magnet Schools

This study addresses three questions to see if conversion schools changed in ways that would be expected based on the theory of action:

1. Did the composition of neighborhood students and students from outside the neighborhood in the magnet schools change after conversion?

2. Did the diversity in the magnet schools increase after conversion, and is there any evidence that it was related to conversion?

3. Did the achievement in the magnet schools increase after conversion, and is there any evidence that it was related to conversion?

1. Did the composition of neighborhood students and students from outside the neighborhood in the magnet schools change after conversion?

Both traditional and destination magnet schools were expected to bring in more students from outside the neighborhood after conversion, and for the outside students to be different from the neighborhood students on various characteristics. To assess whether the first happened, the proportion of students from outside the neighborhood in the study schools before conversion was compared to the proportion afterwards. Then the characteristics of students from outside the neighborhood were compared to the characteristics of neighborhood students—the proportion from racial/ethnic minority groups, the proportion who were economically disadvantaged (i.e., eligible for the federal free and reduced-price lunch program), and the average standardized test scores after conversion. Finally, because there were students from outside the neighborhood

[18] Principal surveys were administered in summer and fall 2008 for 2004 funding cycle schools and fall 2010 through summer 2012 for 2007 funding cycle schools. Two conversion magnet schools that operated at the same location and had been one school during early years of the study time period were counted as one school for most analysis in the report. However, as the schools had different principals at the time of survey administration, each principal was administered a survey, bringing the total number of surveys administered to 22. Responses were collected from 21 of 22 study magnet school principals (95 percent).

already in the magnet schools prior to conversion, an additional step examined whether the differences between the students from outside the neighborhood and the neighborhood students were greater after conversion.

2. Did the diversity in the magnet schools increase after conversion, and is there any evidence that it was related to conversion?

This question focused on the diversity in magnet schools in terms of the proportion of minority students and students from disadvantaged backgrounds. The analysis proceeded in two steps.

Describing changes in magnet schools and their districts. As a first step, the pre- to postconversion change in magnet schools was compared with the change in the districts in which the magnet schools were located. The goal of this analysis was to determine whether magnet schools changed in the anticipated direction relative to any overall change in their districts, and if so, how large the changes were.

The diversity in a magnet school was defined as the proportion of students from minority racial/ethnic groups and the proportion who were economically disadvantaged served by the magnet schools, relative to the same proportions served by their districts overall. This "relative" approach was used for several reasons. First, the characteristics of a converting school could change simply because the demographics of the district are changing; anchoring the magnet school change in the district change helps to take this possibility into account. Second, there is typically a set pool of students in a given district. Thus, when a converting magnet draws a greater or lesser share of some student groups, it invariably means a change in some other school or schools in the district. That outcome is desirable if the changes result in greater balance in student composition across the district. The MSAP gives districts and schools flexibility in how they measure improvements in diversity. For this study, an improvement in diversity is defined as an increase or decrease in the "concentration" of students from certain groups defined by race/ethnicity or socio-economic status in magnet schools in ways that would be expected based on the theory of action. As a result, in this study a positive change in diversity means that the proportion of students who are disadvantaged or from a minority race/ethnic background in the converting magnet schools became more like that of their districts.

Investigating the role of magnet conversion. Once the overall change from pre- to postconversion was examined, a second analysis was conducted to investigate whether magnet conversion may have played a role in any changes in diversity in magnet schools. In an effort to rule out other potential factors that might explain the observed change, the changes in magnet school student composition were compared with the changes in neighborhood elementary schools that did not convert (i.e., schools that primarily served students within their neighborhood, excluding other magnets and charters). In this analysis, the average change in neighborhood schools that did not convert represents a "counterfactual"—in other words, changes in neighborhood schools that did not convert represent what would have occurred in magnet schools if they had not converted. If the magnet schools experienced changes similar to what would be predicted based on the changes experienced by neighborhood schools that did not convert, it would suggest that the magnet school outcomes might be part of a larger trend for all neighborhood schools in the district rather than a result of conversion. If the changes were different than what would be predicted based on neighborhood schools that did not convert, then magnet conversion is a possible explanation for the difference. (The statistical method, a “comparative interrupted time series,” or CITS, analysis, is described in Appendix F.2.2.2.) Although it is not possible to rule out all factors other than conversion with certainty, given the study design it is possible to provide suggestive evidence of the role of conversion.

Because some schools had a higher proportion of minority students or disadvantaged students than their districts and others had a lower proportion, the key variable in this analysis was the *size* (or absolute value) of the difference between the school and district proportions. Regardless of proportion prior to conversion, improved diversity entailed a reduction in the difference between the two proportions. Hence, the analysis used the size of the difference between a school and its district’s proportions to examine whether magnet schools became more like their districts after conversion than would be predicted.

3. Did the achievement in the magnet schools increase after conversion, and is there any evidence that it was related to conversion?

A primary goal of magnet conversion is to improve the achievement of all students in the school. Paralleling the approach for research question 2, this research question was addressed in two steps.

Describing changes in magnet schools and their districts. As a first step, the study examined whether the average mathematics and English language arts (ELA) achievement in the magnet schools was higher after conversion, by comparing the test scores of students attending after conversion to the test scores of students who were in those same grades in the years before conversion. For comparison, a similar analysis was conducted of achievement levels in the districts in which the magnet schools were located. Higher achievement in magnet schools after conversion could be due to either improved learning among students who attended the schools, or to the attraction of higher performing students after conversion who, essentially, bring up average test scores. Both could be a result of the conversion to a magnet school, or of other factors such as district-wide initiatives.

Investigating the role of magnet conversion. As a second step, an analysis was conducted to examine whether conversion played a role in the observed changes in achievement. To assess the potential role of magnet conversion, the year-to-year achievement gains of students in neighborhood schools that did not convert were used to predict what the gains for neighborhood students in study schools would have been *had the study schools not converted*. (The statistical method, a comparative interrupted time series, is described in Appendix F.2.2.2.) To focus the analysis on what students learned while attending a magnet school rather than on what they had learned before, the analysis focused on students’ annual achievement gains—their increases (or decreases) from one grade to the next. In addition, the statistical model also accounted for the race/ethnicity, economic status, age, disability status, and English language learner (ELL) status of students so that the gains for neighborhood students in study schools were compared with students *with similar background characteristics* in neighborhood schools that did not convert.

The analysis focused only on the traditional magnets. The neighborhood student populations in traditional magnet schools—typically higher minority, more economically disadvantaged, and lower achieving—are of the greatest policy interest. In destination schools, the policy interest is the lower performing students from outside the neighborhood, and there are better approaches to examine the outcomes of students who transfer into schools, including methods based on lotteries. However, there were too few students from outside of the neighborhood transferring to destination magnet schools to apply these methods reliably.

Chapter 3: Magnet School Context

The settings in which magnet schools are located could shape the changes that occur in these schools after conversion. Certain district characteristics or efforts could influence the magnet schools' ability to attract and retain students from outside the neighborhood or to distinguish themselves from other district schools. This chapter explores district factors that could, hypothetically, affect study magnet schools' success.

Most study districts had diverse populations from which conversion magnet schools could draw.

The overall composition of students in the districts could influence the magnet schools' ability to draw students from outside their neighborhoods who are different from students already attending these schools. Depending on whether a magnet implements the traditional or the destination approach, the types of students targeted for recruitment likely differ. If the type of student that a magnet targets is a small share of the district's student population, the school might experience difficulty bringing in enough students to change the magnet school's student body. For example, schools implementing the traditional approach might have a hard time attracting economically advantaged students if their districts largely serve economically disadvantaged students. The converse is true for the destination schools. Districts with fewer than 20 percent or more than 80 percent of their students with the characteristics of interest were considered less diverse in ways that could present challenges for the success of magnet recruitment, whichever type of magnet approach was pursued.

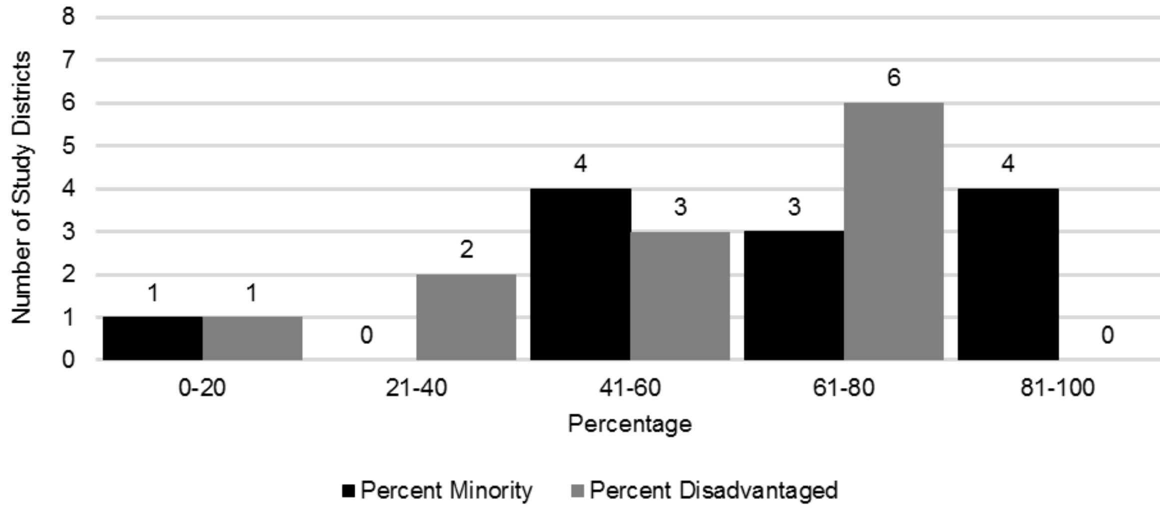
However, most of the magnet schools in the study did not appear to face those conditions (Exhibit 3.1).[19]

- **More than half of the study districts had a mix of white students and students from minority racial/ethnic groups.** In 7 of the 12 study districts, representing 12 magnet schools, the population of students in minority racial/ethnic groups was between 20 percent and 80 percent. Of the six study schools in the four districts with more than 80 percent of the students from minority racial/ethnic groups, three were traditional magnet schools that could potentially be constrained by the more limited student diversity and three were destination magnet schools. There was one destination magnet in the one district with relatively few students from minority racial/ethnic groups (less than 20 percent of the district population).
- **All but one district, with one destination magnet school, served an economically diverse student body.** In 11 of the 12 study districts, representing 18 magnet schools, the population of students who were economically disadvantaged was between 20 percent

[19] The sensitivity of the changes in outcomes after conversion to these potential constraints in the pool of targeted students was tested. See Appendix H.1.

and 80 percent. There was one destination magnet in the one district with relatively few economically disadvantaged students.

Exhibit 3.1. Number of Study Districts by Range of Percentage Minority Students and Percentage Disadvantaged in the Year Before Magnet Conversion



NOTE: *N* = 12 districts for this exhibit. District B is represented twice to display differing context for the 2004 and 2007 funding cycle magnet schools in this district.

SOURCE: Common Core of Data 2003–04 and 2006–07 school years.

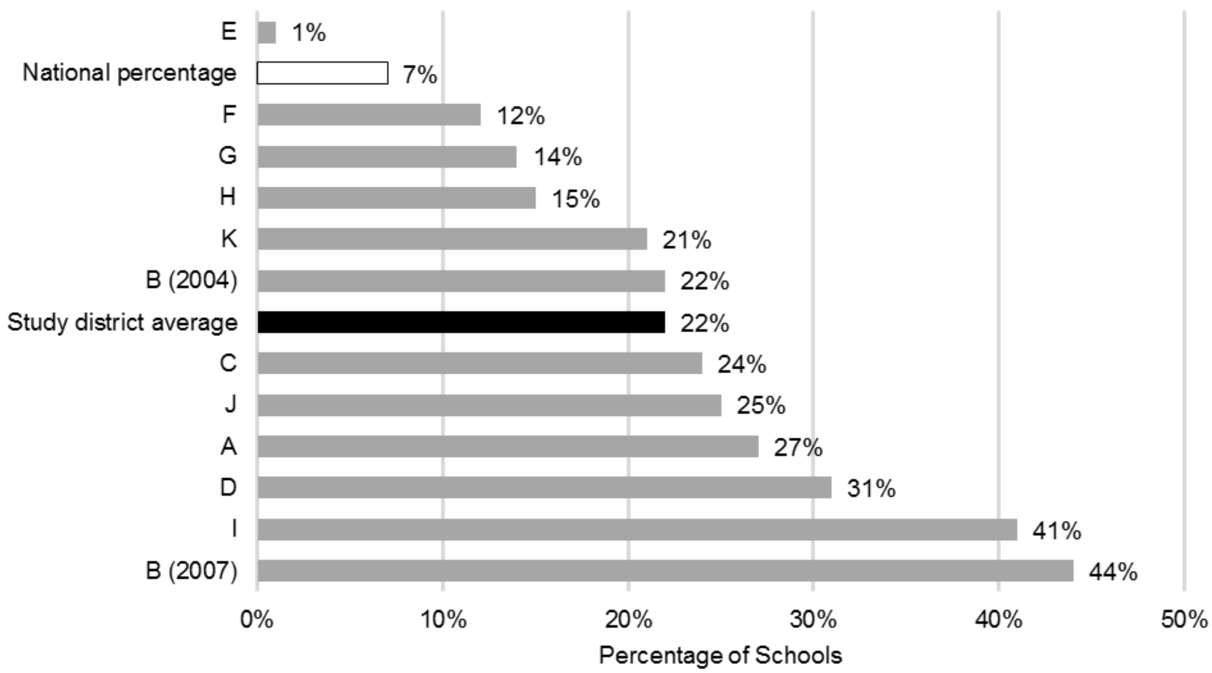
In study districts, the magnet schools were not the only choice option available to parents and students, and not necessarily the better performing of the options.

The availability of other public school choice options (i.e., other magnet and charter schools) and their relative academic performance also could influence study magnet schools' ability to recruit and retain students. More options could mean more competition for students. And to the extent that parents seek out and make their school choices based on test scores, the converting magnet schools could be at an advantage or a disadvantage relative to these other choice options or to the traditional public schools that students could attend in their home neighborhoods.

- **Study magnet schools were located in school districts with many school choice options.** In study districts, on average, 22 percent of the elementary schools were charter or magnet schools (Exhibit 3.2). This was approximately three times the national percentage (7 percent of schools). The percentage of elementary schools that were charter or magnet schools was lower than the national percentage in only one district (District E), where 1 percent of the schools were charter or magnet schools.
- **The other choices available to families were not uniformly better or worse academically than the converting magnet schools, as measured by their program improvement (PI) status.** PI status, a designation that is part of the federal school accountability system and made public to parents, is given to schools that failed to meet adequately yearly progress (AYP) in achievement in a given subject or in the percentage of students tested for two consecutive years. In four study districts (A, B 2004, J, and K),

seven schools that converted to magnet schools had not been in improvement status, whereas other choice and traditional public schools had received that designation (Exhibit 3.3). In the other eight districts, a similar or higher share of the magnet conversions than other schools had been in PI status.

Exhibit 3.2. Percentage of Elementary Public Schools in Study Districts and the United States That Were Charter or Magnet Schools in the First Year of the MSAP Grant



NOTE: District B is represented twice to display differing context for the 2004 and 2007 funding cycle magnet schools in this district. CCD identifiers of magnet and charter schools were verified and, in some instances, corrected with data from the MSAP office, district websites, and MSAP director interviews.

SOURCE: CCD 2004–05 and CCD 2007–08.

Exhibit 3.3. Number of Study Magnet Schools, Percentage of Other Magnet and Charter Schools, and All Other Schools Ever in Program Improvement (PI) During the Postconversion Period

District	Study Magnet Schools		Other Magnet and Charter Schools	All Other Schools
	N	Ever in PI		
A	1	0%	42%	54%
B (2004)	2	0%	33%	29%
B (2007)	2	50%	29%	30%
C	1	100%	20%	62%
D	3	100%	76%	62%
E	1	100%	50%	59%

District	Study Magnet Schools		Other Magnet and Charter Schools	All Other Schools
F	3	100%	N/A	13%
G	3	33%	37%	20%
H	1	100%	75%	45%
I	1	100%	71%	80%
J	2	0%	42%	32%
K	2	0%	50%	20%
Combined		55%	52%	50%

NOTE: District B is represented twice to display differing context for the 2004 and 2007 funding cycle magnet schools in this district. In District F, there were no other magnet or charter schools.

SOURCE: ED*Facts* and state accountability websites.

Study schools were converting to magnet schools during a period in which their districts were improving academically and implementing a variety of reforms.

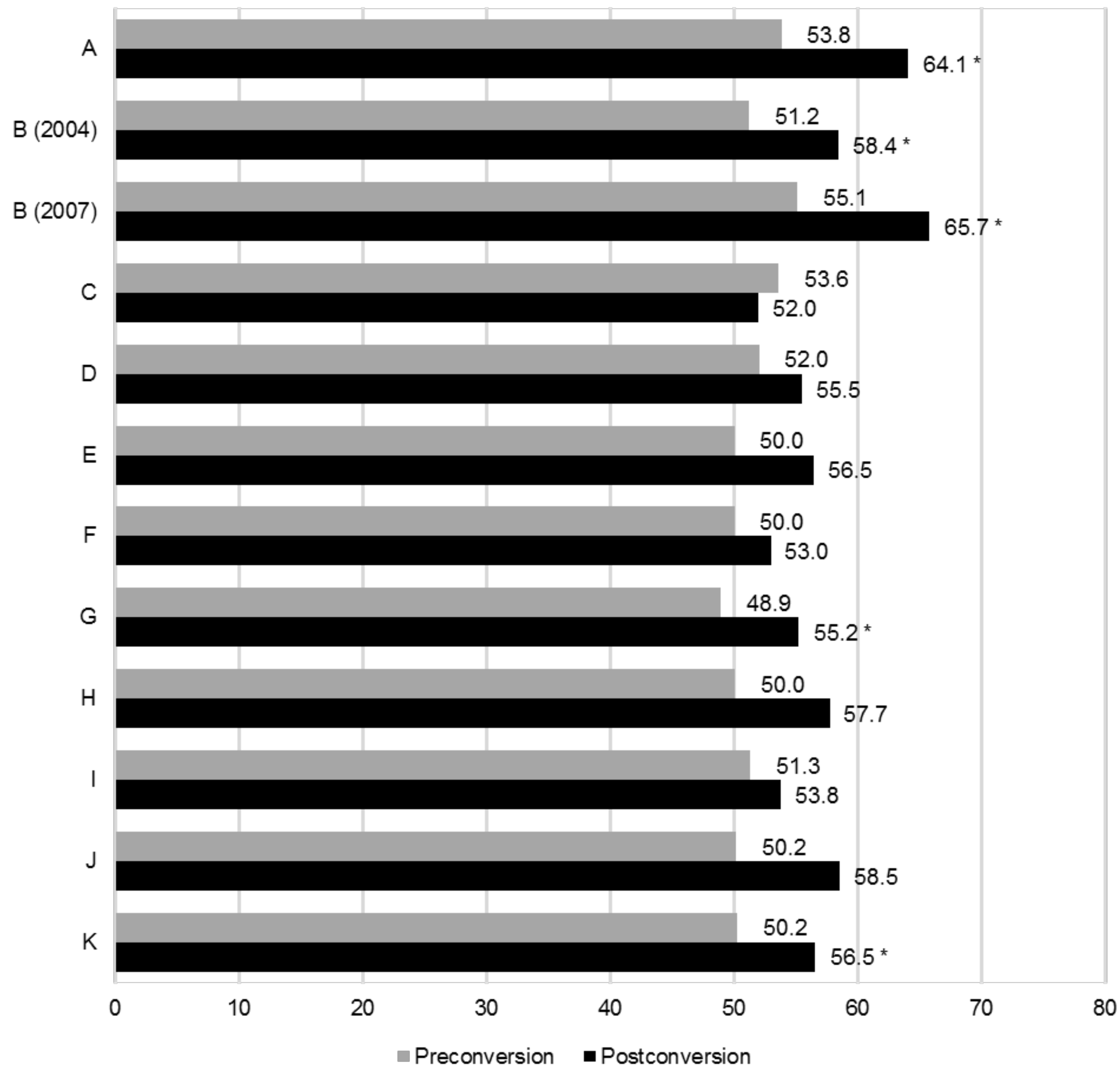
The introduction of district activities designed to improve achievement, whether targeted to particular schools or implemented districtwide, has the potential to affect the converting magnet schools. Education reforms taking place in nonmagnet schools could make it more difficult for newly created magnet schools to distinguish themselves academically. District reforms the magnet schools had to undertake (because they were required for all schools in the district or just the low-performing schools) could interfere with the simultaneous implementation of a new schoolwide magnet program.

- **Study schools were located in districts that were, on average, higher achieving in the postconversion period relative to the preconversion period.** Study districts experienced an average increase of 6 percentile points in ELA and 8 percentile points in mathematics (Exhibits 3.4 and 3.5, respectively). Five districts (containing nine study schools) experienced an increase in ELA achievement, whereas seven districts (containing 14 study schools) experienced an increase in mathematics achievement.[20] No district experienced a significant decrease in achievement in either subject.
- **Almost all the study districts required schools to undertake reform activities during the time that the conversions were being implemented, according to MSAP directors.** In seven (of the eight) reporting districts, MSAP directors reported that at least one reform activity was required of all elementary schools in the district (Exhibit 3.6).[21] In four of these districts, at least one additional reform activity was required for schools in PI status. In the districts requiring reform activities in PI schools, all of the conversion magnet schools in the district were in PI status.

[20] District B is represented twice, once for each funding cycle.

[21] Information on district reform activities was collected retrospectively as part of MSAP program director interviews in which directors were asked about reforms that were implemented in their districts. This information was not collected for the 2004 funding cycle for schools in Districts A and B.

Exhibit 3.4. Average ELA Achievement Percentile for Districts, Pre- and Post-conversion

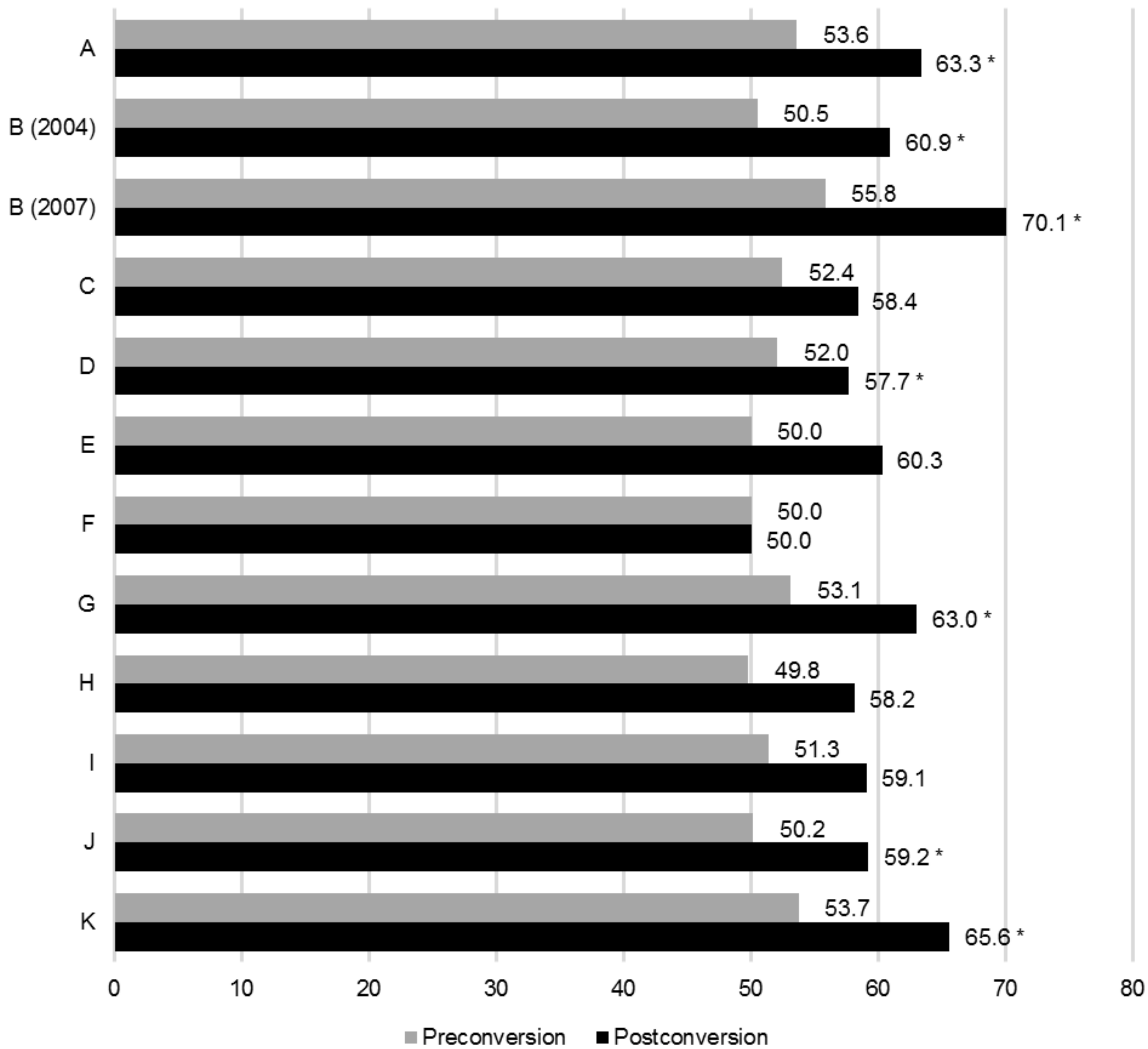


* The difference between pre- and postconversion achievement is statistically significant (*p* < .05).

NOTE: District B is represented twice to display the differing contexts for the 2004 and 2007 funding cycle magnet schools in this district. District data were standardized within grade and district using the first year of data as a base year. Statistical tests were based on annual achievement averages for each district; average achievement was compared for the years before and after conversion.

SOURCE: District administrative data.

Exhibit 3.5. Average Mathematics Achievement Percentile for Districts, Pre- and Postconversion



* The difference between pre- and postconversion achievement is statistically significant (*p* < .05).

NOTE: District B is represented twice to display the differing contexts for the 2004 and 2007 funding cycle magnet schools in this district. District data were standardized within grade and district using the first year of data as a base year. Statistical tests were based on annual achievement averages for each district; average achievement was compared for the years before and after conversion.

SOURCE: District administrative data.

Exhibit 3.6. Districtwide School Reform Activities Required in Years After Conversion for All Schools, Schools in PI (Only PI), or None of the Schools for Study Districts With the 2007 Funding Cycle Study Magnet Schools

District	Study Magnet Schools (*N*)	Adopt New Mathematics Curriculum	Adopt New ELA Curriculum	Increase Instruction Time	Use Frequent Assessments	Assign Instructional Specialist	Test Preparation Activities
B (2007)	2	All	None	All	All	None	All
C	1	None	All	All	All	None	All
D	3	All	None	All	All	None	Only PI
E	1	Only PI	Only PI	Only PI	All	All	Only PI
F	3	All	None	None	None	All	Only PI
G	3	None	None	None	None	None	None
H	1	All	None	Only PI	Only PI	All	None
I	1	—	—	—	—	—	—
J	2	None	None	None	All	None	None
K	2	—	—	—	—	—	—

NOTE: *N* = 10 study districts that contained the 2007 funding cycle study magnet schools. Because this information was collected retrospectively in 2011 and 2012, it was not collected for the 2004 funding cycle schools.

All = Activity was required for all schools in the district.

None = Activity was not required for any school in the district.

Only PI = Study magnet schools were in PI status, and activity was required for all district schools in PI status.

Dash (—) indicates that the MSAP director did not have information to answer the question.

SOURCE: MSAP director interviews.

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Chapter 4: Conversion Magnet School Implementation

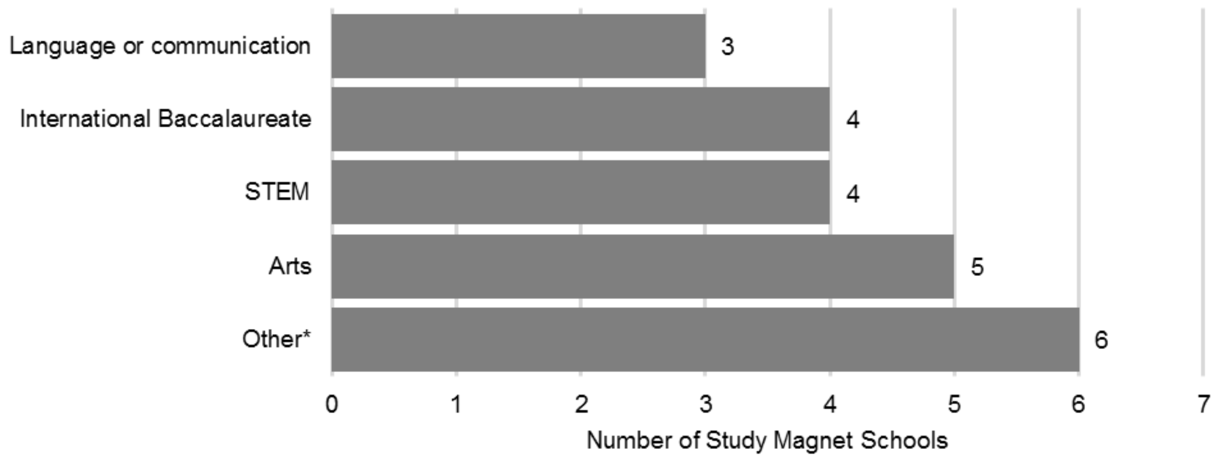
In addition to the district context, the specific characteristics of the school and its magnet program are important factors that could influence outcomes. The approach to magnet conversion, magnet theme, the timeline, the extent of program implementation, and the availability of additional resources could influence the changes in student achievement and composition that magnet schools are able to attain. This chapter explores those school factors that could, hypothetically, affect the study magnet schools' success.

The study magnet schools adopted a variety of themes.

Magnet schools implement distinctive curricula to support instruction and attract students from outside the neighborhood or attendance zone. The MSAP-supported districts and schools selected the themes for their schools. Themes that are better matched to the interests of district students could make recruitment easier or appeal to certain kinds of students the schools want to serve. For example, a mathematics theme may be more appealing to students who are already higher achieving in this subject or students who are motivated to excel in this area.

There was no dominant theme adopted by the conversion magnet schools in the study, although some fell into similar categories (Exhibit 4.1). Curricular themes related to the arts were the most common grouping (five schools). Four schools adopted themes related to STEM or International Baccalaureate, whereas three schools chose themes related to language or communication. The largest category in Exhibit 4.1 (other) included subject themes that did not fall into the other categories, such as museum studies and international studies, as well as some themes focused on a method of learning, such as experiential learning.

Exhibit 4.1. Number of Study Magnet Schools by Magnet School Theme Category



* Themes in the other category include both subject themes that do not fall in any of the categories listed as well as school themes focused around a method of learning (e.g., experiential learning) rather than a particular subject matter.

NOTE: Twenty-two conversion magnet schools are represented. The two magnet schools treated as the same school for analysis elsewhere are considered separately here as they had different themes.

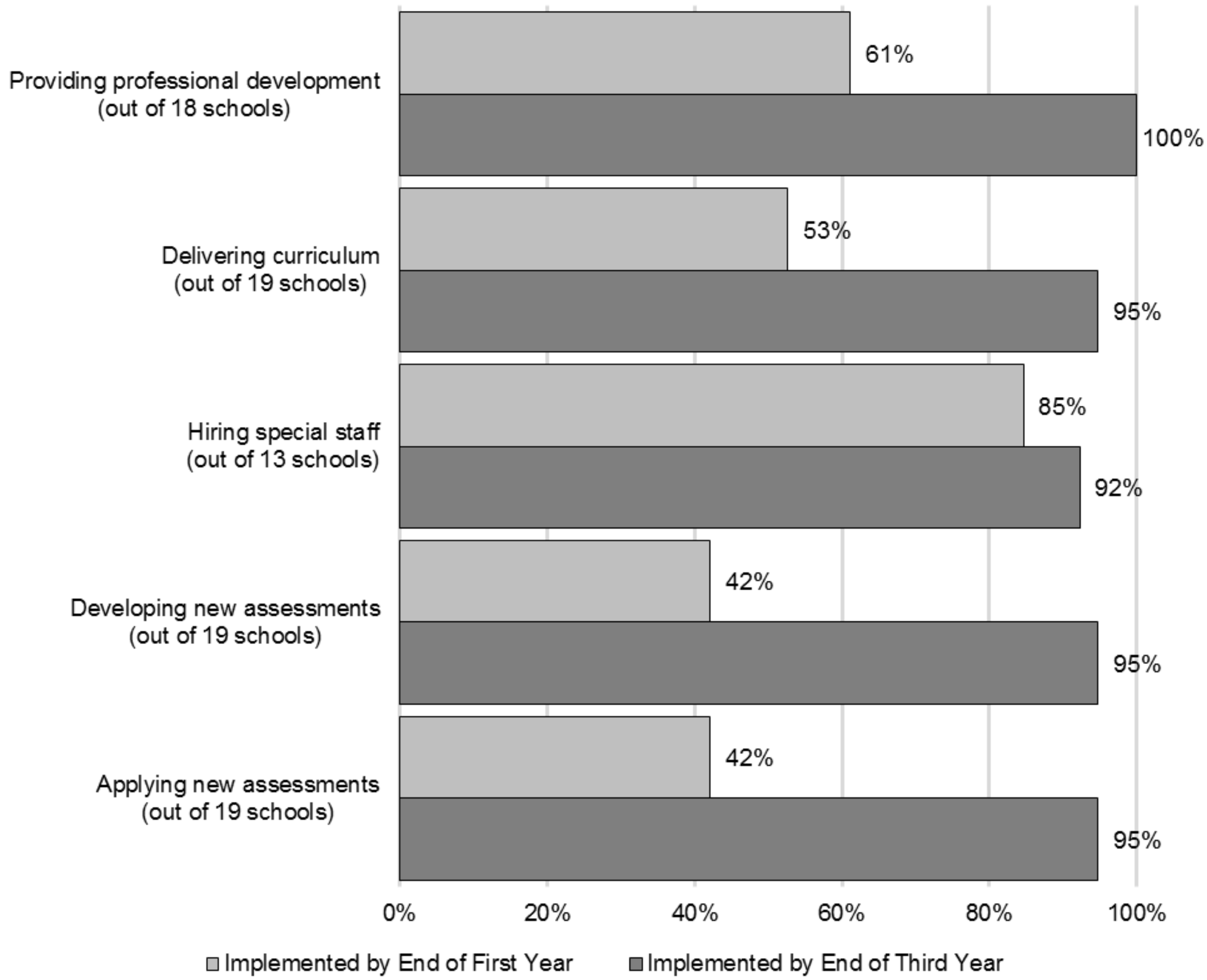
SOURCE: MSAP director interviews.

Principals reported that almost all the study magnet programs were fully implemented and reached all students by the third grant year.

Magnet school outcomes could depend on the timely and full implementation of the magnet program. However, magnet conversions can take some time to implement. Teachers need to be trained in the new curriculum theme and approach, and new students need to be recruited (U.S. Department of Education 2003).

- **Principals reported that the magnet components that they considered important were in place by the third grant year.** Almost all the principals (more than 90 percent) reported mostly or fully implementing magnet program components that they viewed as important by the third grant year (Exhibit 4.2). However, fewer principals reported implementing these components in the first grant year. For example, approximately half of the principals reported mostly or fully delivering curriculum or developing or applying new assessments in the first grant year (53 percent and 42 percent, respectively). In contrast, by the third grant year, almost all the principals reported mostly or fully implementing these same components (95 percent).
- **In all but one conversion magnet school, the principals reported that all students were receiving instruction in the magnet curriculum by the third grant year.** Principals reported that in all but one conversion magnet school, all students were receiving instruction in the magnet curriculum by the third grant year. In the remaining school, more than half of the kindergarten and first-grade students were receiving instruction in the curriculum, but fewer than 25 percent of the students in grade 2 and higher were receiving instruction in the curriculum.

Exhibit 4.2. Percentage of Principals Reporting That Magnet Program Components Considered Important Had Been Implemented by the End of the First and Third Year After Conversion



NOTE: Nineteen principals provided information on the importance and the implementation of components. The results shown for each component are based on the principals who responded that the component was of major or moderate importance to the success of the magnet program. The number of principals reporting major or moderate importance is noted in parentheses beneath the component label. Percentages in the display are calculated from the number in parentheses.

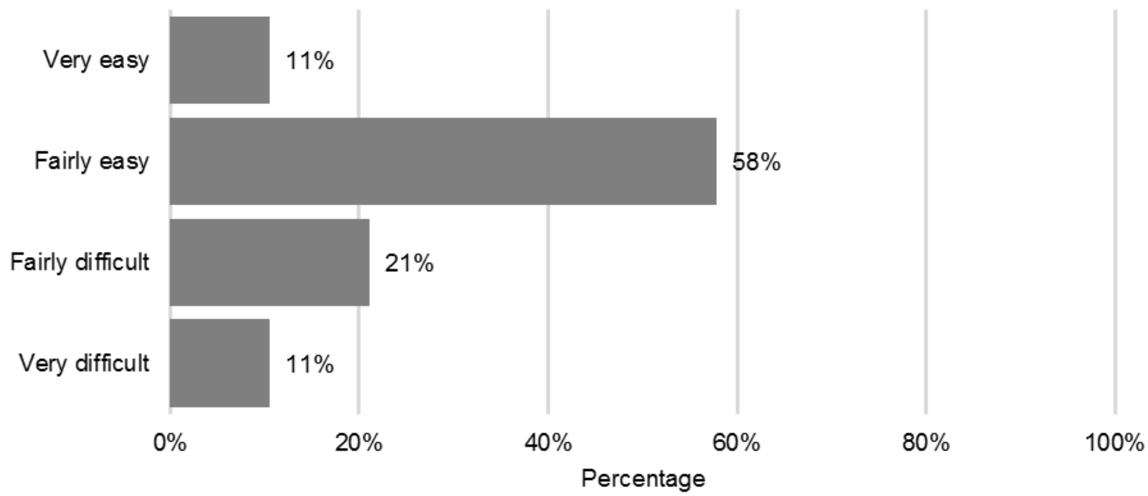
SOURCE: MSAP principal survey.

Most study magnet schools reported that they did not experience problems with staff development or student recruitment.

Given the importance to magnet school conversion of introducing a new curricular theme and attracting students from outside the neighborhood, challenges in either of these areas could have some bearing on student and school outcomes.

- **Most principals reported that it was easy to build a staff that supported the magnet program.** More than two thirds of principals (69 percent) reported that it was fairly easy or very easy to do so (Exhibit 4.3).
- **MSAP directors reported that most study magnet schools did not have problems recruiting or retaining students because of choice in their districts or their PI status.** According to the directors, less than one third of the conversion magnet schools experienced these challenges. Most MSAP directors reported that schools did not have difficulty recruiting or retaining students because of competition from other magnet or charter schools or because of conversion schools' PI status (Exhibit 4.4).

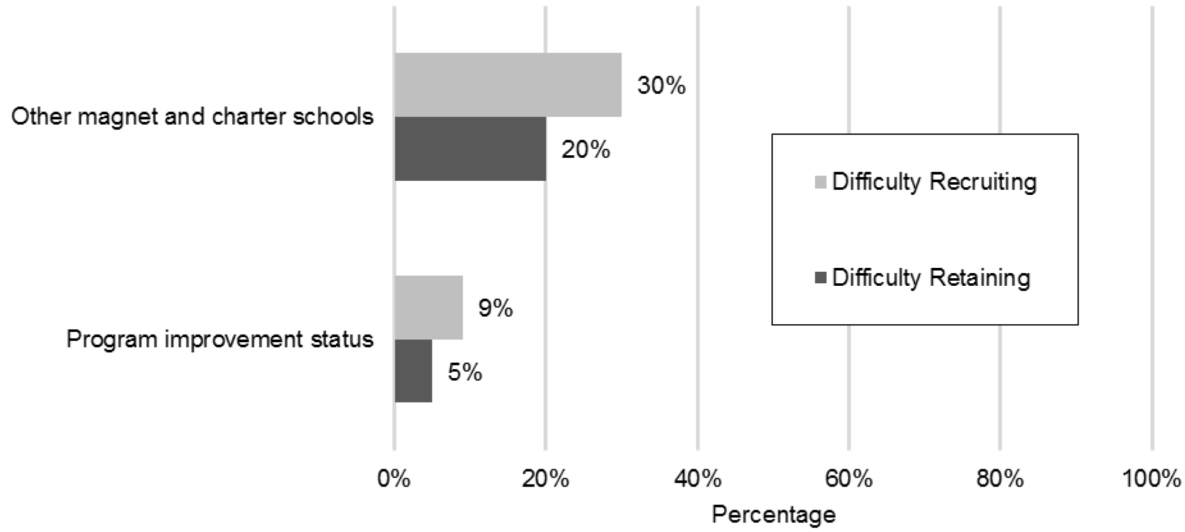
Exhibit 4.3. Percentage of Study Magnet School Principals Who Reported That It Was Very Easy, Fairly Easy, Fairly Difficult, and Very Difficult to Build Staffs That Actively Supported Their Magnet Programs



NOTE: Percentages are based on 19 respondents to this question.

SOURCE: MSAP principal survey.

Exhibit 4.4. Percentage of MSAP Directors Reporting That Other Magnet and Charter Schools or Program Improvement Status of Study Magnet School Posed Difficulty for Recruiting or Retaining Students



NOTE: Percentages for other magnet and charter schools are based on 20 schools for which MSAP directors provided responses. Percentages for PI status are based on 22 schools. The two magnet schools treated as the same school for analysis elsewhere were considered separately here because they had been treated separately in the interview with their MSAP director. All schools cited as having difficulty as a result of PI status also had difficulty as a result of other magnet and charter schools.

SOURCE: MSAP director interviews.

More than half of the conversion magnet schools received financial support for the magnet program beyond the MSAP grant.

More funding could help magnet schools implement their program or recruit students more fully and effectively. Of the 22 study schools, 13 received additional financial assistance from sources other than MSAP. This support took a number of forms, including supplemental funds from the district (one school); federal or state grants (five schools); financial or in-kind support from magnet program partners (six schools); and local grants, foundations, or fundraisers (12 schools).

All but one study magnet school had plans to continue the magnet program after the MSAP grant ended.

Continuation as a magnet school beyond the MSAP grant period may be a signal that district and school staff members were invested in the magnet program and viewed the magnet conversions as successful or developing in the right direction. MSAP directors reported that, with one exception, all conversion magnet schools planned to continue their programs after the grant period.

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Chapter 5: Outcomes for Traditional Conversion Magnet Schools

Descriptive information provided in the previous chapters indicate that the study schools felt able to implement their magnet programs, despite other activities and school choice options in their districts that could have presented challenges to them. The key issues are (1) whether the converting magnet schools attained the improvements in diversity and achievement that motivate the MSAP program and (2) whether their outcomes changed after conversion in ways that mirrored or differed from what would be predicted had they not converted based on other neighborhood schools in their districts. The latter supports the hypothesis that the conversion played a role in those changing outcomes, although the study design does not allow conclusions about the impact of the conversion to be drawn.

Because schools engaged in the two conversion approaches described earlier—traditional and destination—start off with different student bodies and seek to target their recruitment to different types of students, it is important to assess their outcomes separately. Traditional magnet schools typically begin as low-performing schools serving higher proportions of students from low-income households or minority racial/ethnic groups. Implementing a distinctive and attractive academic program is expected to help them recruit students who are higher achieving, more economically advantaged, or more likely to help the school achieve racial/ethnic diversity. Both the academic program itself and the new mix of students are hypothesized to improve achievement. This chapter examines these outcomes for the 17 study schools that fall into this category of magnet school conversion.

The traditional magnet schools served a somewhat larger share of students from outside their neighborhood after conversion, but these students were similar to the neighborhood students on a variety of characteristics.

According to theory, one important step all converting magnet schools take is to attract students from outside the neighborhood who are different from the neighborhood students assigned to the school in terms of race/ethnicity, income, or achievement. The study schools that became traditional magnet schools did not appear to achieve all of these objectives.

- **Even before the schools converted, about one fifth of their enrollment came from students who lived outside the neighborhood (Exhibit 5.1).** On average, 21.0 percent of the students attending these schools were from outside the neighborhood prior to the conversion. This seemingly high proportion may result from preexisting choice policies in the districts that, as noted in Chapter 3, offered a larger share of school options for families than did districts nationally.[22] Neighborhood schools in the study districts that did not convert to magnet schools, on average, served a similar share of students from outside their attendance boundaries (20.1 percent).

[22] Although the data in Exhibit 3.2 correspond to the first year after conversion, they are likely a good indicator of the availability of choice schools prior to conversion.

- **For the converting schools, the share of students who were from outside the neighborhood rose by 5.8 percentage points (Exhibit 5.1).** Across the study schools, the proportion of students from outside the neighborhood increased from 21.0 percent before conversion to 26.8 percent afterward. The average number of students from outside the neighborhood increased from 108 to 137—an additional 29 students per converting magnet school, which equates to about one additional student in each class.[23]

Exhibit 5.1. Share of Students From Outside the Neighborhood in Traditional Magnet Schools (Average Across Schools)

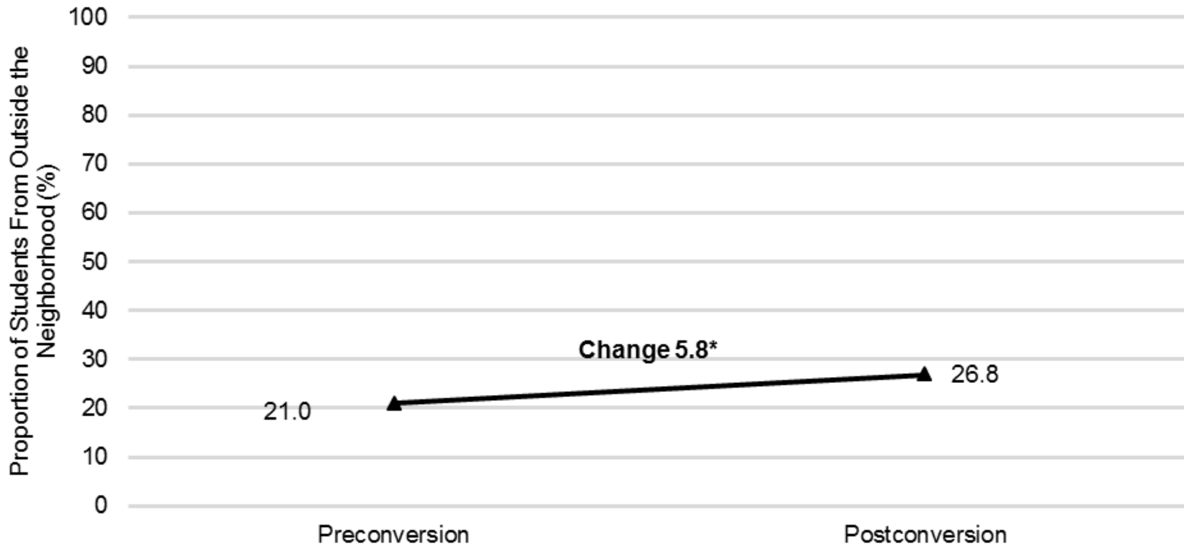


EXHIBIT READS: Before (pre-) conversion, the average proportion of students from outside the neighborhood in the magnet schools was 21 percent. This proportion increased by 5.8 percentage points to 26.8 percent after (post-) conversion.

NOTE: N = 17 schools in 10 districts. See Appendix F for methods used for calculations and significance testing. See appendix Exhibit I.1 for additional detail.

SOURCE: District administrative data.

- **After conversion, the share of students from inside and outside the neighborhood who were from minority racial/ethnic groups or economically disadvantaged was similar (Exhibit 5.2).** The theory of action predicts that successful traditional magnet schools would try to attract outside students who were more economically advantaged or more likely to help the school achieve racial/ethnic diversity. After conversion, about

[23] Because the analysis of the share of students from outside the neighborhood was conducted using data on students in grades in which achievement tests were available (generally grades 2 or 3 through 5), some extrapolation was necessary to estimate the number of students from outside the neighborhood for all grades in each magnet school. First, the average attendance per grade was calculated based on the available data (85.4 students per grade). This number was multiplied by 6 to estimate the average attendance in grades K–5 (512 students per school), which was the typical grade range in study schools. The percentages in Exhibit 5.1 were then used to estimate the number of students from outside the neighborhood (108 students before conversion and 137 after). Because information on the number of classes in each grade and school was not available, it was assumed that the average class size was 20 students (Digest of Education Statistics 2013). Based on this assumption, the increase in students from outside the neighborhood per class was estimated to be approximately 1 student per class (29 extra students over approximately 26 classes).

84 percent of the students from both outside the magnet neighborhood and inside the magnet neighborhood were members of racial/ethnic minority groups. These proportions were virtually unchanged since prior to conversion (84.4 percent for students from outside the neighborhood and 83.0 percent for students from inside it). The share of students who were economically disadvantaged rose for both groups of students, which is not what was expected according to theory for the students from outside the neighborhood. Moreover, after conversion the two groups were similar (71.2 percent for students from outside the neighborhood and 73.8 percent for students from inside; increases from 65.4 and 70.1, respectively).[24] Thus, the characteristics of students from outside the neighborhood did not change in the direction that would be expected based on the theory of action.[25]

[24] After conversion, the difference between students from outside the neighborhood and neighborhood students in the proportion from disadvantaged backgrounds (2.6 percentage points) was not statistically significant (p=0.072).

[25] The gap between students from the neighborhood and from outside the neighborhood did not change significantly from before to after conversion, in terms of either race/ethnicity (a 1.4 percentage point difference before conversion to a 0.5 percentage point difference after conversion) or economic disadvantage (a -4.7 percentage point difference to a -2.6 percentage point difference). That is, the characteristics of the students from outside the neighborhood were not “more different” from the neighborhood students after conversion than they were beforehand.

Exhibit 5.2. Characteristics of Neighborhood Students and Students From Outside the Neighborhood in the Traditional Magnet Schools (Average Across Schools)

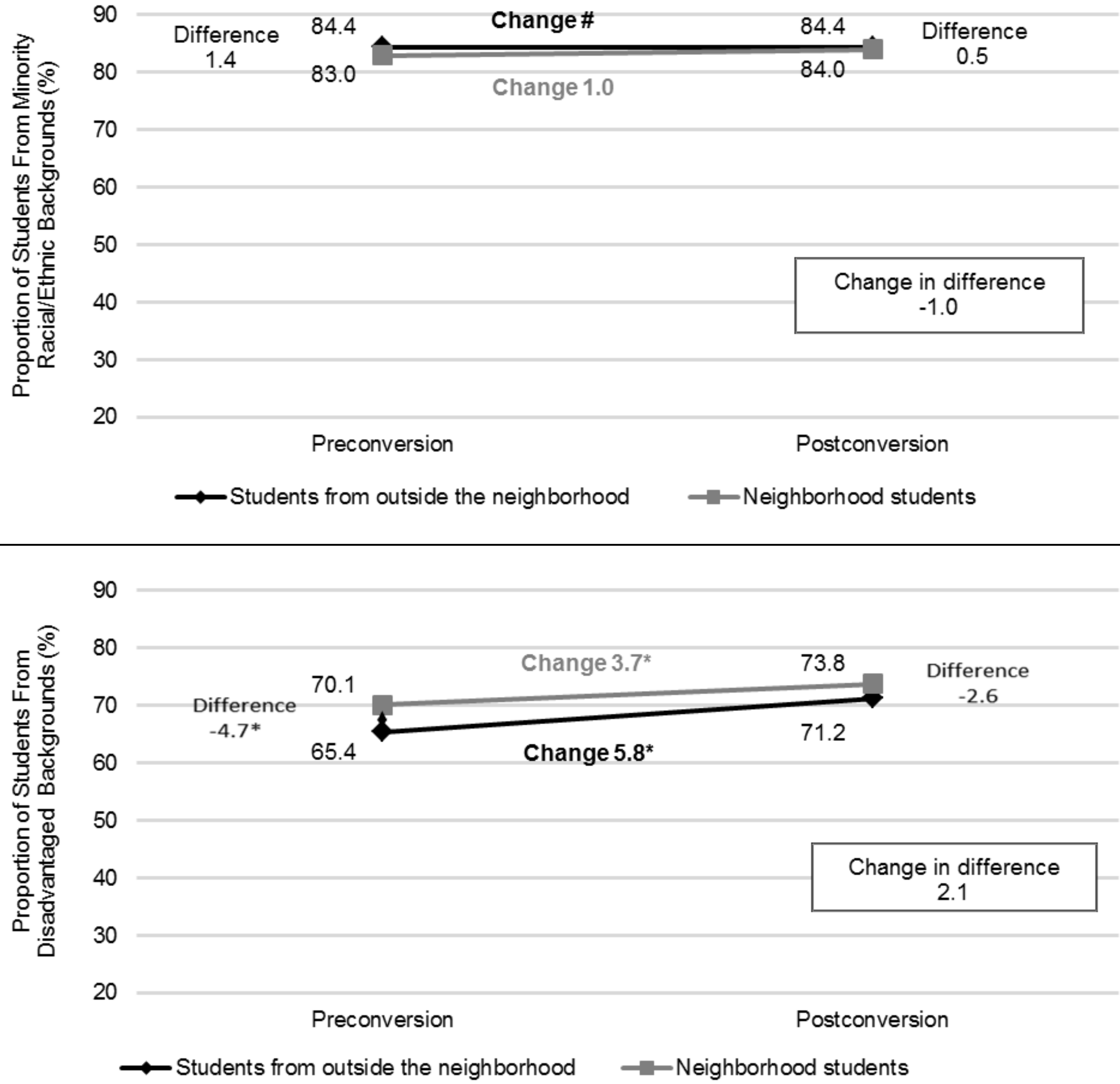


EXHIBIT READS: Before (pre-) conversion, the average proportion of students from outside the neighborhood who were from minority racial/ethnic groups in the magnet schools (84.4 percent) was 1.4 percentage points higher than the average proportion of neighborhood students from minority racial/ethnic groups (83.0 percent), which was not a statistically significant difference. From pre- to post-conversion, there was no statistically significant change in the proportion of students from outside the neighborhood who were from minority groups (0.0 percentage points) or the proportion of neighborhood students who were from minority groups (1.0 percentage points). As a result, after (post-) conversion, the average proportion of students from outside the neighborhood who were from minority racial/ethnic groups in the magnet schools (84.4 percent) was 0.5 percentage points higher than the average proportion of neighborhood students who were from minority racial/ethnic groups (84.0 percent), which was still not a statistically significant difference.

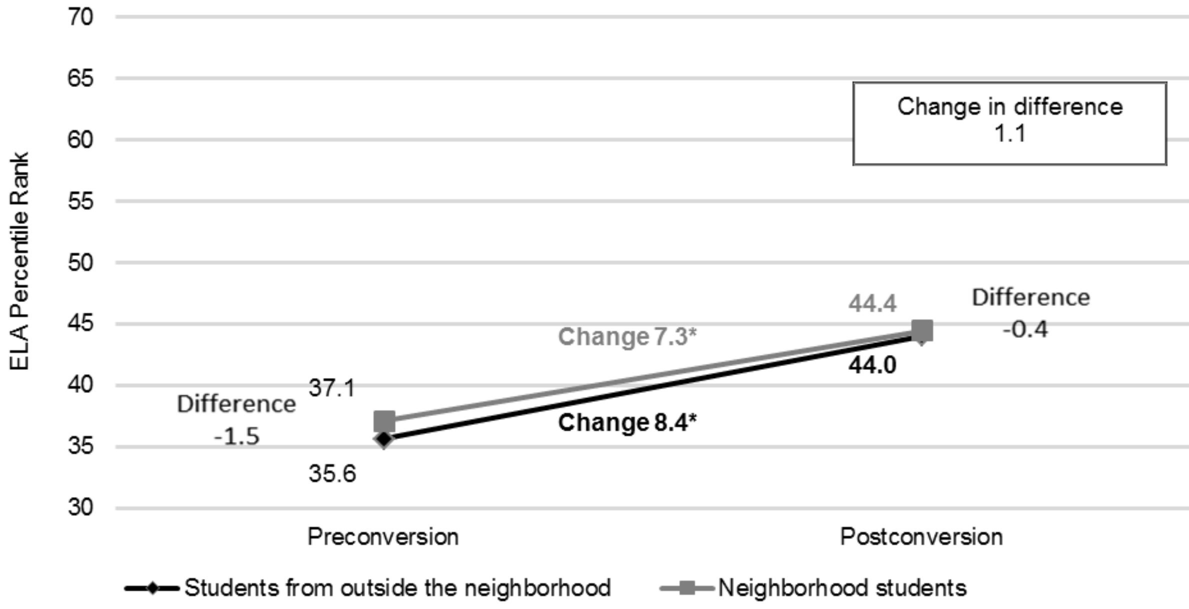
NOTE: # = Rounds to zero. See Appendix F for methods used for calculations and significance tests. For the proportion of students from minority racial/ethnic backgrounds, N = 17 schools in 10 districts; for the proportion of students from economically disadvantaged backgrounds, N = 11 schools in seven districts. Results include neighborhood students and students from outside the neighborhood only; students missing neighborhood status were not included in this exhibit. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure. See appendix Exhibit I.2 for additional detail.

SOURCE: District administrative data.

- **After conversion, the academic achievement of students from outside the neighborhood in traditional magnet schools was not higher than the achievement of neighborhood students (Exhibit 5.3).** In ELA, both neighborhood students and students from outside the neighborhood scored at about the 44th percentile after conversion, with the test scores of both groups higher by a similar amount compared to before the conversion. In mathematics, both groups of students scored higher after conversion, at about the 48th percentile. The increase in test scores after conversion for students from outside the neighborhood is consistent with what theory predicts for traditional magnet schools. However, it is not possible with the available data and study design to determine whether the higher achievement for non-neighborhood students was caused by the recruitment of students who came with higher test scores or caused by higher levels of learning while in the magnet schools. In any case, the students from the neighborhood were not exposed to higher achieving peers from outside the neighborhood after conversion.[26]

[26] The gaps in achievement between students from the neighborhood and from outside the neighborhood did not change significantly from before to after conversion, in terms of either ELA (a -1.5 percentage point difference before conversion to a -0.4 percentage point difference after conversion) or mathematics (a -4.1 percentage point difference to a 0.0 percentage point difference, p=0.091). That is, the achievement of the students from outside the neighborhood was not "more different" from the neighborhood students' achievement after conversion than it was beforehand. It is also important to note that the test scores of students from outside the neighborhood after conversion could reflect differences in the academic performance of students recruited to the school before versus after conversion. Or the scores could reflect increases or decreases in learning among those students from outside the neighborhood who were attending the traditional magnets both before and after the conversion.

Exhibit 5.3. Achievement of Neighborhood Students and Students From Outside the Neighborhood in Traditional Magnet Schools (Average Across Schools)



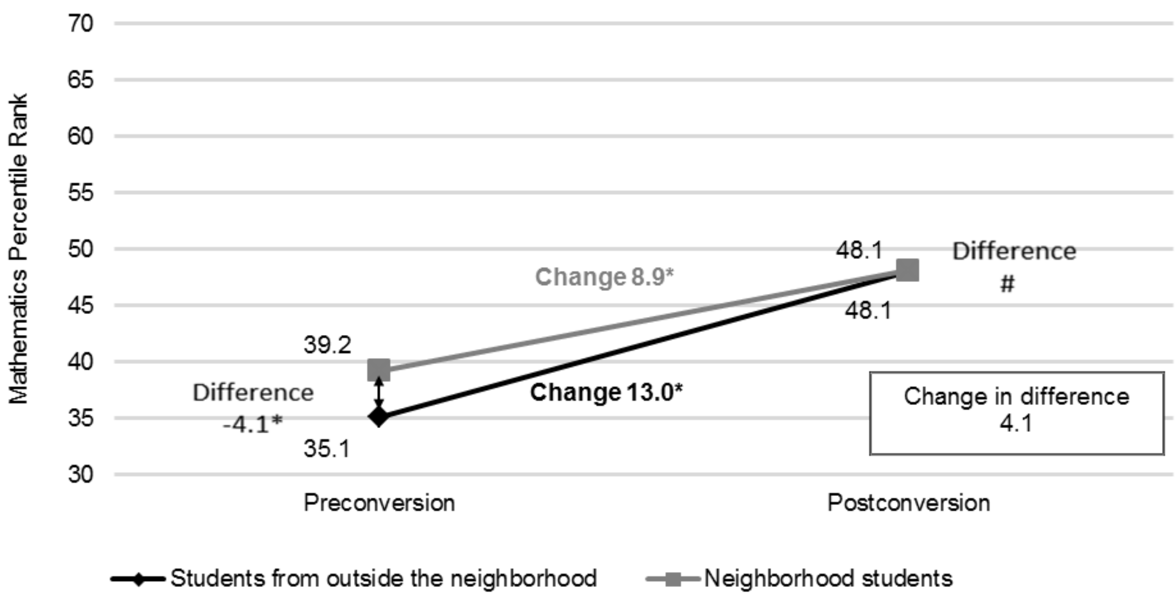


EXHIBIT READS: Before (pre-) conversion, the average ELA achievement of students from outside the neighborhood (35.6 percentile) was 1.5 percentage points lower than the average ELA achievement of neighborhood students (37.1 percentile), which was not a statistically significant difference. From pre- to post-conversion, there was a 7.3 percentage point increase in the average ELA achievement of students from outside the neighborhood and a similar increase (8.4 percentage points) in the average ELA achievement of neighborhood students. As a result, after (post-) conversion, the average ELA achievement of students from outside the neighborhood (44.0 percentile) was 0.4 percentage points lower than the average ELA achievement of neighborhood students (44.4 percentile), which was still not a statistically significant difference.

NOTE: See Appendix F for methods used for calculations and significance tests. *N* = 17 schools in 10 districts. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure. See appendix Exhibit I.3 for additional detail.

SOURCE: District administrative data.

Relative to their districts, there was a lower concentration of students from minority racial/ethnic backgrounds in the traditional magnet schools after conversion, and the conversion may have played a role.

Although the traditional conversion magnet schools did not attract new students who were significantly different from those attending from the neighborhood, the schools' efforts to increase diversity must be viewed relative to changes in their districts' demographics. In general, the study magnet schools must draw from the pool of students in their districts; changes in the pool can affect both the opportunities for the conversion schools to alter the composition of their student bodies and the concentration of different types of students in those schools when compared with their districts overall. There is evidence that the traditional magnet schools experienced a reduction in the concentration of students from minority racial/ethnic groups relative to their districts, which is what would be expected based on the theory of action.

Describing changes in magnet schools and their districts.

- **The proportion of minority students in the converting magnet schools did not change, while there was an increase in their districts, thereby reducing the concentration of these students in the traditional magnet schools relative to their districts (Exhibit 5.4).** On average, neighborhood schools that converted to traditional magnet schools initially served a higher proportion of minority students (84.5 percent) relative to their districts (64.1 percent—a 20.4 percentage point difference). Although the districts experienced a 2.3 percentage point increase in the share of their students who were from racial/ethnic minority groups (from 64.1 percent to 66.3 percent[27]), the traditional magnet schools remained virtually unchanged (84.5 percent to 84.9 percent; a 0.4 percentage point increase). Thus, the proportion of minority students in the magnet schools became more like their districts after conversion (a difference of 18.5 percent) compared with before (20.4 percent), as predicted for this type of conversion approach.

[27] The value of 2.3 differs from 66.3 – 64.1 because of rounding.

Exhibit 5.4. Concentration of Racial/Ethnic Minority Students in Traditional Magnet Schools (Average Across Schools)

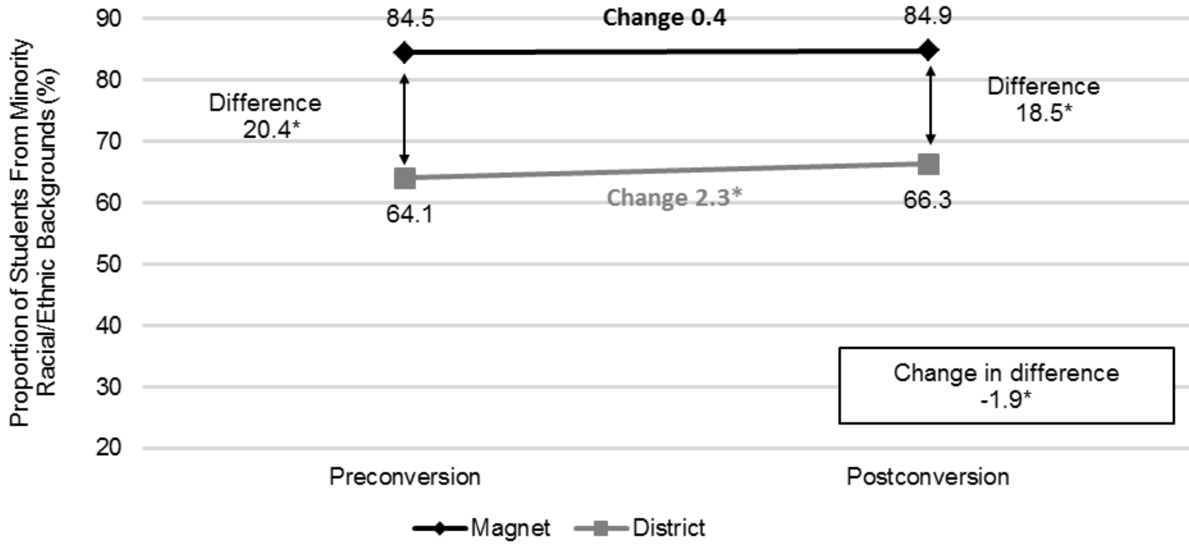


EXHIBIT READS: Before (pre-) conversion, the average proportion of minority students in the magnet schools (84.5 percent) was 20.4 percentage points higher than the proportion in their districts (64.1 percent). From pre- to post-conversion, there was no statistically significant change in the magnet schools' proportion (0.4 percentage points) while the proportion in their districts increased by 2.3 percentage points. As a result, after (post-) conversion, the magnet schools' average proportion (84.9 percent) was 18.5 percentage points higher than the proportion in their districts (66.3 percent)—a significant change in the difference between the magnet schools and their districts of -1.9 percentage points. This change represents a reduction in the concentration of minority students in the magnet schools relative to their districts.

NOTE: See Appendix F for methods used for calculations and significance tests. *N* = 17 schools in 10 districts. Results include all students: neighborhood students, students from outside the neighborhood, and students missing neighborhood status. District proportion is based on students in all schools in the district. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure. See appendix Exhibit I.4 for additional detail.

SOURCE: District administrative data.

Investigating the role of magnet conversion.

- There is suggestive evidence that magnet conversion played a role in bringing the proportion of racial/ethnic minority students in the traditional magnet schools closer to their districts. The reduced concentration of minority group students in traditional magnet schools relative to their districts identified in Exhibit 5.4 could be caused by factors other than magnet conversion. Although it is not possible to rule in or out these other factors with certainty, given the study design, this hypothesis can be examined to some extent by using neighborhood schools that did not convert as a kind of proxy for what would be expected to happen to the study schools if they had not converted. The statistical approach, a comparative interrupted time series analysis, examined whether the schools' student composition became more like their districts after conversion than would be predicted based on changes in neighborhood schools that did not convert (see Appendix F).[28]

- Without conversion, the study magnet schools would have been predicted to differ from their districts by 21.7 percentage points (no change from before conversion), based on the changes in neighborhood schools that did not convert (Exhibit 5.5). The converting magnet schools' actual difference from their districts in the proportion of minority students served was 19.8 percentage points, or 1.9 percentage points less than would be predicted, which provides support for the hypotheses that conversion, rather than other factors, helped bring the magnet school composition closer to their districts.[29,30]

[28] The analysis examined whether the schools' student composition became more like their districts, regardless of whether the magnets and other neighborhood public schools served a higher or lower proportion of students from minority racial/ethnic groups than their district prior to conversion. To do this, the difference was measured using the absolute value so that a smaller gap between a school and its district meant a smaller value, regardless of where they started. Although, on average, the schools that became traditional magnets started off serving a higher proportion of minority students than their districts, two schools started off with a lower proportion.

[29] The analysis shown in Exhibit 5.5 was based on the average concentration of minority students in magnet schools and neighborhood public schools relative to their districts for the years before conversion and the average for the years after. An additional analysis was conducted to examine the trend in the concentration of minority students from the first to the fourth year after conversion, in case changes took a few years to observe. Those results indicate that magnet schools grew closer to their districts each year after conversion, relative to neighborhood public schools—consistent with what might be expected if implementation took time. See Exhibit I.19 in Appendix I for results.

[30] Attracting students from nonminority racial/ethnic backgrounds might have been challenging for schools located in districts with few nonminority students. The study checked the sensitivity of the results to this potential difficulty by eliminating from the analysis the three traditional schools (and corresponding neighborhood public schools) that were in districts that had limited racial/ethnic diversity (greater than 80 percent of the students in the district were from minority racial/ethnic backgrounds). The results were similar to those with the full set of schools. See Appendix H.1 for more detail.

Exhibit 5.5. The Role of Magnet Conversion in the Concentration of Racial/Ethnic Minority Students in Traditional Magnet Schools (Average Across Schools)

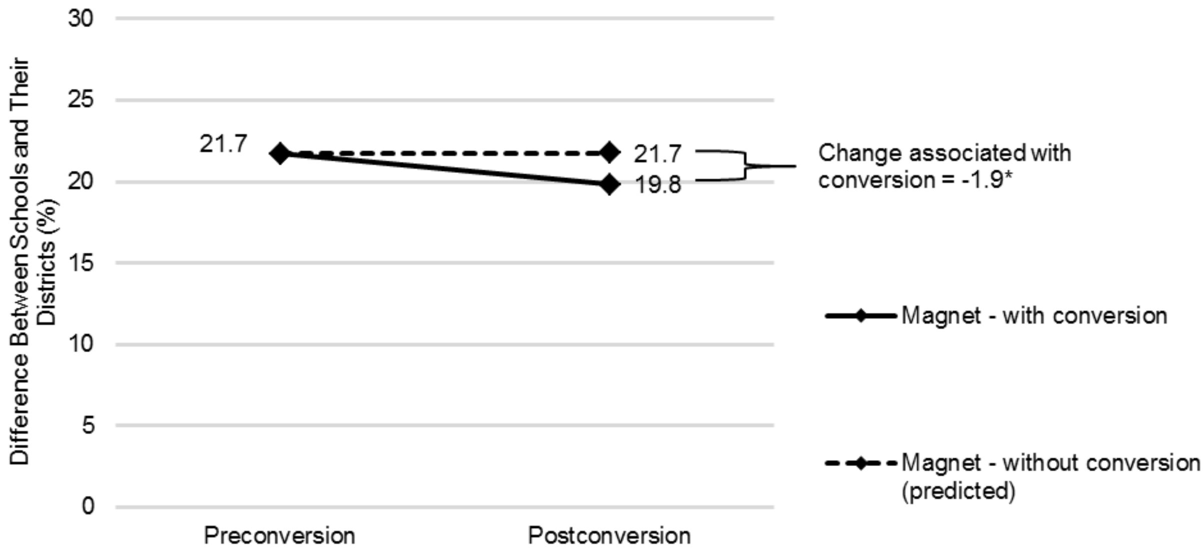


EXHIBIT READS: Before (pre-) conversion, the average size (absolute value) of the difference between the proportion of minority students served by the magnet schools and their districts was 21.7 percentage points. Based on neighborhood schools that did not convert, if the magnet schools had not converted, the size of the predicted difference after (post-) conversion would also be 21.7 percentage points. Postconversion, the actual size of the difference between the magnet schools and their districts was 19.8 percentage points, or 1.9 percentage points less than predicted, a statistically significant difference associated with conversion. This indicates that the magnet conversion could be a factor in bringing the proportion of minority students in magnet schools 1.9 percentage points closer to their districts. Statistical testing was not conducted on the preconversion-to-postconversion changes in this figure; only the primary outcome, the difference between the predicted and actual magnet outcome, was tested.

NOTE: See appendix Exhibits I.5, I.6, and I.7 for additional detail.

SOURCE: District administrative data.

Relative to their districts, the concentration of economically disadvantaged students in traditional magnet schools was unchanged after conversion.

Because creating more diversity in economic background is also an aim, the analysis examined whether the proportion of low-income students in the study's traditional magnet schools decreased relative to the district average after conversion. The data indicate that the shifts in the proportion of economically disadvantaged students served by the magnet schools were similar to those experienced by both the district overall and neighborhood schools that did not convert. Thus, the magnet schools did not become more like their districts.

Describing changes in magnet schools and their districts.

- **The share of students who were from low-income backgrounds in the converting schools increased rather than decreased, with the change reflecting a districtwide change (Exhibit 5.6).** Neighborhood schools that converted to traditional magnet schools initially served a higher proportion of disadvantaged students (71.4 percent) relative to their districts (46.1 percent; a 25.3 percentage point difference). These schools experienced an increase in the share of their students who were disadvanted (71.4 percent to 74.2 percent, a 2.8 percentage point change) during the conversion period, which is similar to that of their districts (46.1 percent to 50.1 percent; a 3.9 percentage point change[31]). Because the proportion of students who were economically disadvantaged rose by comparable amounts in both the traditional magnet schools and their districts, the concentration of disadvantaged students in the magnet schools did not significantly decline relative to their districts as would be expected based on the theory of action for this conversion approach.[32]

Exhibit 5.6. Concentration of Economically Disadvantaged Students in Traditional Magnet Schools and Their Districts (Average Across Schools)

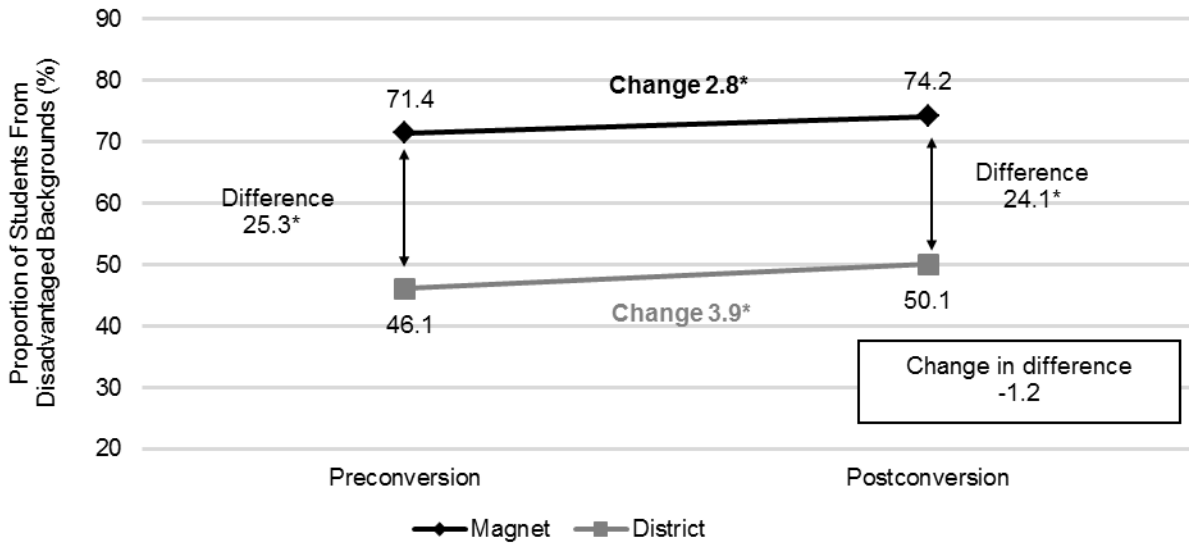


EXHIBIT READS: Before (pre-) conversion, the average proportion of economically disadvantaged students in the magnet schools (71.4 percent) was 25.3 percentage points higher than the proportion in their districts (46.1 percent). From pre- to post-conversion, the average proportion of disadvantaged students in the magnet schools and their districts increased by similar amounts (2.8 and 3.9 percentage points respectively). As a result, after (post-) conversion, the magnet schools' average proportion (74.2 percent) was 24.1 percentage points higher than the proportion in their districts (50.1 percent)—a non-significant change in the difference between the magnet schools and their districts of -1.2 percentage points. While the magnet schools were 1.2 percentage points closer to their districts after conversion, this change is not statistically different from zero and, thus, does not represent a reduction in the concentration of disadvantaged students in the magnet schools.

NOTE: See Appendix F for methods used for calculations and significance tests. *N* = 11 schools in seven districts. Results include all students: neighborhood students, students from outside the neighborhood, and students missing neighborhood status. District proportion is based on students in all schools in the district. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure. See appendix Exhibit I.8 for additional detail.

SOURCE: District administrative data.

Investigating the role of magnet conversion.

- **There is not evidence that the magnet conversion influenced the concentration of economically disadvantaged students in traditional magnet schools.** To assess whether the changes identified in Exhibit 5.6 might have been caused by magnet conversion, the changes were compared with the changes in neighborhood schools that did not convert. Without conversion (based on the changes in neighborhood schools that

[31] The value of 3.9 differs from 50.1 – 46.1 because of rounding.

[32] The proportion of economically disadvantaged students in traditional magnet schools was 1.2 percentage points closer to the proportion in their districts after conversion, but this change was not statistically significant.

did not convert), the study magnet schools would be predicted to differ from their districts by 26.7 percentage points in the proportion of low-income students served (Exhibit 5.7). Although they actually experienced a postconversion difference from their districts of 24.1 percentage points, or 2.5 percentage points less than would be predicted, this change associated with the conversion is not statistically different from zero.[33]

Exhibit 5.7. The Role of Magnet Conversion in the Concentration of Economically Disadvantaged Students in Traditional Magnet Schools (Average Across Schools)

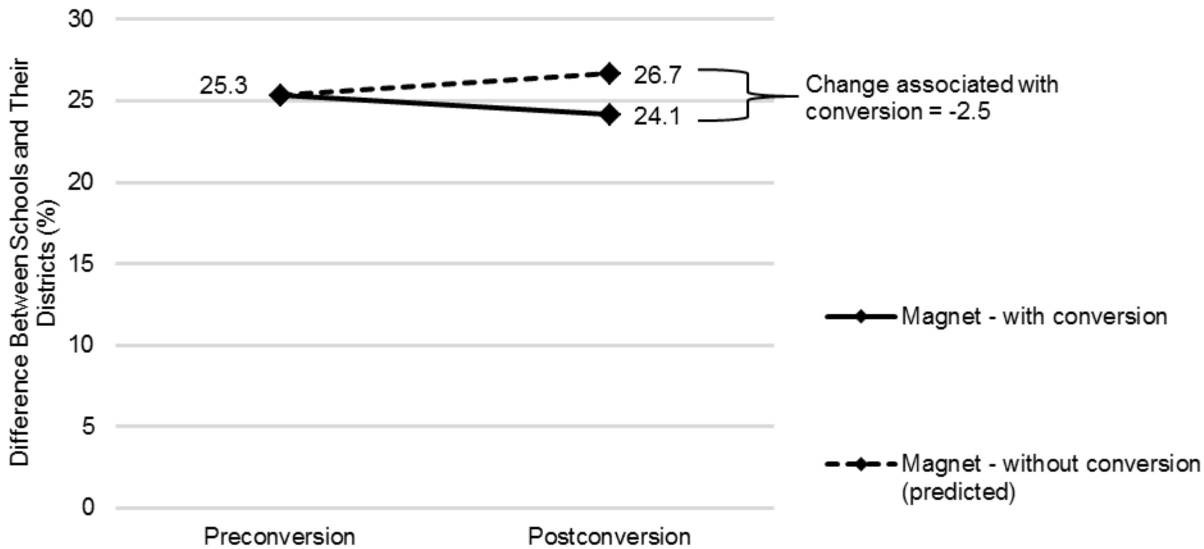


EXHIBIT READS: Before (pre-conversion), the average size (absolute value) of the difference between the proportion of disadvantaged students served by the magnet schools and their districts was 25.3 percentage points. Based on neighborhood schools that did not convert, if the magnet schools had not converted, the size of the predicted difference after (post-) conversion would be 26.7 percentage points. Instead of increasing, the average size of the difference decreased after conversion (1.2 percentage points), bringing them 2.5 percentage points closer to their districts than would be predicted (an actual average difference of 24.1 percentage points between the magnet schools instead of the 26.7 percentage points predicted). While the magnet schools were 2.5 percentage points closer to their districts postconversion than predicted, this difference is not statistically different from zero and, thus, the conversion is not likely a factor in bringing the proportion of disadvantaged students in magnet schools closer to their districts. Statistical testing was not conducted on the preconversion to postconversion changes in this figure; only the primary outcome, the difference between the predicted and actual magnet outcome, was tested.

NOTE: See appendix Exhibits I.9, I.10, and I.11 for additional detail. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure.

SOURCE: District administrative data.

[33] The analysis shown in Exhibit 5.7 was based on the average concentration of disadvantaged students in magnet schools and neighborhood public schools relative to their districts for the years before conversion and the average for the years after. An additional analysis was conducted to examine the trend in the concentration of disadvantaged students from the first to the fourth year after conversion, in case changes took a few years to observe. However, those results indicate that magnet schools did not grow closer to their districts each year after conversion, relative to neighborhood public schools. See Exhibit I.19 in Appendix I for results.

Average achievement in the traditional magnet schools was higher after conversion, outpacing district improvement in ELA but not in mathematics; however, there is not evidence that the conversion played a role in improving the achievement gains of neighborhood students, the population of policy interest.

The theory of action for traditional magnet schools suggests multiple ways that achievement might be improved. Attracting higher achieving students from outside the neighborhood after conversion could raise average test scores in the schools simply because these students' higher achievement pushes up the average, or because of spillover effects on the lower achieving neighborhood students (e.g., setting higher standards for behavior or academic motivation, encouraging higher expectations among teachers). If the adoption of a specialized curriculum or instructional methods leads to a strengthened academic program, it also could improve achievement for all students in the schools—beyond any improvement that their districts experienced overall.

Though achievement in the traditional magnet schools improved relative to their districts, there is not evidence that the conversion was a factor.

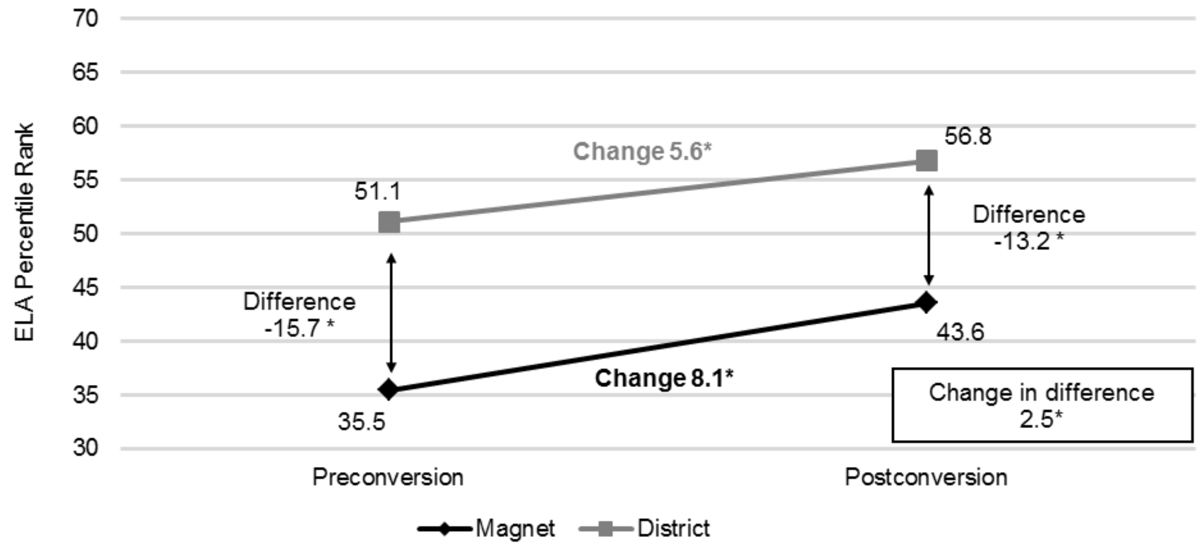
Describing changes in magnet schools and their districts.

- **ELA achievement improved in both traditional magnet schools and their districts, improving more in magnet schools than in their districts (Exhibit 5.8).** The average ELA achievement in traditional magnet schools was higher after conversion than before by 8.1 percentile points (average achievement increased from the 35.5th to the 43.6th percentile).[34] The average ELA achievement in the districts also was higher after conversion by 5.6 percentile points.[35] Thus, the increase in the ELA achievement in the magnet schools outpaced the increase in ELA achievement in their districts by 2.5 percentile points (8.1 percentile point increase in the magnet schools versus a 5.6 percentile point increase in their overall districts).
- **Mathematics achievement improved in both traditional magnet schools and their districts, by about the same amount (Exhibit 5.8).** The average mathematics achievement in traditional magnet schools was higher after conversion than before by 10 percentile points (average achievement increased from the 37.6th percentile to the 47.6th percentile). The average mathematics achievement in the districts also was higher after conversion by 8 percentile points, but it was about 2 percentile points lower than the improvements among the traditional magnet schools. Although this 2 percentile point difference is in the predicted direction, it is not statistically significant. Therefore, it cannot be concluded with a sufficient degree of certainty that the difference is real.

[34] Student achievement percentiles were computed based on the first year of data, which was prior to conversion, separately within each district. This made it possible to assess whether scores increased or decreased across time relative to the base year. For example, if the median score in a district's first year of data was 300, then a score of 300 was standardized as the 50th percentile. If achievement generally increased above 300, then the districtwide median percentile would rise above 50; if achievement fell below 300, the districtwide median percentile would fall below 50. See Appendix F.1.1 for details on the standardization.

[35] The value of 5.6 differs from 56.8 – 51.1 because of rounding.

Exhibit 5.8. Achievement in Traditional Magnet Schools and Their Districts (Average Across Schools)



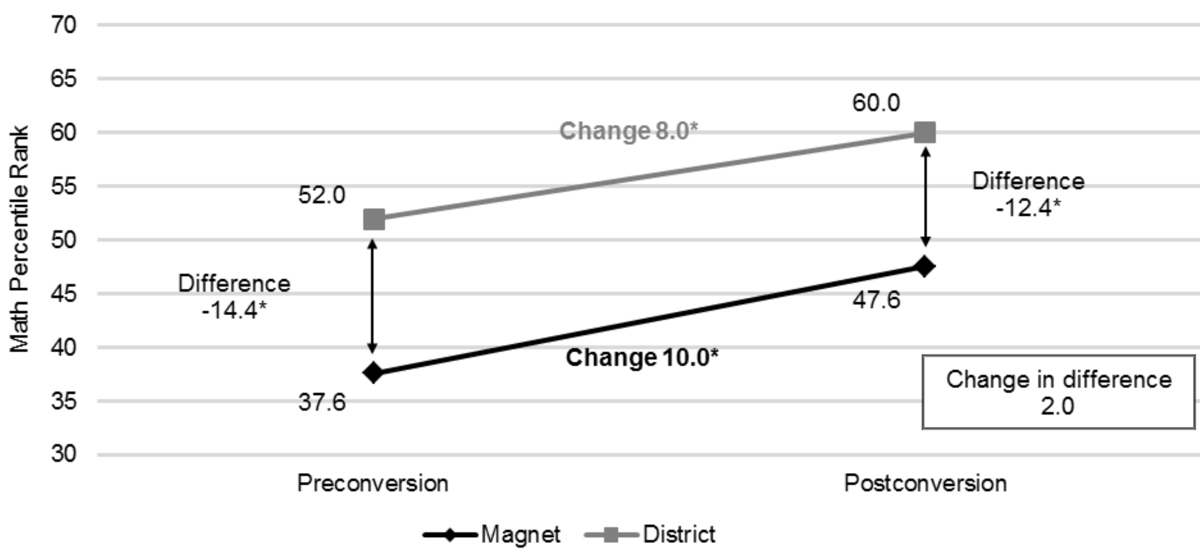


EXHIBIT READS: The average ELA achievement in the magnet schools increased by 8.1 percentile points from before (pre-) conversion (35.5 percentile) to after (post-) conversion (43.6 percentile). The average ELA achievement in their districts increased by 5.6 percentile points from pre-conversion (51.1 percentile) to post-conversion (56.8 percentile). Therefore, the magnet schools increased 2.5 percentile points more than their districts (an 8.1 percentile point increase in the magnet schools compared to a 5.7 percentile point increase in their districts)—a statistically significant change.

NOTE: See Appendix F for methods used for calculations and significance tests. *N* = 17 schools in 10 districts. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure. See appendix Exhibit I.12 for additional detail.

SOURCE: District administrative data.

Investigating the role of magnet conversion.

- **There is not evidence that the conversion played a role in improving the achievement of neighborhood students attending the traditional magnet schools.** As was the case in assessing changes in diversity as the schools converted to become magnet schools, it is possible that the changes in achievement in these schools were caused by factors in the districts other than the conversion itself, including districtwide improvement efforts. In addition, it is possible that changes in the mix of students attending the magnet schools (i.e., different students attending the magnet schools after conversion) could have resulted in changes in school achievement. To help isolate the possible influence of conversion and rule out both district improvement efforts and student compositional factors, year-to-year achievement gains for students in magnet schools were compared to the gains that would be predicted had their school not converted. Predictions were based on the gains of similar students in neighborhood schools that did not convert.[36] Because the policy interest is in neighborhood students, who tend to be lower achieving and also the largest group of students served by traditional magnet schools, this analysis focused solely on neighborhood student achievement.

  In neither ELA nor mathematics was the change in average annual achievement gains for neighborhood students in traditional magnet schools significantly larger or smaller than what would be predicted based on changes for neighborhood students in neighborhood schools that did not convert. If the schools they attended had not converted, the neighborhood students in traditional magnet schools would be predicted to have an annual achievement gain of 0.85 percentile points, based on the annual achievement gain of neighborhood students in neighborhood schools that did not convert. Although their actual ELA annual gain was -0.45 percentile points, 1.30 percentile points lower than predicted, this difference associated with conversion was not statistically different from zero (Exhibit 5.9). In mathematics, the neighborhood students in study schools would be predicted to have an annual achievement gain of 0.57 percentile points if their schools did not convert. Their actual annual gain was 0.65 percentile point, 0.08 percentile points higher than predicted, but also not statistically different from zero (Exhibit 5.10).[37] The similarity of observed and predicted achievement gains for neighborhood students in the study schools makes it unlikely that the conversion was a factor. This finding may seem inconsistent with the results shown in Exhibit 5.8, which indicate that the average achievement in magnet schools increased significantly relative to their districts. One hypothesis that might explain this is that the magnet schools might have attracted academically stronger neighborhood students after conversion, who otherwise would

[36] For details about the approach, a comparative interrupted time series analysis, see Appendix F.4.2.2.

[37] The analysis shown in Exhibits 5.9 and 5.10 were based on the average ELA and mathematics achievement gains of students in magnet schools and neighborhood public schools for the years before conversion and the average for the years after. An additional analysis was conducted to examine the trend in achievement from the first to the fourth year after conversion in case improvements or declines took a few years to see. However, those results indicate that the neighborhood students' annual ELA and mathematics achievement gains in magnet schools did not change over the four years post-conversion, relative to neighborhood students in neighborhood public schools. See Exhibit I.19 in Appendix I for results.

have attended other school choice options. This could have raised the average achievement level of neighborhood students but not their average annual gains if they were already high achieving when they entered magnet schools.

Exhibit 5.9. The Role of Magnet Conversion in ELA Achievement for Neighborhood Students in Traditional Magnet Schools (Average Across Schools)

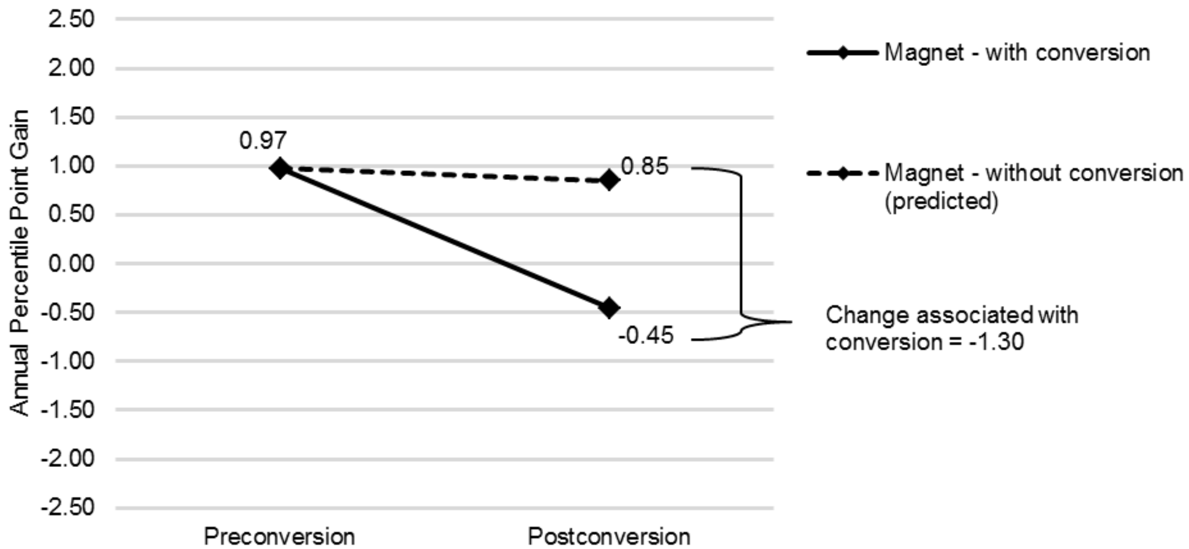


EXHIBIT READS: The average neighborhood student annual percentile point gain in ELA achievement in magnet schools before (pre-) conversion was 0.97 percentile points. Based on similar students in neighborhood schools that did not convert, the average annual percentile point gain for neighborhood students in the magnet schools would be predicted to be 0.85 percentile points after (post-) conversion if the magnet schools had not converted (a 0.12 percentile point decrease from before conversion). The average neighborhood student annual percentile point gain in ELA achievement in the magnet schools after (post-) conversion was -0.45 percentile points (a 1.42 percentile points decrease from before conversion). Thus, the annual percentile point gain for neighborhood students in magnet schools was 1.30 percentile points less than would be predicted had the schools not converted. The change associated with conversion (-1.30) is not statistically different from zero and, thus, there is insufficient evidence to conclude that conversion is a factor in changes to the achievement gains of neighborhood students. Statistical testing was not conducted on the preconversion to postconversion changes in this figure; only the primary outcome, the difference between the predicted and actual magnet outcome, was tested. This Exhibit Reads statement is only intended to walk the reader through the exhibit.

NOTE: See appendix Exhibits I.13, I.14, and I.15 for additional detail.

SOURCE: District administrative data.

Exhibit 5.10. The Role of Magnet Conversion in Mathematics Achievement for Neighborhood Students in Traditional Magnet Schools (Average Across Schools)

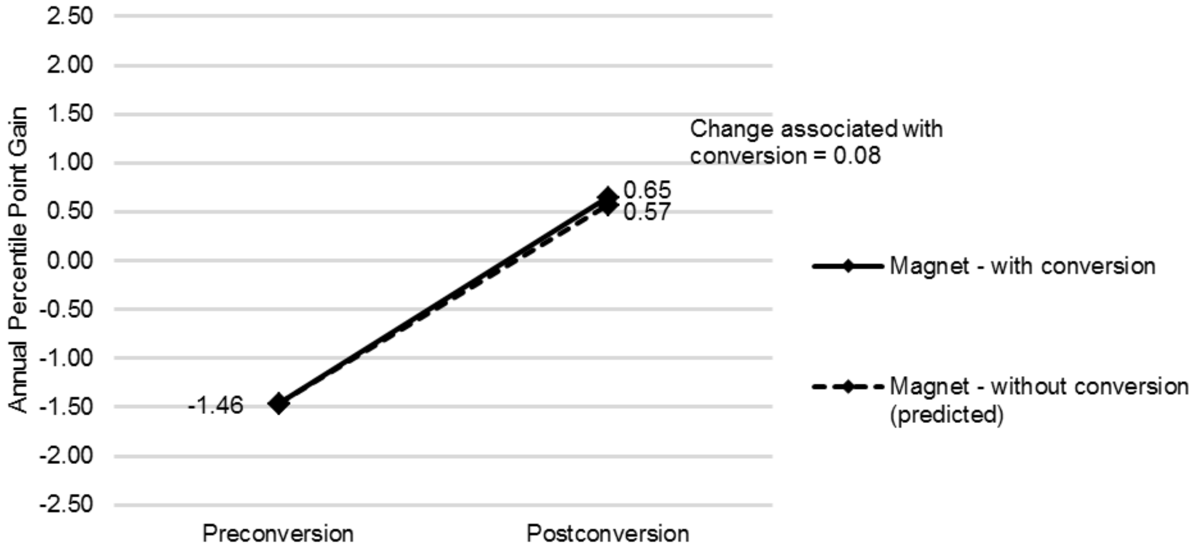


EXHIBIT READS: The average neighborhood student annual percentile point gain in mathematics achievement in magnet schools before (pre-) conversion was -1.46 percentile points. Based on similar students in other neighborhood schools, the average annual percentile point gain for neighborhood students in the magnet schools would be predicted to be 0.57 percentile points after (post-) conversion (a 2.03 percentile point increase from before conversion). The average neighborhood student annual percentile point gain in mathematics achievement in the magnet schools after (post-) conversion was 0.65 percentile points (a 2.08 percentile point increase from before conversion). Thus, the annual percentile point gain for neighborhood students in magnet schools was 0.08 percentile points more than would be predicted had the schools not converted. The change associated with conversion (0.08) is not statistically different from zero and, thus, there is insufficient evidence to conclude that conversion is a factor in changes to the achievement gains of neighborhood students. Statistical testing was not conducted on the preconversion to postconversion changes in this figure; only the primary outcome, the difference between the predicted and actual magnet outcome, was tested. This Exhibit Reads statement is only intended to walk the reader through the exhibit.

NOTE: See appendix Exhibits I.16, I.17, and I.18 for additional detail.

SOURCE: District administrative data.

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Chapter 6: Outcomes for Destination Conversion Magnet Schools

Although there were few destination magnet schools in the study, understanding whether they experienced the changes in composition and achievement that the theory of action predicts is as important as it is for schools that became traditional magnet schools.[38] In contrast to the traditional magnet schools, destination magnet schools typically begin as high-performing schools serving higher proportions of economically advantaged or nonminority students than other schools in their districts. A destination school's new curricular theme is expected to attract minority, economically disadvantaged, or low-achieving students who might then benefit from higher achieving peers. It is also expected to lead to improved learning for students attending from both inside and outside the neighborhood.

In this study, the schools designated as destination magnet schools were higher performing and more economically advantaged than their districts, but they served similar proportions of students from minority racial/ethnic groups. Thus, their ability to become more racially or ethnically diverse—that is, to become more like their district—is limited. This chapter examines the outcomes for the four study schools that followed this approach to conversion.

The destination magnet schools served a somewhat larger share of students from outside their neighborhood after conversion, and these students were different from the neighborhood students in ways consistent with theory.

The composition of the schools that converted to become destination magnet schools changed in ways that are consistent with the theory of action. After conversion, the share of students from outside the neighborhood increased and students from outside the neighborhood were more likely to be from minority racial/ethnic groups, from low-income families, and academically lower performing than students attending as their neighborhood schools.

- **Even before the schools converted, about one-third (34.2 percent) of their enrollment came from students who lived outside the neighborhood (Exhibit 6.1).** It may be that, as hypothesized in Chapter 5, the amount of outside enrollment reflects the role of choice in the districts in which the destination magnet schools are located.[39] This could include the "transfer" requirements under the Elementary and Secondary Education Act, whereby students from consistently low-performing schools are allowed to transfer to higher performing ones.

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[38] Because the number of destination magnet schools in the study sample (four) is smaller than the number of traditional magnets (17), it is harder to draw reliable conclusions about whether conversion was associated with outcomes for destination schools. See Appendix sections F.2.2.3.1, F.3.2.1, and F.4.2.1.1 for additional information on the smallest effects the study can detect for traditional and destination magnet schools.

[39] In other neighborhood schools that did not convert to become magnets, 27.0 percent of their students were from outside the neighborhood.

- **For the converting schools, the share of students who were from outside the neighborhood rose by 7.3 percentage points (Exhibit 6.1).** Across the study schools, the proportion of students from outside the neighborhood increased from 34.2 percent before conversion to 41.4 percent afterward. This equates to an additional 36 students from outside the neighborhood per converting magnet (i.e., approximately 1 additional student on average in each class).[40]

Exhibit 6.1. Share of Students From Outside the Neighborhood in Destination Magnet Schools (Average Across Schools)

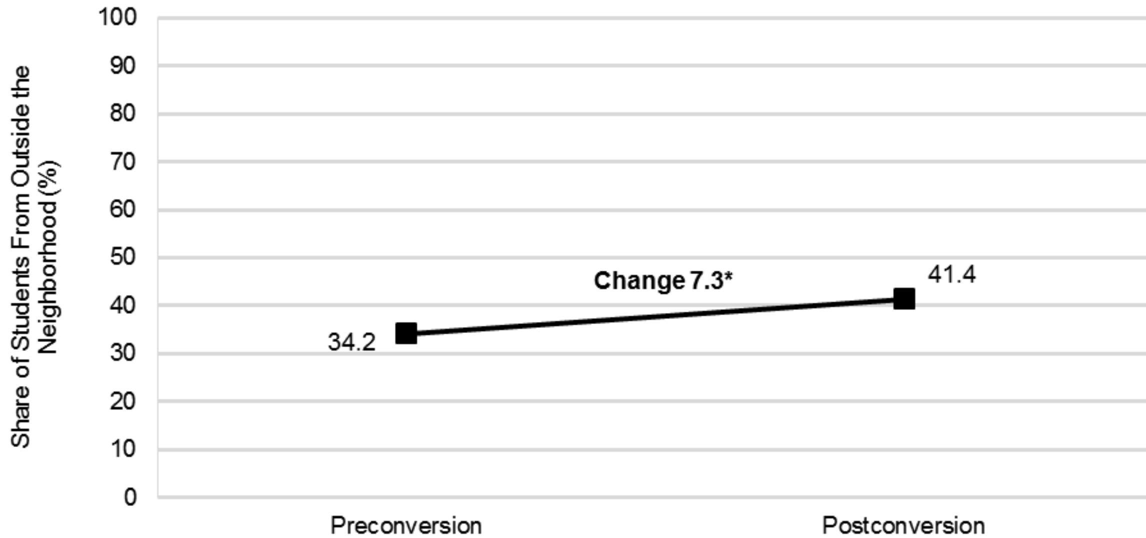


EXHIBIT READS: Before (pre-) conversion, the average proportion of students from outside the neighborhood in the magnet schools was 34.2 percent. This proportion increased by 7.3 percentage points to 41.4 percent after (post-) conversion.

NOTE: See Appendix F for methods used for calculations and significance testing. *N* = four schools in three districts. See appendix Exhibit J.1 for additional detail.

SOURCE: District administrative data.

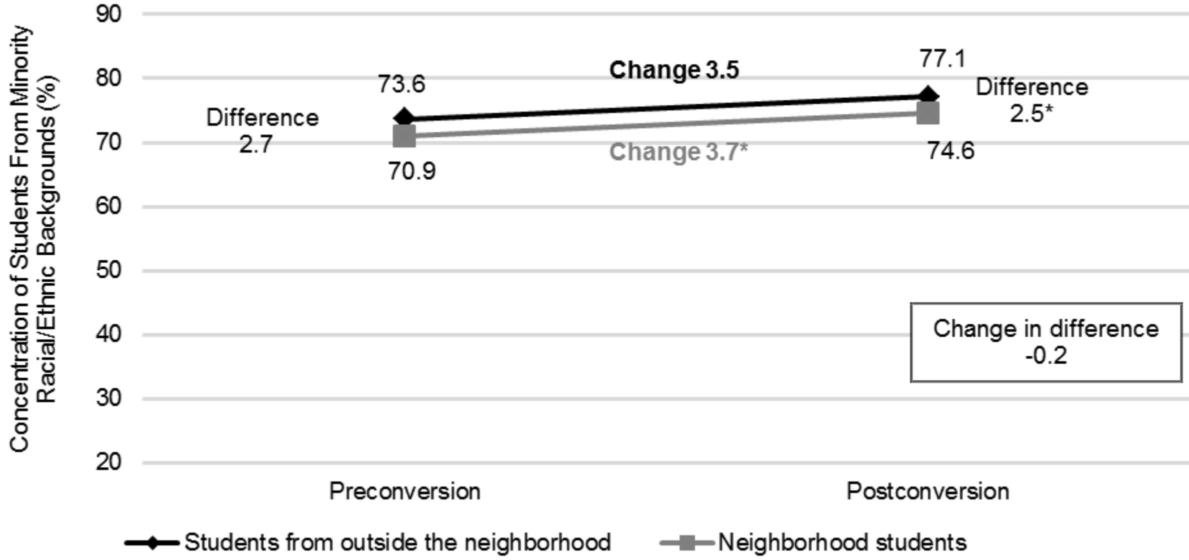
- **After conversion, larger shares of students from outside the neighborhood than from the neighborhood were members of minority racial/ethnic groups and were economically disadvantaged (Exhibit 6.2).** After conversion, 77.1 percent of outside students were from minority groups, compared to 74.6 percent of neighborhood students and, 35.6 percent of outside students were disadvantaged compared to 29.7 of neighborhood students. Therefore, compared to neighborhood students, students from

[40] The estimate of 1 outside student per class was derived using methods similar to the methods used for the analysis of traditional magnets (described in footnote 27 on page 29). The average attendance per grade in destination schools in our analysis (83.0 students per grade) was multiplied by 6 to estimate the average attendance in grades K–5 (500 students per school). The percentages in Exhibit 6.1 were then used to estimate the number of additional students from outside the neighborhood to be 36 (171 students before conversion and 207 after). Because information on the number of classes in each grade and school was not available, it was assumed that the average class size was 20 students (Digest of Education Statistics 2013). Based on this assumption, the increase in students from outside the neighborhood per class was estimated to be approximately 1 student per class (36 extra students over approximately 25 classes).

outside the destination magnet schools' neighborhood were 2.5 percentage points more likely to be from minority racial/ethnic groups after conversion and 5.9 percentage points more likely to be economically disadvantaged. In contrast, before conversion, there was no significant difference between the neighborhood students and those from outside the neighborhood in terms or race/ethnicity or economic disadvantage. The differences in the characteristics of the two groups of students after conversion, combined with the higher proportion of outside students attending, suggest that the destination magnet schools became more diverse, as expected based on the theory of action.[41]

[41] The gap between students from the neighborhood and from outside the neighborhood did not change significantly from before to after conversion, in terms of either race/ethnicity (a 2.7 percentage point difference before conversion to a 2.5 percentage point difference after conversion) or economic disadvantage (a -1.0 percentage point difference to a 5.9 percentage point difference). That is, the characteristics of the students from outside the neighborhood were not "more different" than the neighborhood students after conversion than they were beforehand.

Exhibit 6.2. Characteristics of Neighborhood Students and Students From Outside the Neighborhood in the Destination Magnet Schools (Average Across Schools)



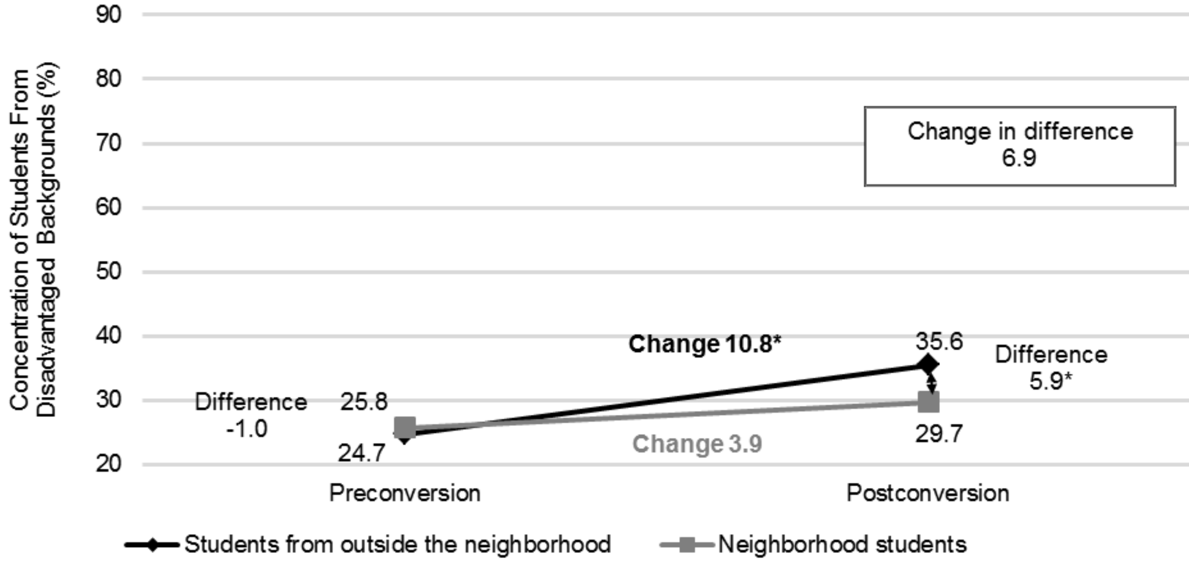


EXHIBIT READS: Before (pre-) conversion, the average proportion of students from outside the neighborhood who were from minority racial/ethnic groups in the magnet schools (73.6 percent) was 2.7 percentage points higher than the average proportion of neighborhood students from minority racial/ethnic groups (70.9 percent), which was not a statistically significant difference. From pre- to post-conversion, the change in the proportion of students from outside the neighborhood who were from minority groups (3.5 percentage points) was not statistically significant but the change in the proportion of neighborhood students who were from minority groups (3.7 percentage points) was. After (post-) conversion, the average proportion of students from outside the neighborhood who were from minority racial/ethnic groups in the magnet schools (77.1 percent) was 2.5 percentage points higher than the average proportion of neighborhood students who were from minority racial/ethnic groups (74.6 percent), which was a statistically significant difference.

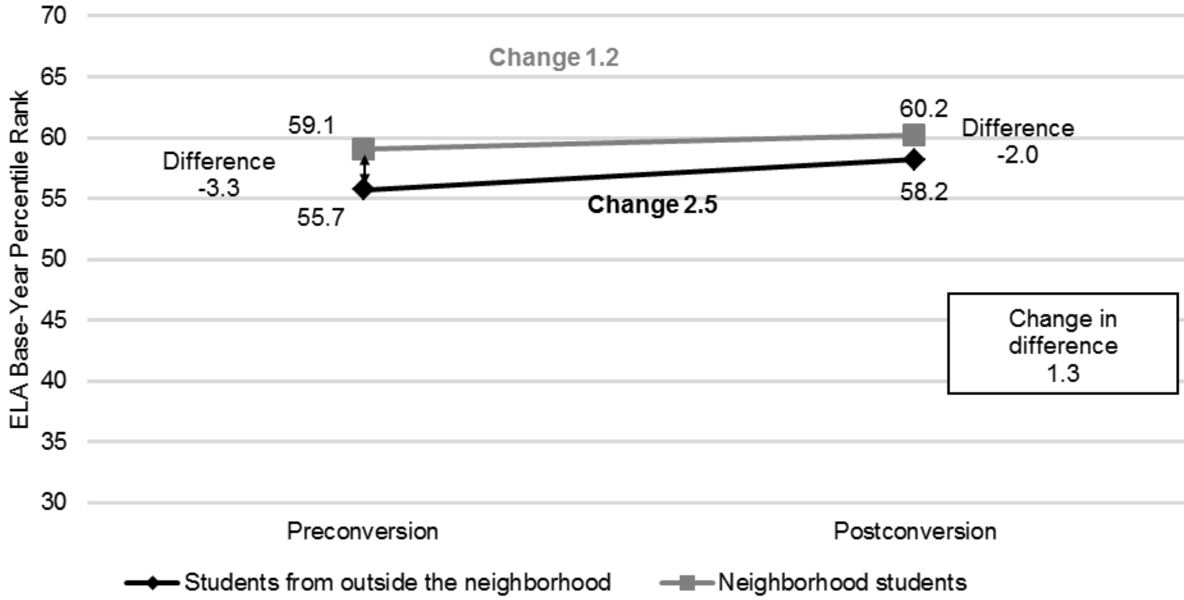
NOTE: See Appendix F for methods used for calculations and significance tests. *N* = four schools in three districts. Results include neighborhood students and students from outside the neighborhood only; students missing neighborhood status were not included in this exhibit. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure. See appendix Exhibit J.2 for additional detail.

SOURCE: District administrative data.

- **After conversion, the academic achievement of students from outside the neighborhood in destination magnet schools was lower than the achievement of neighborhood students in mathematics but similar in ELA (Exhibit 6.3).** Destination schools are expected to reach out to students from lower performing schools or who are lower performing academically themselves. This part of the theory of action was evident among the study schools specifically for mathematics: after conversion, students from outside the destination magnet schools' neighborhood had mathematics test scores that were 5.0 percentile points lower than those of the neighborhood students. But in ELA, neighborhood students and students from outside the neighborhood did not differ significantly in average scores after conversion. Before conversion, students from outside the neighborhood also scored lower than neighborhood students in mathematics but not in ELA. Because the magnet schools served a higher proportion of students from outside the neighborhood after conversion, and in mathematics these students were lower achieving than neighborhood students, the destination magnet schools gave more students from outside the neighborhood exposure to higher achieving peers.[42]

[42] The gaps in achievement between students from the neighborhood and from outside the neighborhood did not change significantly from before to after conversion, in terms of either ELA (a -3.3 percentage point difference before conversion to a -2.0 percentage point difference after conversion) or math (a -8.8 percentage point difference to a -5.0 percentage point difference). That is, the achievement of the students from outside the neighborhood were not "more different" from the neighborhood students after conversion than they were beforehand. It is also important to note that the test scores of students from outside the neighborhood after conversion could reflect differences in the academic performance of students recruited to the school before versus after conversion. Or they could reflect increases or decreases in learning among those students from outside the neighborhood who were attending the destination magnets both before and after the conversion.

Exhibit 6.3. Achievement of Neighborhood Students and Students From Outside the Neighborhood in the Destination Magnet Schools (Average Across Schools)



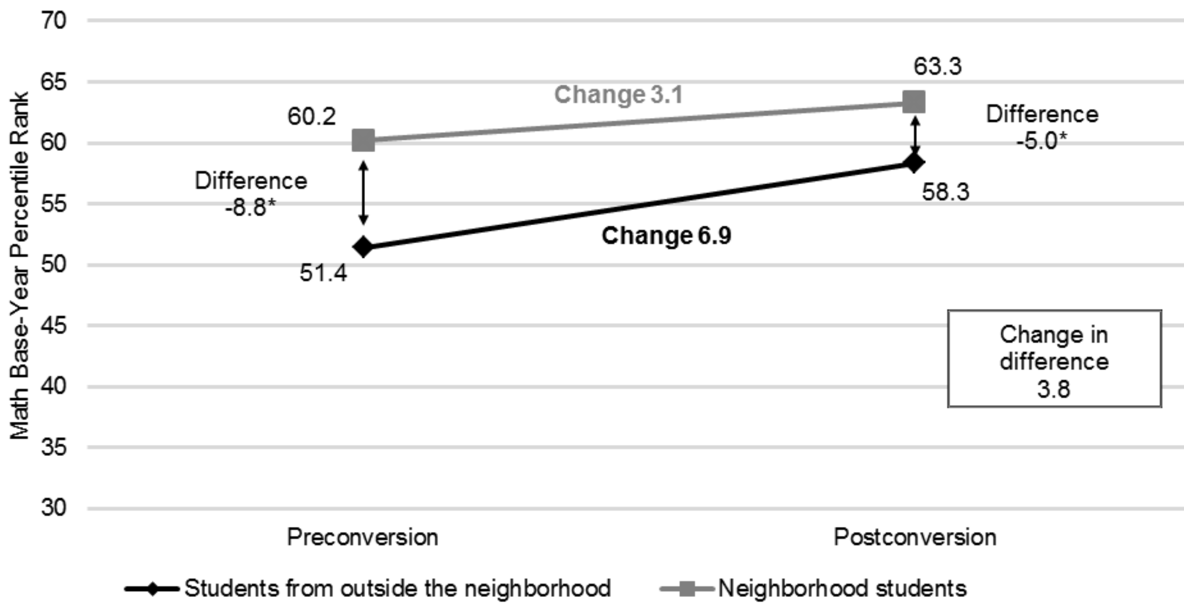


EXHIBIT READS: Before (pre-) conversion, the average ELA achievement of students from outside the neighborhood (55.7 percentile) was 3.3 percentage points lower than the average ELA achievement of neighborhood students (59.1 percentile), which was not a statistically significant difference. From pre- to post-conversion, there was a 2.5 percentile point increase in the average ELA achievement of students from outside the neighborhood and a similar increase (1.2 percentile points) in the average ELA achievement of neighborhood students. As a result, after (post-) conversion, the average ELA achievement of students from outside the neighborhood (58.2 percentile) was 2.0 percentage points lower than the average ELA achievement of neighborhood students (60.2 percentile), which was still not a statistically significant difference.

NOTE: See Appendix F for methods used for calculations and significance tests. *N* = four schools in three districts. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure. See appendix Exhibit J.3 for additional detail.

SOURCE: District administrative data.

Relative to their districts, there was no change in the concentration of students from minority racial/ethnic backgrounds in the destination magnet schools, and there is not evidence that the conversion was a factor.

The destination magnet schools attracted students from outside the neighborhood with characteristics consistent with the theory of action. This section turns to a comparison of destination magnet schools with their districts, focusing on the racial/ethnic diversity of the entire school (neighborhood and outside students). The results indicate that the magnet schools experienced changes that were similar to those in the district, as well as to the neighborhood schools in the districts that did not convert. This suggests that the conversion process probably had no special influence on the racial/ethnic diversity in the magnet schools.

Describing changes in magnet schools and their districts.

- **The proportion of minority students increased in both destination schools and their districts after conversion, leaving the concentration of minority students in the magnet schools unchanged relative to their districts (Exhibit 6.4).** On average, neighborhood schools that converted to destination magnet schools initially served a proportion of minority students (71.6 percent) that was similar to the proportion in their districts overall (72.0 percent). Both the destination schools and their districts experienced an increase in the share of students from minority racial/ethnic groups (an increase of 3.3 percentage points for destination schools and 1.8 for their districts). Contrary to what would be expected, magnet schools did not become more like their districts after conversion. The gap between the magnet schools and their districts before (0.4 percentage point) versus after (1.1 percentage points) the conversion was virtually unchanged.

Exhibit 6.4. Concentration of Racial/Ethnic Minority Students in the Destination Magnet Schools (Average Across Schools)

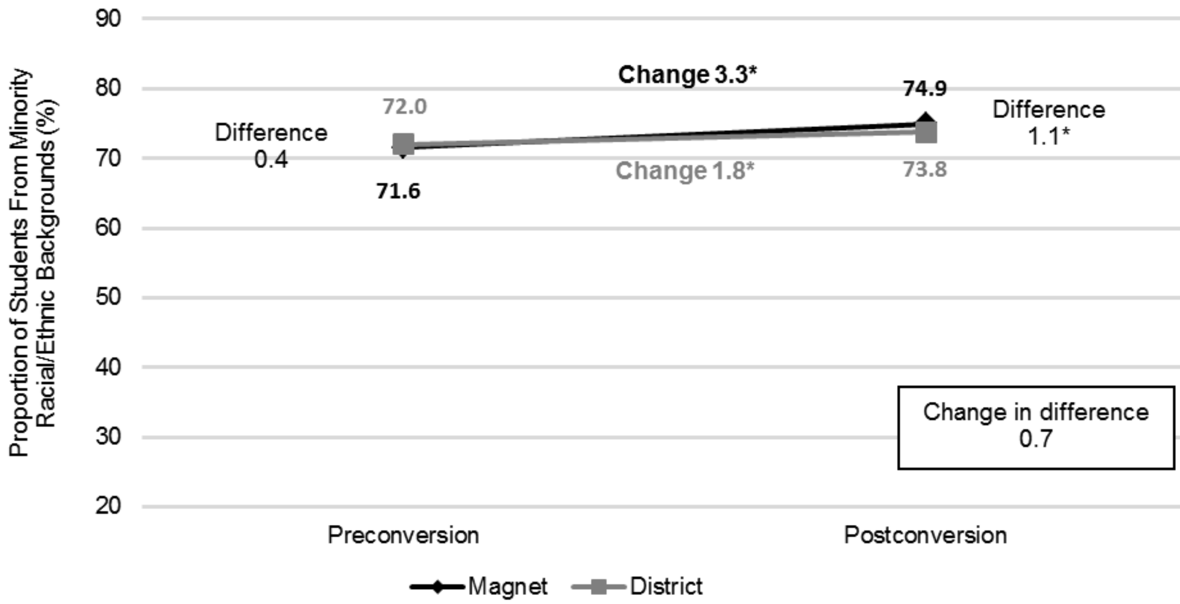


EXHIBIT READS: Before (pre-) conversion, the average proportion of minority students in the magnet schools (71.6 percent) was 0.4 percentage points lower than the proportion in their districts (72.0 percent). From pre- to post-conversion, there was a statistically significant increase in the magnet schools' proportion (3.3 percentage points) and in the proportion in their districts (1.8 percentage points). As a result, after (post-) conversion, the magnet schools' average proportion (74.9 percent) was significantly higher (1.1 percentage points) than the proportion in their districts (73.8 percent), but the change in the difference between the magnet schools and their districts (0.7 percentage points) was not significant.

NOTE: See Appendix F for methods used for calculations and significance tests. *N* = four schools in three districts. Results include all students: neighborhood students, students from outside the neighborhood, and students missing neighborhood status. District proportion is based on students in all schools in the district. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure. See appendix Exhibit J.4 for additional detail.

SOURCE: District administrative data.

Investigating the role of magnet conversion.

- **There is not evidence indicating that conversion to a magnet played a role in the concentration of racial/ethnic minority students in destination magnet schools.**[43] The results in Exhibit 6.4 indicate that destination magnet schools maintained their concentration of racial/ethnic minority students relative to their districts. While this suggests that conversion did not play a role, it is possible that the concentration of minority students in neighborhood schools that did not convert did change. If the change in destination magnet schools differed from what would be predicted if the schools had not converted, this might suggest a role for the conversion in maintaining the concentration of minority students in the magnet schools relative to their districts, though other factors could also be influences. Based on the changes in neighborhood schools that

[43] The analysis examined whether the schools' student composition became more like their districts, regardless of whether the magnets and other neighborhood schools served a higher or lower proportion of students from minority racial/ethnic groups than their district prior to conversion. To do this, the difference was measured using the absolute value so that a smaller gap between a school and its district meant a smaller value, regardless of where the school started.

did not convert, the magnet schools would be predicted to differ from their districts by 4.4 percentage points if they had not converted (Exhibit 6.5). Although the magnet schools differed from their districts by 3.3 percentage points after conversion and, hence, were 1.1 percentage points closer than predicted to their districts in the proportions of minority group students served, that 1.1 difference is not statistically different from zero.[44,45]

Exhibit 6.5. The Role of Magnet Conversion in the Concentration of Students From Minority Racial/Ethnic Backgrounds in Destination Magnet Schools (Average Across Schools)

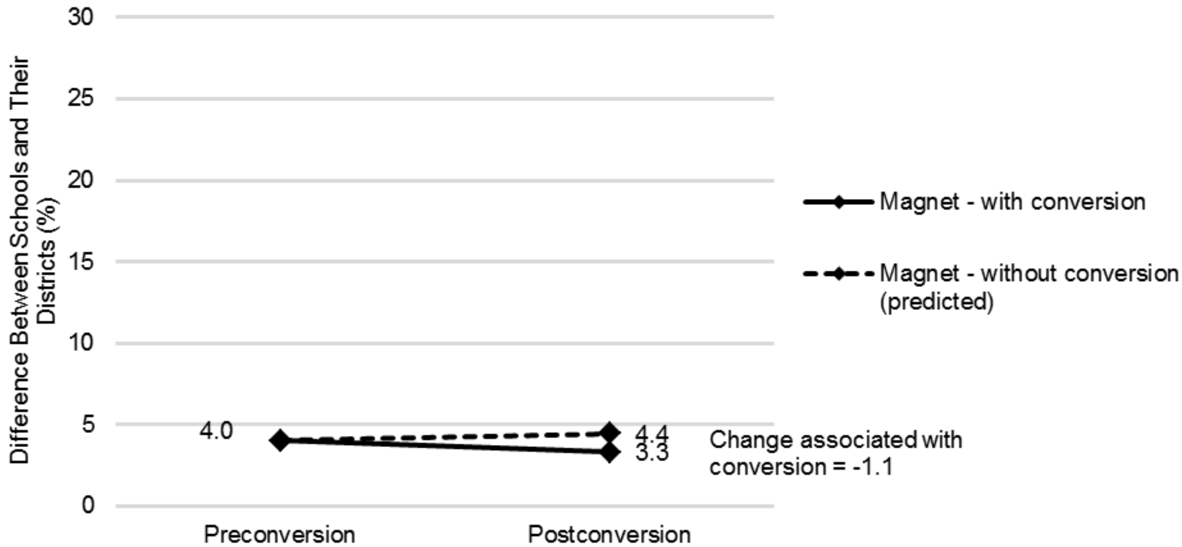


EXHIBIT READS: Before (pre-) conversion, the average size (absolute value) of the difference between the proportion of minority students served by the magnet schools and their districts was 4.0 percentage points. Based on neighborhood schools that did not convert, the average size of the difference between magnet schools and their districts would be predicted to increase to 4.4 percentage points after (post-) conversion had the magnet schools not converted. Instead of an increase, the magnet schools experienced a decrease after conversion (0.7 percentage points), bringing them 1.1 percentage points closer to their districts than would be predicted (a 3.3 percentage point average difference between the magnet schools and their districts instead of 4.4). While the magnet schools were 1.1 percentage points closer to their districts post-conversion than predicted, this difference is not statistically different from zero and, thus, the conversion is not likely a factor in bringing the proportion of minority students in magnet schools closer to their districts. Statistical testing was not conducted on the preconversion to postconversion changes in this figure; only the primary outcome, the difference between the predicted and actual magnet outcome, was tested.

NOTE: See appendix Exhibits J.5, J.6, and J.7 for additional detail.

SOURCE: District administrative data.

[44] The analysis shown in Exhibit 6.5 was based on the average concentration of minority students in magnet schools and neighborhood public schools relative to their districts for the years before conversion and the average for the years after. An additional analysis was conducted to examine the trend in the concentration of minority students from the first to the fourth year after conversion, in case changes took a few years to observe. However, those results indicate that magnet schools did not grow closer to their districts each year after conversion, relative to neighborhood public schools. See Exhibit J.13 in Appendix J for results.

[45] The study checked the sensitivity of the results to the potential difficulty of attracting more students from minority racial/ethnic backgrounds by eliminating from the analysis the one destination school (and corresponding neighborhood public schools) that was in a district that had few minority students (less than 20 percent of the students in the district). However, the results were similar to those with the full set of schools. See Appendix H.1 for more detail.

Relative to their districts, the concentration of economically disadvantaged students in the destination magnet schools was higher after conversion, but there is not evidence that conversion was a factor.

Consistent with the theory of action for destination magnet schools, the growth in the proportion of students from economically disadvantaged backgrounds in the converting magnet schools outpaced their districts. Neighborhood schools that did not convert experienced changes that differed from the magnet schools, but the difference did not meet conventional statistical benchmarks.

Describing changes in magnet schools and their districts.

- **The proportion of economically disadvantaged students in the converting destination schools increased more than in their districts (Exhibit 6.6).** Neighborhood schools that converted to destination magnet schools initially served a smaller proportion of disadvantaged students than their districts (25.0 percent compared with 38.1 percent, a 13.1 percentage point difference). The destination magnet schools experienced an increase in the share of their students who were disadvantaged (25.0 percent to 31.8 percent, a 6.8 percentage point increase), compared with a smaller increase in their districts (38.1 percent to 41.1 percent, a 3.0 percentage point increase). Because the proportion rose by a greater amount for the destination magnet schools than their districts, the concentration of disadvantaged students relative to their districts increased in the destination magnet schools as would be expected based on the theory of action.

Exhibit 6.6. Concentration of Students From Economically Disadvantaged Backgrounds in the Destination Magnet Schools (Average Across Schools)

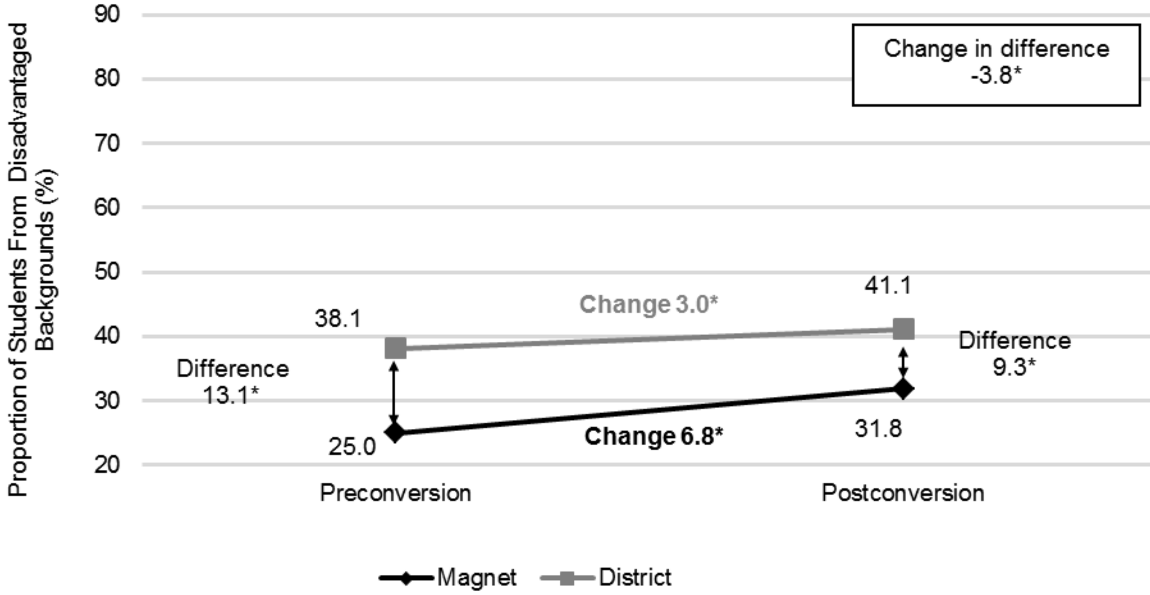


EXHIBIT READS: Before (pre-) conversion, the average proportion of economically disadvantaged students in the magnet schools (25.0 percent) was 13.1 percentage points lower than the proportion in their districts (38.1 percent). From pre- to post-conversion, the average proportion of disadvantaged students increased significantly in the magnet schools (6.8 percentage points) and their districts (3.0 percentage points). As a result, after (post-) conversion, the magnet schools' average proportion (31.8 percent) was 9.3 percentage points lower than the proportion in their districts (41.1 percent), which was a significant change in the difference between the magnet schools and their districts of -3.8 percentage points. This change represents a significant increase in the concentration of disadvantaged students in the magnet schools relative to their districts.

Note: See Appendix F for methods used for calculations and significance tests. *N* = four schools in three districts. Results include all students: neighborhood students, students from outside the neighborhood, and students missing neighborhood status. District proportion is based on students in all schools in the district. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure. See appendix Exhibit J.8 for additional detail.

SOURCE: District administrative data.

Investigating the role of magnet conversion.

- **There is not evidence that conversion influenced the concentration of economically disadvantaged students in destination magnet schools.** To assess whether the changes identified in Exhibit 6.6 might have been caused by magnet conversion, the changes were compared with the changes in neighborhood schools that did not convert. After conversion, the magnet schools moved in a different direction than would be predicted (Exhibit 6.7). Without conversion, the study magnet schools would be predicted to differ from their districts by 15.6 percentage points, based on the changes in neighborhood schools that did not convert. The converting magnet schools' actual difference from their districts in the proportion of disadvanted students served was 9.9 percentage points, or 5.7 percentage points less than would be predicted. This difference is just short of meeting the benchmark most studies use to determine that a finding is reliable and not due to chance (i.e., the difference has a *p*-value of 0.066 rather than a value less than 0.05).[46] It is also the

[46] The study checked the sensitivity of the results to the potential difficulty of attracting more economically disadvantaged students by eliminating from the analysis the one destination school (and corresponding

case that the influence of conversion on the concentration of disadvantaged students in destination magnet schools was greater in the later years after conversion than the earlier years, suggesting some promise about these magnet school outcomes.[47]

Exhibit 6.7. The Role of Magnet Conversion in the Concentration of Economically Disadvantaged Students in Destination Magnet Schools (Average Across Schools)

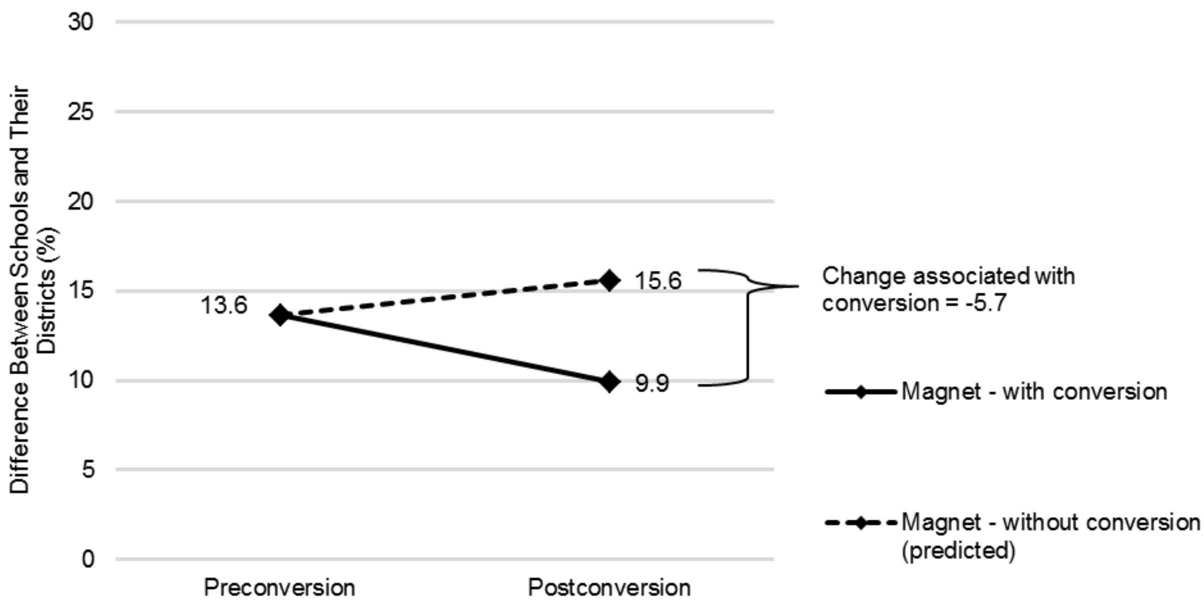


EXHIBIT READS: Before (pre-) conversion, the average size (absolute value) of the difference between the proportion of disadvantaged students served by magnet schools and their districts was 13.6 percent. Based on neighborhood schools that did not convert, the average size of the difference after (post-) conversion would be predicted to increase to 15.6 percentage points had the magnet schools not converted. Instead of an increase, the magnet schools experienced a decrease after conversion (3.7 percentage points), bringing them 5.7 percentage points closer to their districts than would be predicted (a 9.9 percentage point average difference between the magnet schools and their districts instead of 15.6). While the magnet schools were 5.7 percentage points closer to their districts post-conversion than predicted, this difference is not statistically different from zero and, thus, the conversion is not likely a factor in bringing the proportion of disadvantaged students in magnet schools closer to their districts. Statistical testing was not conducted on the preconversion to postconversion changes in this figure; only the primary outcome, the difference between the predicted and actual magnet outcome, was tested.

Note: See appendix Exhibits J.9, J.10, and J.11 for additional detail.

SOURCE: District administrative data.

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neighborhood public schools) that was in a district that had few disadvantaged students (less than 20 percent of the students in the district). With this destination magnet excluded, there was a significant relationship between the change in the concentration of disadvantaged students in the destination magnets relative to their districts and magnet conversion. The estimated change associated with conversion was -7.82 percentage points ($p = 0.007$). See Appendix H.1.

[47] The analysis shown in Exhibit 6.7 was based on the average concentration of disadvantaged students in magnet schools and neighborhood public schools relative to their districts for the years before conversion and the average for the years after. An additional analysis was conducted to examine the trend in the concentration of disadvantaged students from the first to the fourth year after conversion, in case changes took a few years to observe. The results indicate that magnet schools grew closer to their districts each year after conversion, relative to neighborhood public schools, consistent with what might be expected if implementation took time. See Exhibit J.13 in Appendix J for results.

Achievement in destination magnet schools did not change after conversion, whereas achievement in their districts improved.

The theory of action predicts that destination magnet schools might improve achievement through either the specialized curriculum, which could benefit all students, or the opportunity for the outside students to have higher performing or more advantaged peers. However, if the magnet schools bring in more lower-performing students, the average achievement of the schools could decline.

Describing changes in magnet schools and their districts.

- **The destination magnet schools lost ground to their districts in ELA achievement.** Before conversion, average ELA achievement in destination magnet schools (58.8th percentile) was higher than the average in their districts (51.6th percentile)—a difference of 7.2 percentile points (Exhibit 6.8). Average ELA achievement in the districts increased after conversion by 6.9 percentile points (to the 58.5th percentile), whereas achievement in the magnet schools did not change significantly (1.4 percentile point increase to the 60.2th percentile).
- **The changes in mathematics achievement in the magnet schools and their districts were similar.**[48] Before conversion, the average mathematics achievement in the destination magnet schools (58.4th percentile) was higher than the average in their districts (51.6th percentile)—a difference of 6.8 percentile points (Exhibit 6.8). Average mathematics achievement in the districts increased after conversion by 8.9 percentile points (to the 60.5th percentile), whereas the achievement in the magnet schools did not change (the 3.9 percentile point increase to the 62.2th percentile was not statistically different from zero).[49] The 1.7 percentile point mathematics achievement gap between the magnets and their districts after conversion is just short of being statistically different from the 6.8 percentile gap before conversion (p=0.051 rather than p=0.050).

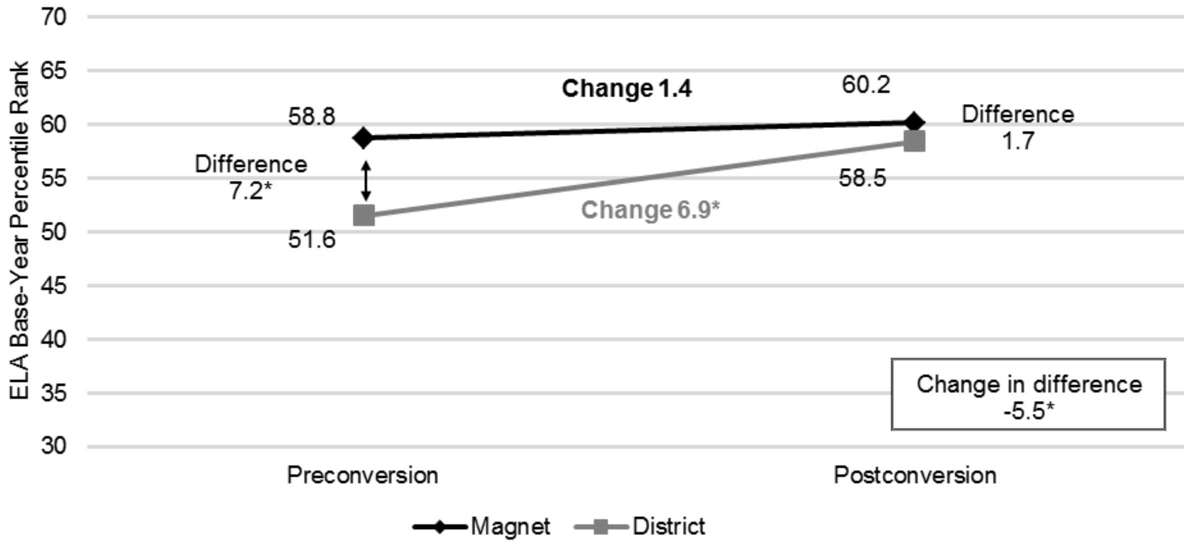
Investigating the role of magnet conversion.

Examining the role of conversion by comparing the changes in achievement gains for the destination magnet schools to those of neighborhood schools that did not convert is not appropriate for students from outside the neighborhood, as discussed in Chapter 2. There are better approaches, including the use of lotteries, to examine the effects of attending a converted magnet for these students. However, these approaches were not feasible in this study.

[48] The estimated change in the difference (-5.1 percentile points) was just short of statistically significant (p=0.051 rather than p=0.050).

[49] The value of 3.9 differs from 62.2 – 58.4 because of rounding.

Exhibit 6.8. Achievement in Destination Magnet Schools and Their Districts (Average Across Schools)



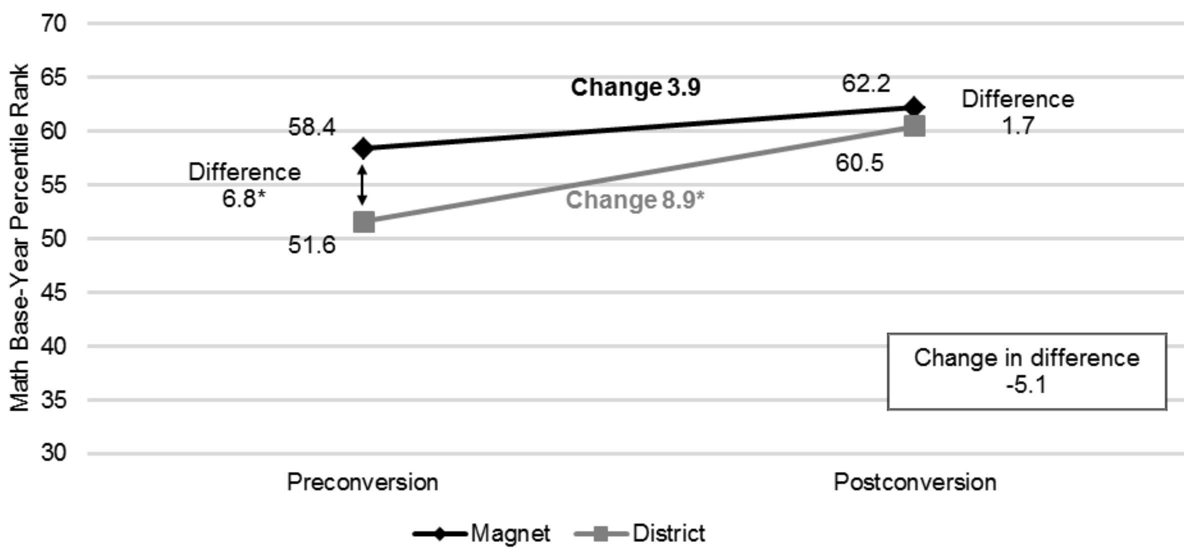


EXHIBIT READS: The average ELA achievement in the magnet schools did not significantly change (increase of 1.4 percentile points) from before (pre-) conversion (58.8 percentile) to after (post-) conversion (60.2 percentile). The average ELA achievement in their districts increased significantly by 6.9 percentile points from preconversion (51.6 percentile) to postconversion (58.5 percentile). Therefore, the districts increased 5.5 percentile points more than the magnet schools (a 1.4 percentile point increase in the magnet schools compared to a 6.9 percentile point increase in their districts)—a statistically significant change.

NOTE: See Appendix F for methods used for calculations and significance tests. *N* = four schools in three districts. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown on the figure. See appendix Exhibit J.12 for additional detail.

SOURCE: District administrative data.

Chapter 7: Variation in Results and Next Steps in Understanding Magnet School Outcomes

This study tracked the student body composition and test scores of a set of schools over 7 years, examining how they changed from before to after the schools converted to become magnet schools. Because student body composition and performance in the magnet schools' districts (and shifts in these factors) could affect the converting magnet schools' ability to achieve improvements in diversity and achievement, changes in the converting magnet schools were compared to those in their districts overall. In addition, to examine whether what occurred in the magnet schools differed from the general patterns experienced by other district schools, changes in the magnet schools were compared to what would be predicted if they had not converted (based on neighborhood schools that did not convert). Two different approaches to magnet conversion (traditional and destination) were examined, separately, because the types of students they sought to attract and influence were different.

The results of these analyses are mixed. Both the traditional and destination magnet schools experienced some changes in diversity in the direction expected from the theory of how each type of conversion would play out. While the achievement in traditional magnet schools was higher after conversion, beyond their districts' improvement in academic performance, the destination magnet schools lost ground to their districts. However, for only one of these outcomes—the reduced concentration of minority students in traditional magnet schools relative to their districts—was there evidence that the conversion could have played a role, as opposed to other changes happening in schools districtwide.

Sometimes examining the outcomes for a set of schools on average, as was the case in the previous chapters, can mask important differences among them. Not only were there two categories of magnet schools—traditional and destination—but they were implemented in different ways and in different contexts. Looking at the individual results for each converting magnet compared to what would be predicted had it not converted can help determine whether a small subset of the schools have a big influence on the results or whether the results are consistent across schools in the study. A lot of variation, in particular, may suggest that converting magnet schools or their contexts may be so different that an average look across them (even separately by traditional versus destination) may be less meaningful, or at least that it would be important to study a larger number of these schools in the future. Consistency in the outcome comparisons across individual schools would suggest that the average results from this study may be a good marker of what other converting magnet schools might experience.

Conducting this type of analysis reveals significant variation in how individual magnet schools changed in comparison to what would be predicted based on neighborhood schools that did not convert—i.e., whether conversion may have a role in the changes seen in diversity or achievement. For example, in 9 of the 17 traditional magnet schools, conversion may have been a factor in an increase in racial/ethnic diversity. (See Exhibit 7.1, which shows that nine bars were significantly below the horizontal line, indicating that the difference between those schools and their districts was reduced.) In another three schools the conversion may be related to a decrease in racial/ethnic diversity, and in five schools there is not evidence to suggest any role at all (the changes in outcomes for the magnet schools were similar to the changes that would be predicted). Among the 11 traditional magnet schools with data on student disadvantage, conversion may have been a factor in an increase in economic diversity in 6 traditional magnet schools and a decrease in economic diversity in 2 schools. In the remaining three schools, there is not evidence of conversion playing a role.

In terms of achievement, neighborhood students in some traditional magnet schools (five in ELA and nine in mathematics) fared better than would be predicted based on similar students in neighborhood schools in their districts that did not convert, while some other traditional magnet schools (seven in ELA and six in mathematics) fared worse (Exhibit 7.2). In the four destination schools, conversion may have been a factor in increased economic diversity in three of these schools. In terms of racial/ethnic diversity, outcomes were split (Exhibit 7.3).[50]

Ideally, this variation would provide an opportunity to assess whether specific aspects of the magnet schools' implementation or context are related to better or worse outcomes. Unfortunately, there were too few converting schools in the study sample to draw even tentative hypotheses about what factors might contribute to that variation. For example, there were only 4 schools that used a STEM focus for their magnet schools—not enough to determine whether a STEM focus was related to better or worse outcomes than other conversion themes. Future research on magnet conversion should make such an assessment a priority.

[50] Tests for significant variation across schools in the association between conversion and outcomes were conducted and results indicated significant variation in each instance tested (see Appendices I and J, Exhibits I.6, I.10, I.14, I.17, J.6, and J.10). See Appendix F.2.2.3 for more details.

Exhibit 7.1. The Role of Magnet Conversion in the Concentration of Racial/Ethnic Minority and Economically Disadvantaged Students in Traditional Magnet Schools

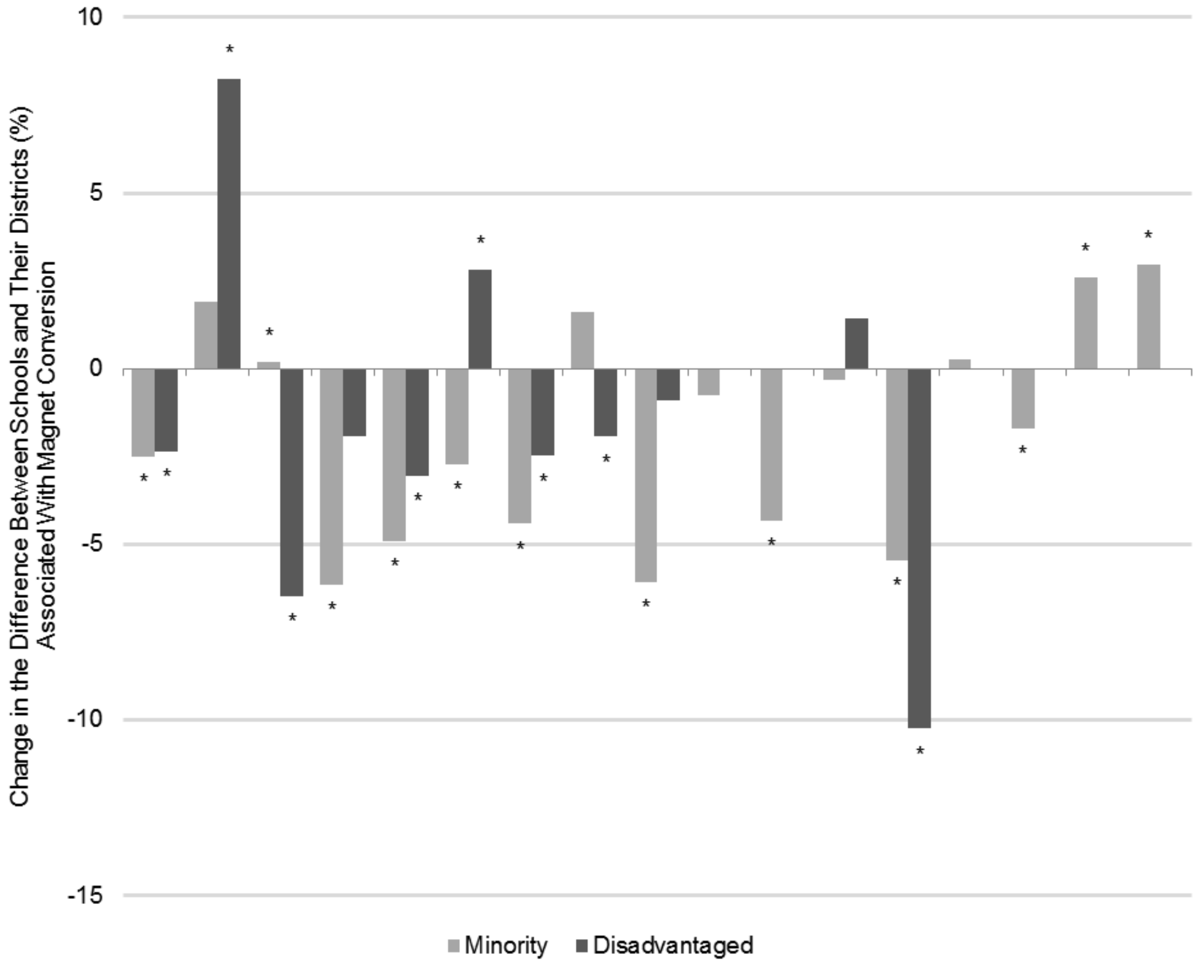


EXHIBIT READS: Each pair of bars represents results for one traditional magnet school. From before (pre-) conversion to after (post-) conversion, the far left traditional magnet school experienced a 2.5 percentage point decrease in the difference between the proportion of racial/ethnic minority students served by this magnet school and its district beyond what would be predicted based on the changes in neighborhood schools in this district that did not convert (indicated by the light grey bar). The same magnet school experienced a 2.4 percentage point decrease in the difference between the proportion of disadvantaged students served by this magnet school and its district beyond what would be predicted based on the changes in neighborhood schools in this district that did not convert (indicated by the dark grey bar).

NOTE: *N* = 17 study magnet schools in 10 districts for the percentage minority; *N* = 11 study magnet schools in 7 districts for the percentage disadvantaged. (3 districts G, J, and K did not have data on whether students were disadvantaged.) A statistically significant estimate is denoted by the following symbol: * = statistically significant with $p < .05$, two-tailed test.

SOURCE: District administrative data.

Exhibit 7.2. The Role of Magnet Conversion in Achievement for Neighborhood Students in Traditional Magnet Schools

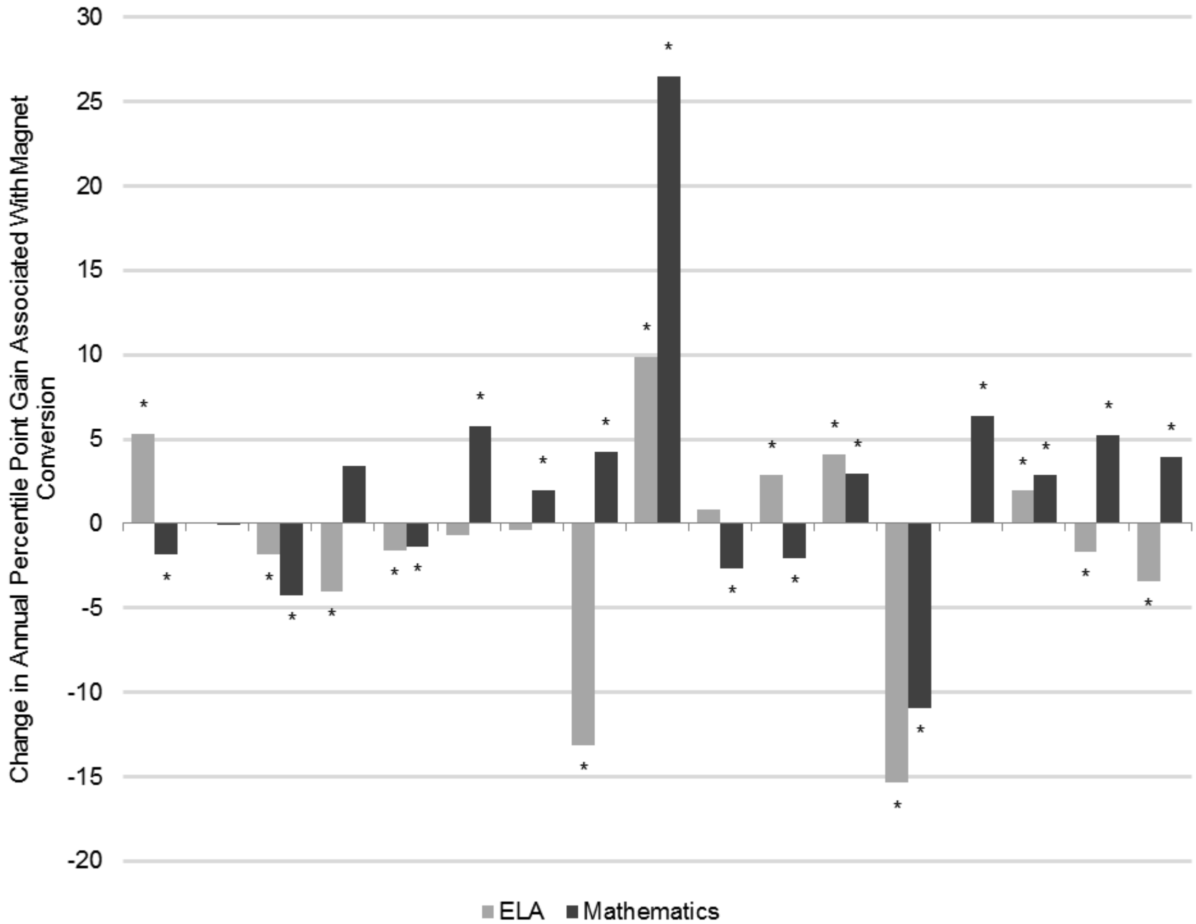


EXHIBIT READS: Each pair of bars represents results for one traditional magnet school. From before (pre-) conversion to after (post-) conversion, the average neighborhood student annual percentile point gain in ELA achievement in the far left traditional magnet increased by 5.3 percentile points more than would be predicted based on the average neighborhood student annual percentile point gain in ELA achievement in neighborhood schools that did not convert (indicated by the light grey bar). From before (pre-) conversion to after (post-) conversion, the average neighborhood student annual percentile point gain in mathematics achievement in the far left traditional magnet decreased by 1.9 percentile points more than would be predicted based on the average neighborhood student annual percentile point gain in mathematics achievement in neighborhood schools that did not convert (indicated by the dark grey bar).

NOTE: *N* = 17 turnaround schools in 10 districts. A statistically significant estimate is denoted by the following symbol:
* = statistically significant with *p* < .05, two-tailed test.

SOURCE: District administrative data.

Exhibit 7.3. The Role of Magnet Conversion in the Concentration of Racial/Ethnic Minority and Economically Disadvantaged Students in Destination Magnet Schools

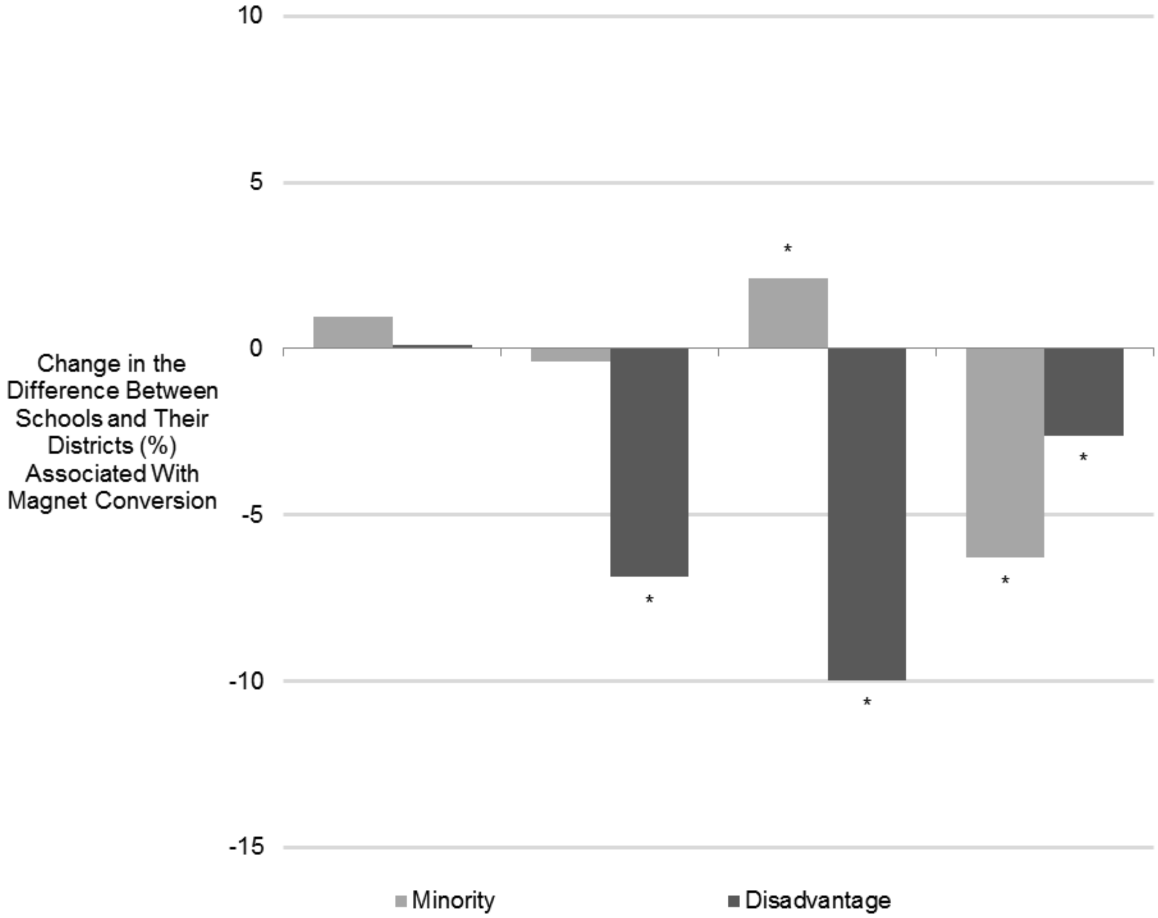


EXHIBIT READS: Each pair of bars represents results for one destination magnet school. Over the conversion period, the far left destination magnet school experienced a 0.9 percentage point decrease in the difference between the proportion of racial/ethnic minority students served by this magnet school and its district beyond what would be predicted based on the changes in neighborhood schools in this district that did not convert, which was not a statistically significant difference (indicated by the light grey bar). The same magnet school experienced a 0.1 percentage point increase in the difference between the proportion of disadvantaged students served by this magnet school and its district beyond what would be predicted based on the changes in neighborhood schools in this district that did not convert, which was also not a statistically significant difference (indicated by the dark grey bar).

NOTE: *N* = four study magnet schools in three districts. A statistically significant estimate is denoted by the following symbol: * = statistically significant with $p < .05$, two-tailed test.

SOURCE: District administrative data.

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Appendix A: Districts and Schools in the Study

A.1. Sample Selection

The magnet conversion sample for this study consists of 21 schools in 11 distinct districts selected from the 2004 and 2007 MSAP grant cohorts, the two most recent cohorts at the time the study was initiated. (Three schools in two districts[51] were selected from the 2004 cohort, and 18 schools in 10 districts, one of which was also included in the first cohort, were selected from the 2007 cohort.) Sample selection began with a full list of 385 grantee magnet schools (in 81 districts) from the 2004 and 2007 funding cohorts.[52] Data provided by the MSAP program office were used to narrow the potential sample to 119 schools (in 41 districts) in which existing elementary schools were to be converted into schoolwide magnet schools. Because the main analyses to be conducted for the study involved comparing achievement before and after magnet school conversion, schools in states where the state student assessments were not consistent for two years prior to and two years after the magnet conversion were eliminated. Finally, the study collected additional information by mail and phone from district MSAP directors for the remaining 46 candidate schools in 24 districts to apply two final selection criteria. The following additional information was sought:

- Magnet schools with stable attendance boundaries during the study period[53]
- Districts that were able to provide the data necessary to conduct the analyses presented here, including information to distinguish between neighborhood students and students from outside the neighborhood in each school in the district[54,55]

[51] One district contained study magnet schools in both the 2004 and 2007 cohorts.

[52] Since the initiation of this study, MSAP has funded new cohorts of districts in 2010 and 2013.

[53] Stable attendance zones were needed to allow for identification and comparison of resident and nonresident students in a manner that did not change across time. Unstable zones would cause changes in the resident and possibly nonresident populations, making it difficult to infer patterns related to the magnet school conversion itself.

[54] The original study design proposed to use a sample of matched comparison schools. Thus, one additional criterion used to select the magnet study sample was the availability of one or more matching comparison schools in the magnet school's district. In the final analysis, however, all noncharter and nonmagnet schools in the district were used as comparisons. Restricting the sample to MSAP districts with at least one matched comparison school for each selected magnet school resulted in the omission of one district with one magnet conversion school that might have been kept in the study. The district was eliminated because the closest potential matching school had test scores and demographics very different from the magnet conversion school's demographics (greater than a 0.5 standard deviation difference in test scores; greater than a 20 percentage point difference in percentage minority and percentage free or reduced-price lunch eligible). For details on the decision to use all noncharter and nonmagnet schools in the district as comparisons rather than creating a matched comparison sample, see Betts et al. (2009), which describes a simulation study conducted as part of the design phase of this research project. This paper is available on request from the authors.

[55] It is possible that districts that were able to provide the data and thus were included in the study were different from those not included in ways that also affected the magnet school conversion process. For example, the districts that were included may have had more sophisticated data systems and thus perhaps may also have had more experience adopting new practices than districts not included.

The 21 magnet schools in 11 districts from the 2004 and 2007 cohorts that met these criteria constituted the study analysis sample.[56] Given the restrictions applied in the selection process, this sample of schools and districts was purposive; it was not a representative or random sample of the population of MSAP-funded elementary magnet schools, funded districts, or schools within funded districts.

A.2. Information on State Assessments

One criterion for district selection listed previously was that the district's state student assessments were consistent for at least two years prior to and two years after the magnet conversion. As part of site selection for the study conducted in early 2007, information was collected on changes in state assessments that had occurred through the 2006–07 school year and changes anticipated after the 2006–07 school year. The information was collected from technical documentation on the assessment websites of all states containing potential study districts.

Changes that were considered major and to have interrupted consistency were the following: change from fall to spring testing, changes in content standards, and the use of new assessments. Changes that were considered minor and not to have interrupted consistency included the following: changes in cut scores for percent proficient and changes in the month of the assessment within the same school year (e.g., from January to April).

Although districts were eliminated during prescreening if there were major changes in their state assessments, a subsequent review in 2013 of documentation on state assessment websites indicated that in a few districts, changes had occurred outside the years screened. Exhibits A.1 and A.2 indicate for each district and each analysis year whether there was no major change in the assessment (indicated by ✓), or if there was a change (indicated by **Δ**). In District C, the change in ELA and mathematics assessments was a shift from fall to spring testing. The other changes in Districts D, F, and I in 2010–11 were either changes in content standards or the use of new assessments.

[56] Twenty-two magnet schools were analyzed for the study, but two schools from the 2007 cohort were located in the same building and had been one school prior to conversion. These two co-located schools were treated as one school in the analysis, resulting in 21 schools.

Exhibit A.1. Years of Assessment Data Used, Base Year for Standardization for Chapter 6 Analysis, and Changes for ELA Assessments

Districts (Cohorts)	Number of Study Magnet Schools	School Year								
		2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
A (2004)	1	✓	✓	✓	✓	✓	✓	✓	✓	—
B (2004 and 2007)	4	✓	✓	✓	✓	✓	✓	✓	✓	—
C (2007)	1	—	—	✓	✓	✓	✓	Δ	✓	✓
D (2007)	3	—	—	—	✓	✓	✓	✓	✓	Δ
E (2007)	1	—	—	—	—	✓	✓	✓	✓	✓
F (2007)	3	—	—	—	—	✓	✓	✓	✓	✓
G (2007)	2	—	—	—	✓	✓	✓	✓	✓	✓
H (2007)	1	—	—	—	✓	✓	✓	✓	✓	✓
I (2007)	1	—	—	—	✓	✓	✓	✓	✓	Δ
J (2007)	2	—	—	—	✓	✓	✓	✓	✓	✓
K (2007)	2	—	—	—	✓	✓	✓	✓	✓	✓

NOTE: — = Not available; data were not collected or not reported. ✓ = no change in assessment from the previous year. **Δ** = change in assessment from the previous year.

SOURCE: Documentation from state assessment websites.

Exhibit A.2. Years of Assessment Data Used, Base Year for Standardization for Chapter 6 Analysis, and Changes for Mathematics Assessments

Districts (Cohort)	Number of Study Magnet Schools	School Year								
		2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
A (2004)	1	✓	✓	✓	✓	✓	✓	✓	✓	—
B (2004 and 2007)	4	✓	✓	✓	✓	✓	✓	✓	✓	—
C (2007)	1	—	—	✓	✓	✓	✓	**Δ**	✓	✓
D (2007)	3	—	—	—	✓	✓	✓	✓	✓	**Δ**
E (2007)	1	—	—	—	—	✓	✓	✓	✓	✓
F (2007)	3	—	—	—	—	✓	✓	✓	✓	✓
G (2007)	2	—	—	—	✓	✓	✓	✓	✓	✓
H (2007)	1	—	—	—	✓	✓	✓	✓	✓	✓
I (2007)	1	—	—	—	✓	✓	✓	✓	✓	**Δ**
J (2007)	2	—	—	—	✓	✓	✓	✓	✓	✓
K (2007)	2	—	—	—	✓	✓	✓	✓	✓	✓

NOTE: — = Not available; data were not collected or not reported, ✓ = no change in assessment from the previous year, **Δ** = change in assessment from the previous year.

SOURCE: Documentation from state assessment websites.

A.3. Grades and Years Analyzed

Exhibit A.3 provides the grades and school-years analyzed for each district, as well as the number of preconversion and postconversion years included in the analysis, and the total number of student observations.

Exhibit A.3. MSAP Grant Year, Grades, and Years Analyzed for Study Districts

District	MSAP Grant Year	Grades Analyzed	Years Analyzed	Number of Years Preconversion	Number of Years Postconversion	Number of Student Observations
A	2004	3–5	2002–03 to 2007–08	2	4*	450,224
B (2004)	2004	2–5	2002–03 to 2007–08	2	4*	44,867
B (2007)	2007	2–5	2002–03 to 2009–10	5	3	48,053
C	2007	2–4	2004–05 to 2010–11	3	4	11,507
D	2007	3–5	2005–06 to 2010–11	2	4	186,195
E	2007	3–5	2006–07 to 2010–11	1	4	164,521
F	2007	4–5	2006–07 to 2010–11	1	4	10,857
G	2007	3–5	2005–06 to 2010–11	2	4	134,549
H	2007	2–5	2005–06 to 2010–11	2	4	51,124
I	2007	3–5	2005–06 to 2010–11	2	4	150,048
J	2007	2–5	2005–06 to 2010–11	2	4	221,027
K	2007	3–5	2005–06 to 2010–11	2	4	42,776
Total†						1,470,881

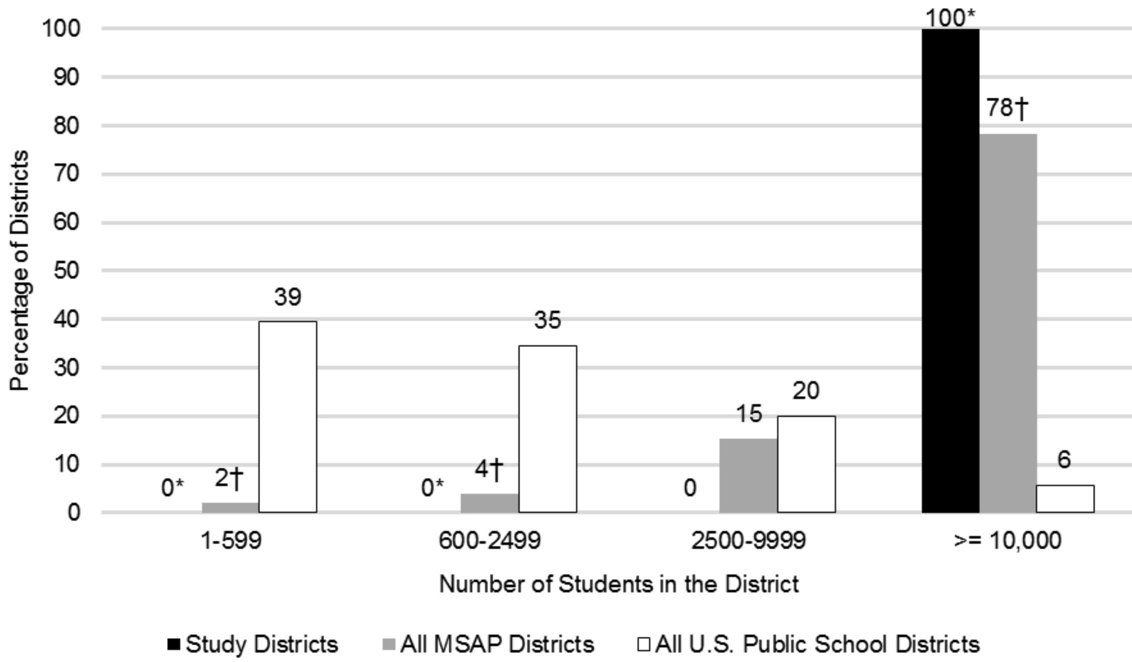
† Total row includes numbers from District B (2007) but not District B (2004); * Study schools from the 2004 MSAP grant year for which data were also available for two additional years: the 2008–09 and 2009–10 school years. These extra years of data were included in statistical models that analyzed achievement to increase precision of parameter estimates for the covariates, but reported results for magnet conversion pertain only to the first four postconversion years.

SOURCE: District administrative data.

A.4. Characteristics of the Study Districts

Chapter 2 reported comparisons of the districts selected for the study to all districts that received MSAP support and all districts in the United States. Exhibits A.4 and A.5 report the results for district size and geographic location, which were discussed in Chapter 2 but not presented in exhibits in the chapter.[57]

Exhibit A.4. Distribution of Districts by Size of Study Districts, All MSAP Districts, and All U.S. Public School Districts



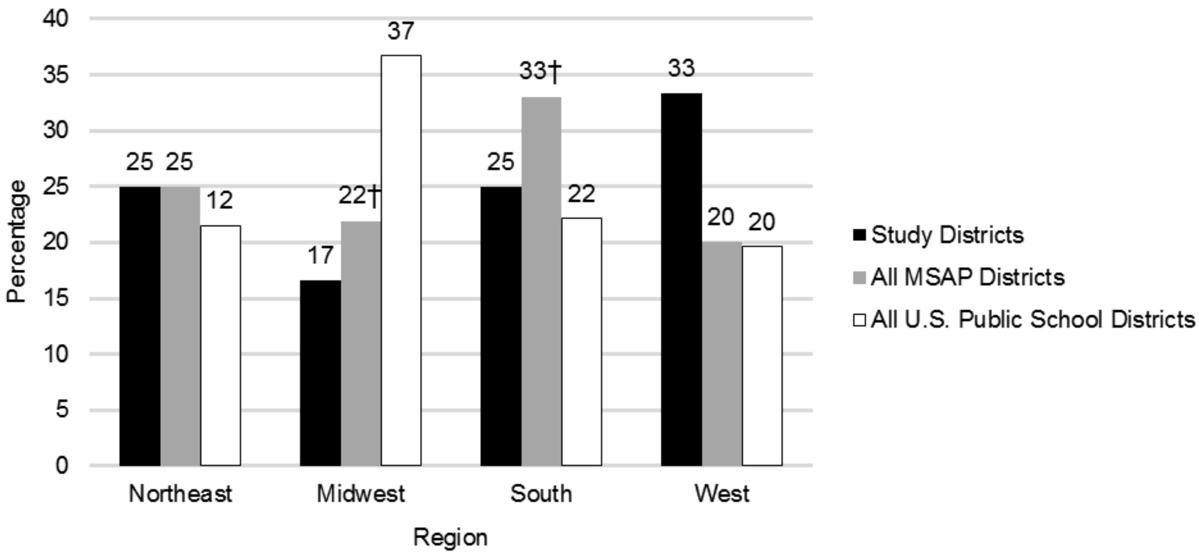
* All study districts significantly different from all U.S. public school districts (*p* < .05); † All MSAP districts significantly different from all U.S. public school districts (*p* < .05).

NOTE: *N* = 12 for sample districts with District B represented twice in the data, once for the 2004 and once for the 2007 MSAP funding cycles. For all MSAP districts and all districts nationally, distributions represent a weighted average of 2003–04 and 2006–07 distributions, where the 2003–04 numbers were weighted 2/12 for the two 2004 funding cycle study districts represented in the exhibit, and the 2006–07 numbers were weighted 10/12 for the ten 2007 funding cycle districts represented in the exhibit.

SOURCE: CCD 2003–04 and 2006–07.

[57] One study district containing magnet schools from both funding cycles is represented twice in background exhibits to display the differing context for the 2004 and 2007 funding cycle magnet schools in this district. Hence, the count of districts here, and in other exhibits when noted, is 12 rather than 11.

Exhibit A.5. Region of Study Districts, All MSAP Districts, and All U.S. Public School Districts



† All MSAP districts significantly different from all U.S. public school districts (*p* < .05).

NOTE: *N* = 12 for sample districts with District B represented twice in the data, once for each of the 2004 and 2007 MSAP funding cycles. For all MSAP districts and all districts nationally, the percentages in the exhibit are a weighted average of the 2003–04 and 2006–07 percentages, where the 2003–04 percentages were weighted 2/12 for the two 2004 funding cycle study districts represented in the exhibit, and the 2006–07 percentages were weighted 10/12 for the ten 2007 funding cycle districts represented in the exhibit.

SOURCE: Common Core of Data 2003–04 and 2006–07.

A.5. Classification of Study Schools as Traditional or Destination Magnet Schools

As described in Chapter 2, study magnet schools were classified as traditional or destination based on the following criteria.

- A school was classified as a ***traditional magnet school*** if, prior to conversion, its average achievement in ELA and in mathematics were both *below* the district average, and the proportion of students in the school from minority backgrounds and the proportion from disadvantaged backgrounds were both *above* the proportion for the district as a whole. Fourteen schools met all four of these criteria. Three additional schools that met three of the four criteria were also classified as traditional.[58]
- A school was classified as a ***traditional magnet school*** if, prior to conversion, its average achievement in ELA and in mathematics were both *below* the district average, and the proportion of students in the school from minority backgrounds and the proportion from disadvantaged backgrounds were both *above* the proportion for the district as a whole.

[58] The percentage of students from economically disadvantaged backgrounds was not available for six schools. On the basis of their other characteristics, all six were classified as traditional magnet schools.

Fourteen schools met all four of these criteria. Three additional schools that met three of the four criteria were also classified as traditional.

Exhibit A.6 provides the magnitude of the difference between the magnet school and the district. These differences in averages were calculated across all preconversion years and used as the basis of the classification of schools. Exhibit A.6 also indicates whether each school was above the district average in ELA and mathematics achievement ("yes" if above, "no" if below); and whether it was below the district in the proportion of students from minority racial/ethnic and disadvantaged backgrounds ("yes" if below, "no" if above).

Exhibit A.6. Classification of Study Schools as Traditional or Destination Magnet Schools

District	MSAP Grant Year	School ID Number	Difference From District Average Achievement (School – District) & Whether Above the District Average (Yes/No)		Difference From District Proportion (School – District) & Whether Below the District Proportion (Yes/No)		Magnet Type
			ELA	Mathematics	Minority	Disadvantaged	
A	2004	001	-0.233 No	0.164 Yes	7.2% No	18.4% No	Traditional
B	2004	001	0.026 Yes	0.124 Yes	-1.2% Yes	0.5% No	Destination
B	2004	002	-0.467 No	-0.474 No	1.7% No	15.3% No	Traditional
B	2007	003	-0.107 No	-0.109 No	-1.1% Yes	15.8% No	Traditional
B	2007	004	0.455 Yes	0.479 Yes	1.8% No	-32.9% Yes	Destination
C	2007	001	-0.435 No	-0.586 No	26.1% No	14.8% No	Traditional
D	2007	001	-0.725 No	-0.564 No	36.2% No	42.3% No	Traditional
D	2007	002	-0.610 No	-0.583 No	29.3% No	25.1% No	Traditional
D	2007	003	-0.752 No	-0.572 No	39.3% No	43.9% No	Traditional
E	2007	001	0.104 Yes	0.202 Yes	5.3% No	-17.9% Yes	Destination
F	2007	001	0.102 Yes	-0.113 No	-7.6% Yes	-2.3% Yes	Destination
F	2007	002	-0.551 No	-0.803 No	27.3% No	31.3% No	Traditional
F	2007	003	-0.226 No	-0.127 No	23.1% No	11.8% No	Traditional

District	MSAP Grant Year	School ID Number	Difference From District Average Achievement (School – District) & Whether Above the District Average (Yes/No)		Difference From District Proportion (School – District) & Whether Below the District Proportion (Yes/No)		Magnet Type
G	2007	001	-0.468 No	-0.288 No	17.8% No	N/A	Traditional
G	2007	002	-0.437 No	-0.238 No	43.1% No	N/A	Traditional
H	2007	001	-0.696 No	-0.562 No	22.0% No	27.0% No	Traditional
I	2007	001	-0.345 No	-0.725 No	43.7% No	32.8% No	Traditional
J	2007	001	-0.265 No	-0.261 No	-9.7% Yes	N/A	Traditional
J	2007	002	-0.213 No	-0.161 No	5.8% No	N/A	Traditional
K	2007	001	-0.084 No	-0.032 No	19.8% No	N/A	Traditional
K	2007	002	-0.294 No	-0.355 No	15.3% No	N/A	Traditional

NOTE: N/A indicates that the category is not applicable. Three districts, Districts G, J, and K, did not have data to identify economically disadvantaged students. To be classified as a destination magnet school, a school needed at least one “Yes” in “Difference From District Average Achievement” (i.e., above the district in ELA or mathematics or both) and at least one yes in “Difference From District Proportion” (i.e., below the district proportion in minority or disadvantaged or both).

SOURCE: District administrative data.

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Appendix B: Use and Coding of Administrative Data

The analyses reported in Chapters 5 and 6 and Exhibits 3.4 and 3.5 were based on administrative data collected from participating study districts. The information requested and received from each study district was student-level data for multiple years before and after magnet conversion (typically two years before and four years after conversion; see Exhibit A.3 for details on years collected and analyzed) and included the following types of variables:

- **Student Achievement.** Standardized test scores in ELA and mathematics from the state's annually administered standardized achievement tests
- **Student Characteristics.** Grade, age, race or ethnicity, gender, free or reduced-price lunch eligibility (except from Districts G, J, and K[59]), special education status, and English language learner (ELL) status
- Student's school of enrollment
- Student's catchment school (i.e., assigned neighborhood school)

The four sections in this appendix discuss the use and coding of these administrative data. First, the structure of the data elements provided by the districts is presented. This section focuses on enrollment and catchment school data. Second, the definition and coding of student residency status are discussed. Residency status determinations were based on district-provided enrollment and catchment school data. Third, the definition and coding of school dosage and test-to-test years are presented. The final section reports sample sizes for achievement analyses.

B.1. Structure of Administrative Data

Data on the four types of variables listed previously were obtained at least once per year, with some data provided at multiple time points.

- **Achievement.** Achievement data were recorded once per year, at the time of annual achievement testing.
- **Student Characteristics.** Student characteristics were recorded by districts once per year.
- **Student's School of Enrollment.** Each student's school of enrollment (the school in which the student was enrolled) was recorded at least once per year. In district-provided data, a student's school of enrollment was typically indicated by the school's building ID code. Enrollment data files came in two basic forms: transactional and snapshot. As shown in the third column of Exhibit B.1, five districts provided transactional data, and six districts provided snapshot data.

[59] District J did not provide free or reduced-price lunch eligibility information for its students. Districts G and K provided free or reduced-price lunch eligibility information that was judged to be unreliable. Specifically, at least one study magnet school in these districts had a large change (greater than 30 percentage points) in free or reduced-price lunch eligibility across time. For these schools, the district-provided percentages for free or reduced-price lunch eligibility were compared with the statistics for the same school years reported in the Common Core of Data; these large changes were not reflected there.

- **Transactional Data.** Transactional data are structured as one observation per student, per year, per "event," with starting and ending dates. An event is generally a change in the school of enrollment, and the period between the starting and ending dates is an enrollment "spell." If a student was enrolled in only one school in a given year, he or she would have one observation for that year. If a student was enrolled in more than one school in a given year, the student would have one observation for each school in which he or she was enrolled during that year, and each observation would contain the start and end dates for the enrollment spell in that school.[60]
- **Snapshot Data.** In contrast, snapshot data are structured as one enrollment status record for each student in a district on a particular date. Snapshot data are an extract of enrollment data on all students in a district, typically taken on a few dates each school year. Multiple snapshots for each school year were collected from six districts that used this type of enrollment data: Five districts provided two snapshots per year, and one district provided three snapshots per year. Thus, for districts that provided two snapshots per year, the study typically had two observations for each student, for each year the student was enrolled in the district.[61] Students who changed schools in the period between snapshots would have different schools of enrollment in their two snapshot records. Unlike transactional data, snapshot data do not provide the exact dates that a student changed schools; the analysis imputed these dates based on the timing of the snapshots. The method of imputation was to divide the time between snapshots in half and assign half of the time to each of a student's observed enrollment spell.

▪ **Student's Catchment School.** A student's catchment school is the student's assigned neighborhood public school—the school to which the student was assigned based on residence. In district-provided data, a student's catchment school was typically indicated by the building ID code of his or her neighborhood school. The missing data rate for the catchment variable varied by district. Further, the catchment information did not always match the type (transactional versus snapshot) or frequency per year of the enrollment data. The difference in type and frequency occurred because catchment school information was typically derived from a different data source in the district data system than the enrollment school data. Catchment school information was always provided at least once a year. Exhibit B.1 lists the study districts, the category of enrollment school data they provided, and the frequency of catchment school information relative to the enrollment data.

- In 3 of the 11 districts, enrollment information and the catchment data were provided with equal frequency. In the "Frequency of Catchment School Data per Year" column, this is designated with "Simultaneous"—in other words, every enrollment entry had corresponding catchment school information.
- In 8 of the 11 districts, the catchment school information was provided once per year.

[60] Some events not related to changing schools—for instance, a suspension or leaving the district for some period of time—can be represented by additional transactions within a school year. Such extraneous transactions were removed during the creation of the final analysis data file.

[61] This statement is true provided the student did not leave or enter the district in between snapshots, in which case there would be just one observation (i.e., present in only one snapshot) for that student.

Exhibit B.1. Enrollment Data Type and Frequency of Catchment Data, by District

District	Cohort	Enrollment Data Type	Frequency of Catchment School Data per Year
A	2004	Snapshot	Once
B	2004 and 2007	Transactional	Once
C	2007	Transactional	Simultaneous
D	2007	Snapshot	Simultaneous
E	2007	Transactional	Once
F	2007	Transactional	Simultaneous
G	2007	Snapshot	Once
H	2007	Snapshot	Once
I	2007	Snapshot	Once
J	2007	Transactional	Once
K	2007	Snapshot	Once

NOTE: Data for Districts G and K came from the same administrative body even though they are separate districts.

SOURCE: District administrative data.

When catchment data were provided less often than enrollment data, the time of year the catchment school was recorded was taken into account when matching catchment data with enrollment data to establish student residency. For example, if the catchment information was recorded at the start of the school year, it would be merged to the first snapshot of the school year. When students changed schools within a school year, the catchment school was treated as missing in periods for which the enrollment and catchment data could not be matched in this way. Thus, if in the second snapshot the student had a new enrollment school, the catchment school indicator was set to missing.

B.2. Residency Status Definition and Imputation

A student's residency status was defined as an indicator of whether or not the student attended the assigned catchment school. If the student attended the assigned school, he or she was considered a neighborhood student. If not, the student was considered a student from outside the neighborhood. In analyses, a student's residency status was classified as one of three values: neighborhood student, student from outside the neighborhood, or unknown. Unknown represents cases in which residency status could not be determined because of missing data.

Districts did not provide residency status directly. Instead, it was derived from a student's enrollment school ID and catchment school ID, which was defined previously.

Residency status was then determined as follows:

- If a student's enrollment school ID was the same as his or her catchment school ID, the student was classified as a neighborhood student.
- If a student's enrollment school ID was not the same as his or her catchment school ID, the student was classified as a student from outside the neighborhood.

- If a student's catchment school ID was missing, he or she was classified as having an unknown residency status.

B.2.1. Extent of Missing Catchment School Data

Exhibit B.2 reports the percentage of observations with missing catchment data by district and by year. Districts A, C, and D had catchment school information for all students. Districts G and K were each missing catchment data for all students in the 2005–06 school year.

Exhibit B.2. Percentage of Student Observations With Missing Catchment Data, by District and by Year

District	Cohort	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
A	2004	0	0	0	0	0	0	0	0	—
B	2004 and 2007	0.1	0.1	0.2	#	0.1	0.0	0.0	#	—
C	2007	—	—	0	0	0	0	0	0	0
D	2007	—	—	—	0	0	0	0	0	0
E	2007	—	—	—	—	9.5	9.5	8.4	7.8	6.8
F	2007	—	—	—	—	10.3	10.2	8.5	7.9	10.3
G	2007	—	—	—	100.0	2.5	2.4	5.3	5.8	3.7
H	2007	—	—	—	0	0	0	0	0	0
I	2007	—	—	—	0.3	0.2	0.2	0.3	0.0	1.1
J	2007	—	—	—	10.1	9.0	9.0	9.2	7.6	6.6
K	2007	—	—	—	100.0	6.6	6.6	5.3	8.3	5.9

NOTE: Data for Districts G and K came from the same administrative body even though they are separate districts. # = Rounds to zero. — = Not available; data were not collected or not reported.

SOURCE: District administrative data.

B.2.2. Imputation of Catchment School

Given the rate of missing catchment data (see Exhibit B.2), the analysis imputed catchment school, and, hence, residency status, for some students using their own data in other years. In addition, to determine residency status for each time point for which school of enrollment data were available, the analysis imputed catchment data within school years wherever a district had provided enrollment data more frequently than catchment data. Because school of enrollment did not change for most students within the school year, only a small proportion of students required within-school-year imputations. The methods used for imputing catchment school across time periods are described in this section. The methods were used for both within- and between-year imputation.

When information about a student's catchment school was missing, available catchment school information for a given student was used to impute the student's catchment school, using three specific conditions (scenarios) that are described in the following subsections. Information from one student was never used to impute the catchment school for another student. The primary condition for imputing a student's catchment school in period (school year) T is that the student's enrollment school must be the same in period T as in at least one of the adjacent periods $T-1$ or $T+1$.[62] The underlying logic is that if a family has not switched a child from one school to another, then it is unlikely that they moved out of the neighborhood, causing the child's catchment school to change.[63]

Scenario 1. Imputation in Time *T* With Information From Both Time *T* − 1 and Time *T* + 1
This scenario occurred when a student was continuously enrolled at the same school across three periods, and non-missing catchment school information was available from observations in two bracketing time periods—$T-1$ and $T+1$—to impute information at time T. Exhibit B.3 provides the relevant data for two students: students 1 and 2. As shown for student 1, if the enrollment school at time T equaled the enrollment school at time $T-1$ and the enrollment school at time $T+1$, and the catchment school at time $T-1$ equaled the catchment school at time $T+1$, then the missing catchment school at time T was set equal to the catchment school of $T-1$ and T + 1. However, as shown for student 2, if the catchment school at time $T-1$ was not equal to the catchment school at time T + 1, then no imputation was made.

[62] T is used generically to number a series of enrollment spells: $T = 1$ might or might not be within the same school year as $T = 0$. Hence, the examples here apply to imputing within a school year as well as across school years.

[63] It is possible that a student could have changed residency status without changing the school of enrollment. However, such a switch does not reflect the typical magnet school transition in which students join a school from outside its catchment area.

Exhibit B.3. Example of Imputing at Time *T* With Information From Both Time *T* − 1 and Time *T* + 1

Time	Student 1			Student 2		
	T − 1	T	*T* + 1	*T* − 1	T	*T* + 1
Enrollment school	A	A	A	A	A	A
Catchment school	X	Missing	X	X	Missing	Y
Catchment school with imputation	X	X	X	X	Missing	Y

NOTE: A is an enrollment school ID; X and Y are catchment school IDs that may or may not be equal to A.

Scenario 2. Imputation in Time *T* With Information From Either Time *T* − 1 or Time *T* + 1
When continuous enrollment or bracketing catchment information was unavailable, information from either the period before (*T* − 1) or the period after (*T* + 1) was used to impute.[64] Exhibit B.4 illustrates the method, using two students. As illustrated by student 1, if a student's enrollment school at time *T* equaled his or her enrollment school at time *T* − 1, and that student's catchment school at time *T* was missing, then the catchment school at time *T* was set to be equal to the student's catchment school at time *T* − 1. As illustrated by student 2, if the enrollment school changes, no imputation was made.

Exhibit B.4. Example of Imputing at Time *T* With Information From Time *T* − 1

Time	Student 1		Student 2	
	T − 1	T	*T* − 1	T
Enrollment school	A	A	A	B
Catchment school	X	Missing	X	Missing
Catchment school with imputation	X	X	X	Missing

NOTE: A and B are enrollment school IDs; X is a catchment school ID that may or may not be equal to A or B.

The rationale was the same for imputing time *T* with information in time *T* + 1, as illustrated in Exhibit B.5.

Exhibit B.5. Example of Imputing at Time *T* With Information From Time *T* + 1

Time	Student 1		Student 2	
	T	*T* + 1	T	*T* + 1
Enrollment school	A	A	A	B
Catchment school	Missing	X	Missing	X
Catchment school with imputation	X	X	Missing	X

NOTE: A and B are enrollment school IDs; X is a catchment school ID that may or may not be equal to A or B.

[64] These situations occur when (1) the student did not have continuous enrollment at the same school for three periods; (2) catchment school information was missing for one of the bracketing periods, *T* − 1 or *T* + 1; or (3) the period to be imputed was either the first or last time the student was observed, and hence, data for the student were missing for period *T* − 1 or *T* + 1, respectively.

Scenario 3. Imputation in Time *T* With Information From Either Time *T* − 2 or Time *T* + 2. Catchment school information was also imputed across more than one period when certain conditions were met. As in scenarios 1 and 2, this approach is predicated on a student's having had continuous enrollment at the same school. This situation is illustrated in Exhibit B.6 for imputing a value in period *T* with information from time *T* + 2; however, the rationale is the same for imputing with information from period *T* − 2 (not illustrated). If a student's enrollment school at time *T* equaled his or her enrollment school at time *T* + 1 and his or her enrollment school at time *T* + 2 and the catchment school was missing in time *T* and time *T* + 1, both were set to equal the catchment school in time *T* + 2.

Exhibit B.6. Example of Imputing at Time *T* and at Time *T* + 1 With Information From Time *T* + 2

Time	Student 1		
	T	*T* + 1	*T* + 2
Enrollment school	A	A	A
Catchment school	Missing	Missing	X
Catchment school with imputation	X	X	X

NOTE: A is an enrollment school ID; X is a catchment school ID that may or may not be equal to A.

B.2.3. Summary of Extent of Imputation and Time Periods Used for Imputation

In Districts A, C, D, and H, there was no need to impute residency status (see Exhibit B.2). For the remaining seven districts where imputation was used, Exhibits B.7 through B.13 summarize the extent to which values were imputed and which time periods were used in the imputation. These exhibits display the missing rates before imputation, the percentage imputed under each scenario described previously, and the missing rate after imputation for each district included in the study.

Exhibit B.7. Missing Catchment Data and Imputation for District B

District B	Imputation Type Used	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Missing prior to imputation (%)	None	0.1	0.1	0.2	#	0.1	0.0	0.0	#	—
Imputed (%)	From *T* − 1 *and T* + 1	0.0	0.0	0.0	#	0.0	0.0	0.0	0.0	—
	From *T* − 1 *or T* + 1	#	0.1	0.1	0.0	#	0.0	0.0	#	—
	From *T* − 2 or *T* + 2	#	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—
Missing after imputation (%)	All	#	#	0.1	#	#	0.0	0.0	0.0	—

NOTE: # = Rounds to zero. — = Not available; data were not collected or not reported.

SOURCE: District administrative data.

Exhibit B.8. Missing Catchment Data and Imputation for District E

District E	Imputation Type Used	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Missing prior to imputation (%)	None	—	—	—	—	9.5	9.5	8.4	7.8	6.8
Imputed (%)	From *T* − 1 and *T* + 1	—	—	—	—	#	0.4	0.1	#	0.0
	From *T* − 1 or *T* + 1	—	—	—	—	5.9	5.3	5.1	4.7	4.3
	From *T* − 2 or *T* + 2	—	—	—	—	0.5	0.6	0.4	0.3	0.2
Missing after imputation (%)	All	—	—	—	—	3.1	3.2	2.8	2.8	2.3

NOTE: # = Rounds to zero. — = Not available; data were not collected or not reported.

SOURCE: District administrative data.

Exhibit B.9. Missing Catchment Data and Imputation for District F

District F	Imputation Type Used	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Missing prior to imputation (%)	None	—	—	—	—	10.3	10.2	8.5	7.9	10.3
Imputed (%)	From $T - 1$ and $T + 1$	—	—	—	—	0.0	0.0	0.0	0.0	0.0
	From $T - 1$ or $T + 1$	—	—	—	—	0.0	0.0	3.5	2.5	4.6
	From $T - 2$ or $T + 2$	—	—	—	—	0.0	0.0	0.0	0.8	0.4
Missing after imputation (%)	All	—	—	—	—	10.3	10.2	5.0	4.6	5.3

NOTE: # = Rounds to zero. — = Not available; data were not collected or not reported.

SOURCE: District administrative data.

Exhibit B.10. Missing Catchment Data and Imputation for District G

District G	Imputation Type Used	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Missing prior to imputation (%)	None	—	—	—	100.0	2.5	2.4	5.3	5.8	3.7
Imputed (%)	From $T - 1$ and $T + 1$	—	—	—	0.0	0.0	0.1	#	0.0	0.0
	From $T - 1$ or $T + 1$	—	—	—	44.6	0.3	1.0	3.5	4.6	0.2
	From $T - 2$ or $T + 2$	—	—	—	#	#	0.0	0.1	0.1	2.5
Missing after imputation (%)	All	—	—	—	55.4	2.2	1.3	1.7	1.1	1.1

NOTE: # = Rounds to zero. — = Not available; data were not collected or not reported.

SOURCE: District administrative data.

Exhibit B.11. Missing Catchment Data and Imputation for District I

District I	Imputation Type Used	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Missing prior to imputation (%)	None	—	—	—	0.3	0.2	0.2	0.3	0.0	1.1
Imputed (%)	From $T-1$ and $T+1$	—	—	—	#	0.0	#	#	0.0	0.0
	From $T-1$ or $T+1$	—	—	—	#	#	#	0.1	0.0	1.0
	From $T-2$ or $T+2$	—	—	—	0.0	#	#	#	0.0	0.0
Missing after imputation (%)	All	—	—	—	0.2	0.2	0.1	0.1	0.0	0.2

NOTE: # = Rounds to zero. — = Not available; data were not collected or not reported.

SOURCE: District administrative data.

Exhibit B.12. Missing Catchment Data and Imputation for District J

District J	Imputation Type Used	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Missing prior to imputation (%)	None	—	—	—	10.1	9.0	9.0	9.2	7.6	6.6
Imputed (%)	From $T-1$ and $T+1$	—	—	—	#	0.1	0.1	0.1	0.1	0.0
	From $T-1$ or $T+1$	—	—	—	4.8	4.3	4.4	4.4	3.4	1.3
	From $T-2$ or $T+2$	—	—	—	#	#	#	#	#	#
Missing after imputation (%)	All	—	—	—	5.2	4.6	4.6	4.6	4.1	5.2

NOTE: # = Rounds to zero. — = Not available; data were not collected or not reported.

SOURCE: District administrative data.

Exhibit B.13. Missing Catchment Data and Imputation for District K

District K	Imputation Type Used	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Missing prior to imputation (%)	None	—	—	—	100.0	6.6	6.6	5.3	8.3	5.9
Imputed (%)	From *T* − 1 and *T* + 1	—	—	—	0.0	0.0	0.1	0.1	0.0	0.0
	From *T* − 1 or *T* + 1	—	—	—	42.0	0.5	3.1	3.6	6.8	0.2
	From *T* − 2 or *T* + 2	—	—	—	0.0	0.0	0.0	0.1	0.1	4.0
Missing after imputation (%)	All	—	—	—	58.0	6.0	3.4	1.6	1.4	1.6

NOTE: # = Rounds to zero. — = Not available; data were not collected or not reported.

SOURCE: District administrative data.

B.3. School Enrollment Dosages and Test-to-Test Years Used in Achievement Analysis That Predicted Achievement for Students in Magnet Conversion Schools Based on Neighborhood Schools in Their Districts That Did Not Convert

The achievement analysis that predicted what the student achievement would have been in magnet conversion schools had those schools not been converted used student enrollment information provided at multiple time points each year when it was available. As noted in Chapter 2, each student's dosage (time spent) at each school was calculated in "test-to-test years"—the time between administrations of the state tests. The concepts of enrollment dosage and test-to-test years are discussed further in this section.

B.3.1. Enrollment Dosages

An enrollment dosage is the proportion of a school year that a student was enrolled at a given school. The length of time a student was enrolled in a given school was expressed as a proportion of the school year—a continuous measure between 0 and 1.

B.3.2. Test-to-Test Years

For the achievement analysis, years were measured as the time between each annual test administration date and the next (i.e., between the time points when achievement outcomes were measured) rather than based on the start and end of the school year.

The unit of observation for the achievement analysis was a given student in a given year. Using dosages and test-to-test years allowed the analysis to associate student gains proportionately with each school a student attended in the period during which the achievement gain outcome was measured. If, for example, a student enrolled in school A took the state tests in April, attendance at school A in May and June cannot have had a causal impact on the test score gain observed in April. Further, if a student attended two schools during the year prior to the time of testing, it would not be valid to attribute the entire gain to only one of those schools. Using dosages and test-to-test years allowed the analysis to associate the observed test score gain proportionally with the schools each student attended in the period between tests.

The construction of dosages and test-to-test years is described further in the following sections. Both dosages and test-to-test years required the following pieces of information:

- Date of the first and last day of the school year
- Date of transfer (if any) between schools
- Date of annual assessment

B.3.3. Partitioning a School Year

The enrollment dosage for a given student in a given school is the proportion of the school year that the student spent at the given school.

Step 1. Partition School Year. To create dosages, the school year was first divided into parts defined by the following time points: the start of the school year, the date of transfer to a different school, the date of the annual assessment, and the end of the school year. At a minimum, a full school year was broken into two spells:

- From the start of the school year to the annual assessment date
- From the annual assessment date to the end of the school year

If a student switched schools between the first day of school and the assessment, the school year was broken into three spells:

- From the start of the school year to the transfer date
- From the transfer date to the annual assessment
- From the annual assessment to the end of the school year

For districts with transactional enrollment data, the start, transfer, and end dates could be determined precisely. For districts with snapshot enrollment data, the exact dates of any transfers between schools were unknown. Thus, the following assumptions were implemented:

- A student started the school year at the same school at which he or she was enrolled in the first snapshot of the school year.
- A student ended the school year at the same school at which he or she was enrolled in the last snapshot of the school year.
- If a student changed schools between snapshots, the student transferred halfway between the dates at which the snapshots were taken.

For districts with transactional enrollment data as well as districts with snapshot enrollment data, if the assessment date was not provided, it was assumed to be at the midpoint of the state assessment testing window.

Step 2. Calculate Proportions for Each Partition. The proportion of the school year represented by each part of the school year defined in Step 1 was calculated. The denominator for the proportion was the number of days in the school year (i.e., between the first and last day of the school year); the numerator was the number of days in the part (e.g., number of days between the start of the school year and the first transfer to another school).

Step 3. Associate Each Partition With a School of Enrollment and a Residency Status. Because transfer to a different school and change in residency status were used as time points to divide a school year into parts, each student had only one school of enrollment and one residency status (neighborhood student, student from outside the neighborhood, or unknown) for each part of the school year as defined previously. A single school of enrollment and a single residency status was thus associated with each part of the year for each student. Each student had multiple records for each school year, one for each part, and each record or part had an associated school of enrollment and residency status.

B.3.4. Shifting Time Frame From School Years to Test-to-Test Years

The analysis required one record per student per year. The procedure to calculate dosages for each part of the year described previously resulted in multiple records per student per school year. These multiple observations per student per year were collapsed into one record per student per test-to-test year (i.e., from the previous year's annual assessment to the current year's assessment) rather than one record per student per school year (i.e., first day of school to last day of school). Both the collapsing and the definition of a test-to-test year are further described next.

To understand the creation of a test-to-test year, consider as an example a student who never transferred schools during two school years: 2003–04 and 2004–05. Under the partitioning described previously, two partitions for each school year would be created, or four parts total:

- Part A = start of 2003–04 school year to assessment in 2003–04 school year
- Part B = assessment in 2003–04 school year to the end of the 2003–04 school year
- Part C = start of 2004–05 school year to assessment in 2004–05 school year
- Part D = assessment in 2004–05 school year to the end of the 2004–05 school year

Hence, parts A and B together constituted the 2003–04 school year, and parts C and D constituted the 2004–05 school year. To shift to test-to-test years, the parts between assessments were associated with each other. Together, these parts between tests formed a test-to-test year. In this example, parts B and C together would have formed the 2004–05 test-to-test year.

B.3.5. Assembly of Test-to-Test Year "Dosages"

To obtain one record per student per year, parts that made up the test-to-test years were combined. The parts were collapsed by creating one variable for each school and each residency status. For example, if a district had 40 schools, 120 variables (40 schools times three potential residency statuses = 120 school-residency variables) were created. Each school-residency variable (i.e., dosage) contained the proportion of the test-to-test year that a student spent at a given school with a given residency status. For a student who did not switch schools or change residency status during a test-to-test year, all the variables except one would be zero, and the value of the remaining variable would be 1. However, if a student switched schools or residency status in the middle of the test-to-test year, more than one school-residency variable would be more than zero.

B.4. Sample Sizes for Achievement Analysis

As described in Appendix F.1.1, the outcomes for the descriptive analysis of change in achievement were ELA and mathematics *z*-scores standardized relative to the first year of data in the analysis data set, whereas the outcomes for the comparative interrupted time series (CITS) analysis on relative change in achievement used the annual *z*-score gain, based on *z*-scores standardized within each year. (See Appendix F.4.2 for further discussion of standardization of achievement scores for analysis.) Student records that did not have achievement outcomes were excluded from the analysis. Exhibit B.14 provides the overall sample size by district in the first column (which matches the number of student observations for the study sample reported in

Exhibit 3.6 in Chapter 3[65]), sample sizes for the achievement *z*-score analysis, and sample sizes for the student *z*-score gain analysis for each subject. Recall that for construction of the *z*-score gain, data were necessarily not included in the analysis sample for one year and one grade because these were the base scores for calculating gains.

Exhibit B.14. Number of Student Observations, Observations With *z*-Scores, Observations With *z*-Score Gain for ELA and Mathematics

District	MSAP Funding Cycle	Study Sample				
		Number of Student Observations	Number of Observations With *z*-Score		Number of Observations With *z*-Score Gain	
			ELA	Mathematics	ELA	Mathematics
A	2004	450,224	305,404	305,553	260,035	260,215
B (2004)	2004	44,867	28,968	29,030	23,126	23,199
B (2007)	2007	48,053	31,160	31,235	25,076	25,163
C	2007	11,507	7,126	7,151	5,525	5,525
D	2007	186,195	123,101	123,261	102,723	102,937
E	2007	164,521	111,817	112,222	91,669	92,076
F	2007	10,857	9,637	9,637	8,822	8,822
G	2007	134,549	99,219	102,100	85,049	89,649
H	2007	51,124	41,002	40,998	32,616	32,594
I	2007	150,048	64,126	64,113	51,947	51,900
J	2007	221,027	130,314	130,164	104,098	103,884
K	2007	42,776	28,701	29,332	24,289	25,195
Total[a]		1,470,881	951,607	955,766	791,849	797,960

[a] Total row includes numbers from B (2007) but not B (2004).

SOURCE: District administrative data.

For example, in District A, the lowest grade for which achievement data were available was grade 2. Thus, the lowest grade for which a gain in achievement could be calculated was grade 3 because computing the gain involved subtracting grade 2 achievement from grade 3 achievement. The first year of achievement data available for District A was the 2001–02 school year. Thus, the first year for which a gain in achievement could be calculated for District A was the 2002–03 school year because computing the gain required subtracting grade 2 achievement in 2001–02 from grade 3 achievement in 2002–03.

[65] In this table as in Exhibit 3.6, a given student may have been counted multiple times, once for each year he or she appeared in our analysis data.

Appendix C: Director Interviews

To obtain the data on district improvement policies and other characteristics of study magnet schools reported in Chapters 4 and 5, semistructured telephone interviews were conducted with officials in 10 of the 11 MSAP grant districts between July 2011 and December 2011.[66] An official in the 11th district returned written responses to the interview questions in February 2012. At the time of the interviews, the MSAP grants awarded in 2007 had recently ended, and the districts were writing their final reports.[67] Participants were provided with the interview questions several days in advance of the conversation. The interviews took one to two hours to complete.

The retrospective, self-reported data requested during the interviews were intended to serve several purposes:

- To ensure that the classification of schools included in the study's achievement analysis as conversion magnet schools and other neighborhood public schools during the entire grant period was accurate
- To determine the extent to which the study schools had implemented magnet programs resembling those described in their grant applications
- To provide information about the district policy context in which the programs had been implemented—in particular, the existence of other school reform initiatives that might have enhanced or reduced the contrast between the study schools and nonmagnet schools
- To provide information about the choice context in which the programs had been implemented—in particular, district officials' perception of the extent to which the study schools' ability to attract and retain students had been influenced by competition from other local schools with special offerings or stronger records of student achievement

When possible, the interview was conducted with the director of the local MSAP project. When the individual who had directed the project during most of the grant period was no longer available, other district staff members who were knowledgeable about the MSAP project, the district school choice program, or district school improvement initiatives were consulted. Exhibit C.1 summarizes the interview participants.

[66] One district received MSAP grants in both 2004 and 2007. Both grants were managed by the same project director; the interview for this district encompassed the study schools from both grant cohorts and local conditions during both grant periods.

[67] The two grants awarded in 2004 had been finished for four years in 2011, but the project directors in these two districts were still available for interviews. Many of the topics addressed in the 2011 interview also had been discussed as part of the 2007 screening interviews, as described in Chapter 2 for sample selection, in which these same individuals had participated. The 2007 screening interviews coincided with the end of the 2004 grants.

Exhibit C.1. Individuals Participating in the Project Director Interviews

District Staff Responding to the Project Director Interview	Number of Districts
MSAP project director	6
School choice program director or manager	2
Other[a]	3
Total	11

[a] Other staff included a magnet program facilitator recently promoted to the district magnet program directorship, a student placement director, and staff responsible for special projects and secondary school reform.

Appendix D: Principal Survey

To obtain the data on study magnet school implementation reported in Chapter 5, a survey was administered to the principals of the conversion magnet schools in the study at (or after) the end of their MSAP grants. Principals were given the choice of responding to paper or electronic versions of the survey. To ensure confidentiality, principals were asked to return their responses directly to AIR using either FedEx or e-mail. Respondents were offered $25 gift certificates to acknowledge the time and effort required to complete the survey.

The purpose of the survey was to obtain background information about the following:

- The principals and the resources, staffing, and implementation history of the magnet school programs during the MSAP grant period
- The district policy context in which the programs were implemented during that period

Surveys were sent to the principals of three schools that were funded through 2004 MSAP grants during summer and fall 2007, shortly after their grants ended. Two principals completed the survey. The third principal had left the district at the time the survey was administered, and (according to the district official who collaborated with us on administering the survey) no one else at the school had the knowledge necessary to complete it.

Before the survey was administered to the principals of schools funded through the 2007 MSAP cohort, a few questions were added to collect information about issues that had become more salient during the years following the first survey administration. Consequently, information on some topics is available only for the 19 principals whose schools were in the 2007 MSAP cohort.

The survey of 19 principals whose schools were funded through 2007 MSAP grants began in fall 2010, at the beginning of the fourth year of the 2007 MSAP grant period. Nonrespondents were contacted by e-mail and telephone until all the principals had returned completed surveys. (The last surveys were returned in June 2012.)[68]

Exhibit D.1 summarizes the number of surveys administered and returned by the 22 conversion magnet school principals. As noted previously, two of the study schools that had been co-located were treated as one school for the analyses presented in this report. However, for reporting responses from principal surveys, they are treated separately as the two principals responded separately.

Exhibit D.1. Principal Surveys Distributed and Completed

MSAP Grant Year	Principals Surveyed (N)	Responses (N)	Response Rate
2004	3	2	67%
2007	19	19	100%
Overall	22	21	95%

[68] One district did not allow surveys to be distributed until June 2012.

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Appendix E: Additional Data Sources

To obtain contextual background and magnet program implementation information about study districts and schools (presented in Chapters 3 and 4), data on the district and study schools were collected from interviews with the MSAP directors (see Appendix C for details on the interviews), a survey of study magnet school principals (see Appendix D for details on the survey), and three sources of extant data: the Common Core of Data (CCD), ED*Facts* data, and MSAP applications (see Exhibit E.1). The CCD is a centralized data set maintained by the National Center for Education Statistics that contains institutional information (e.g., location, type, student body demographics) on schools and districts collected from state education agencies. The CCD does not, however, contain academic performance data. ED*Facts* is similarly a centralized repository of information on schools and districts from state education agencies. In contrast to the CCD, ED*Facts* collects academic performance and accountability data. Specifically, it contains school-level information on adequate yearly progress (AYP) and "in need of improvement" status.[69] MSAP applications were reviewed to identify the type of specialized curricula and instructional methods implemented in study magnet schools.

Exhibit E.1. Data Sources and Collection Details

Source	Purpose	Information Collected and Timeline for Collection
CCD	Context and primary analysis	▪ **Content.** District- and school-level information for background comparisons ▪ Student demographic characteristics (race or ethnicity, free or reduced-price lunch eligibility) ▪ Identification of magnet and charter schools in study districts for primary analysis ▪ **Sample.** All U.S. elementary schools and districts, 2001–02 to 2009–10 school years for 2004 cohort schools, and 2004–05 to 2010–11 school years for 2007 cohort schools; universe data (all districts and study schools were represented in the data) ▪ Time Period of Data Collection. Obtained from the CCD website
EDFacts data	Context	▪ **Content.** School-level federal accountability information submitted by states to the Department of Education, including program improvement status and AYP status ▪ **Sample.** All elementary schools in study districts for 2003–04 to 2009–10 school years; universe data (all study schools were represented in the data) ▪ Time Period of Data Collection. Obtained November 2011
MSAP applications for study districts	Context and implementation	▪ **Content.** Information on school magnet program to be implemented with grant ▪ **Sample.** All study magnet districts and schools ▪ **Time Period of Data Collection.** Obtained from MSAP program in fall 2007

[69] See http://www2.ed.gov/about/inits/ed/edfacts/index.html for information describing ED*Facts*.

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Appendix F: Details of Analysis Methods

This appendix provides additional details on the methods used to answer the study's research questions:

1. Did the composition of neighborhood students and students from outside the neighborhood in the magnet schools change after conversion?

2. Did the diversity in the magnet schools increase after conversion, and is there any evidence that it was related to conversion?

3. Did the achievement in the magnet schools increase after conversion, and is there any evidence that it was related to conversion?

Overview of Methods for Research Question 1

In both traditional and destination schools, the theory of action suggests that attracting students from outside the neighborhood is an important first step for converting magnet schools. Because it is possible that these schools could grow or shrink as a result of the movement of families in or out of the district, the analysis takes the size of schools into account by examining the number of students from outside the neighborhood as a *share of the total enrollment.* If conversion schools attracted students from outside the neighborhood as predicted, then this share should have been higher after conversion.

The theory of action also predicts that the students from outside the neighborhood will differ from the students attending the school as their local neighborhood school. For example, traditional magnet schools are expected to attract nonminority, economically advantaged, higher achieving students; and destination magnet schools are expected to attract minority, economically disadvantaged, and lower achieving students. The analysis compared the characteristics of students from outside the neighborhood to students from inside the neighborhood in the years after conversion using the following measures:

- The proportion who were from minority racial/ethnic backgrounds;
- The proportion who were from economically disadvantaged backgrounds;
- The average ELA achievement; and
- The average mathematics achievement.

If traditional magnet schools were successful in their recruitment, then after conversion the proportion of students from minority racial/ethnic backgrounds would be *lower* among students from outside the neighborhood than inside. The same would be expected when looking at the proportions of students who were from economically disadvantaged backgrounds. For ELA and mathematics achievement, the theory predicts that the average for students from outside the neighborhood would be *higher* than the average for neighborhood students. For destination schools, the predictions are reversed.

This analysis focused on comparing the demographic characteristics and achievement of students from inside and outside the neighborhood *after conversion*, because theory predicts that neighborhood students in traditional magnet schools would have access to peers who were different than themselves and benefit from a "spillover" effect. Theory predicts that students from outside the neighborhood in destination schools would also benefit from access to higher achieving peers in the converted schools. Since there were students from outside the neighborhood already in the magnet schools prior to conversion, an additional step examined whether the differences between the students from outside the neighborhood and the neighborhood students were greater after conversion.

Additional detail on the analysis methods for research question 1 is provided in section F.1. Section F.1.1 provides information on how student achievement scores were standardized within grades and districts; section F.1.2 describes the analysis model; and section F.1.3 provides details on the exhibits used to present the results for research question 1 in Chapters 5 and 6.

Overview of Methods for Research Question 2

One of the primary goals of converting a school to a magnet is to improve the diversity in the school. For this study, diversity in a school was measured relative to its district: a school was considered to be more diverse when the makeup of its students became more like the makeup of its district. Diversity is measured in relative terms because the primary way a school can change its composition is to attract students attending other schools in the district—thus, the district's student composition sets the context for any particular school's improvements in diversity.[70] In this way, for example, a traditional magnet school's diversity would be viewed as improving even if the proportion of students from a minority racial/ethnic background increased (rather than decreased, as would be expected), if the district experienced a larger increase.

Under this approach, when the difference between the proportion of students from minority racial/ethnic backgrounds or students who are disadvantaged in a school and in its district is zero (no gap), the school population is considered diverse. The larger the difference, the less diverse the school. The theory of action, hence, predicts that the difference between the magnet school and district proportions will be smaller after conversion than before; that is, the magnet schools will become more diverse.

Describing changes in magnet schools and their districts. The initial step in the analysis involved examining whether the diversity in magnet schools increased after conversion by determining whether the difference between the magnet school and district proportions of students from minority racial/ethnic backgrounds or who were disadvantaged was indeed smaller after conversion.

Investigating the role of magnet conversion. The second step investigated whether magnet conversion may have played a role in the observed change in diversity in magnet schools by predicting the change in magnet schools had they not converted based on neighborhood schools

[70] Magnet schools might also attract students from private schools in the area.

in the study districts that did not convert.[71] The rationale for this approach is that a reduction in the proportion of minority group students or disadvantaged students in traditional magnet schools relative to their districts could be caused by factors other than the magnet conversion—it could be that all schools in the district were becoming more diverse, including study magnet schools, regardless of whether they converted. What happened in neighborhood schools that did not convert served as a proxy for what might have happened to the study schools if they had not converted.[72] If neighborhood schools that did not convert experienced changes similar to those experienced by magnet schools, it would suggest that the magnet school outcomes might be part of a larger trend for all neighborhood and magnet schools in the district rather than a result of conversion; if the changes in other neighborhood schools were different, then magnet conversion is a possible explanation for the difference. This approach is sometimes termed a comparative interrupted times series or difference-in-differences analysis. (See Bloom 2003 and Somers et al. 2013 for a discussion of the methodology.) Although it is not possible to rule out all factors other than conversion with certainty, given the study design, it is possible to provide suggestive, but not conclusive, evidence of the role of conversion.

The methods used to analyze destination schools were similar to the methods described above for traditional schools. Destination schools typically start out with a proportion of students from minority racial/ethnic backgrounds or from disadvantaged backgrounds lower than their districts, whereas traditional schools typically have a proportion higher than their districts. However, because the key variable in this analysis was the *size* of the difference between the school proportion and the district proportion, the analysis was similar whether the school proportion was greater than or less than the district proportion prior to conversion. In both cases, improved diversity entailed a reduction in the size of the difference between the proportion of minority students or disadvantaged students in magnet schools and their districts.

Additional details on the methods for research question 2 are described in section F.2 for racial/ethnic diversity and F.3 for diversity in economic disadvantage. Sections F.2.1 (racial/ethnic diversity) and F.3.1 (diversity in economic disadvantage) describe the first step of the analysis: the comparison of magnet schools to their districts. Sections F.2.2 and F.3.2 describe the second step of the analysis: the comparison of magnet schools to neighborhood schools that did not convert.

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[71] It is generally preferable to have a comparison group of schools that is well matched to the group of schools implementing the practice of interest (here, the conversion to a magnet school) based on their characteristics before the practice is implemented. Some common matching methods (e.g., Mahalanobis distance or regression based matching approaches, such as propensity score matching) were considered during the design phase of the study. However, it was difficult to identify a close match for each magnet school on all relevant school characteristics (proportion minority, proportion disadvantaged, and ELA and mathematics achievement), especially since in some study districts, there were few schools, limiting the pool of potential matches. In addition, a simulation study conducted for the project suggested that the use of all schools in a district might minimize the estimation error. For details on the decision to use all noncharter and nonmagnet schools in the district as comparisons rather than creating a matched comparison sample, see section F.2.2.1. For tables comparing the study magnet schools and all neighborhood public schools that did not convert on the proportion of students from minority backgrounds, the proportion from disadvantaged backgrounds, ELA achievement, and mathematics achievement prior to conversion, see Appendix I for traditional magnet schools and Appendix J for destination magnet schools.

[72] The neighborhood public schools used as a comparison did not include magnet schools or charter schools. The latter restriction was imposed because none of the magnet schools were charters before they converted.

Overview of Methods for Research Question 3

A primary goal of magnet school conversion is to improve student learning. The theory of action suggests two ways that learning might be improved: the adoption of specialized curricula and instructional methods; and spillover effects from higher achieving peers.[73]

Describing changes in magnet schools and their districts. The initial step in examining magnet school achievement involved looking at whether the average achievement in ELA and mathematics in the magnet schools changed after conversion as anticipated by the theory of action. Since the magnet schools were operating within the context of their districts which may have had other efforts to improve learning, the change in the achievement in the magnet schools was compared to the changes that were occurring in their districts overall.

This analysis looks at whether students in the years after conversion performed better than the students who were in those same grades in the years before conversion. In a typical district, the analysis compared the performance of all third, fourth, and fifth grade students in postconversion years to third, fourth, and fifth grade students in the preconversion years (different students), in order to measure the school's progress or improvement. (See Exhibit A.3 for the grade ranges analyzed for each district.) This approach is similar to how school improvement is measured under federal accountability efforts in most states (as required under the Elementary and Secondary Education Act).[74]

For each overall measure, the achievement data were first combined to generate an ELA achievement measure for each magnet school for the preconversion period and one for the postconversion period. For the preconversion measure, the ELA achievement scores of all students in grades 3, 4, and 5 in each school were averaged for each preconversion year (typically two years). Then, the annual school measures were averaged. For the postconversion measure, the same process was used to combine the achievement scores (typically over a four-year period). A similar approach was used for mathematics achievement in magnet schools and for district ELA and mathematics achievement.

Investigating the role of magnet conversion. As described in Chapter 1, the main population of policy interest and the mechanisms for improving learning differ in traditional and destination magnet schools. In traditional schools, neighborhood students, who are typically lower achieving, are the main focus of policy interest. In contrast, in destination schools, students from

[73] In traditional magnets, higher achieving students from outside the neighborhood may boost the achievement of lower achieving neighborhood students. In destination magnets, higher achieving neighborhood students may boost the achievement of lower achieving students from outside the neighborhood. See Chapter 1.

[74] For example, because the students in the third grade in one year were not the same students in the third grade in a later year, an increase in achievement could have been due to actual improvements in learning within the schools, or it could have been due to changes in the composition and achievement trajectory of students attending a certain grade in a given year. The possibility of the latter is a particular concern in interpreting magnet school achievement changes, because the schools specifically aim to change the mix of students attending the schools after conversion, which could in turn affect the average achievement in the magnet schools. This issue is addressed in the analysis discussed next that compared change in achievement in magnet schools to change in achievement of neighborhood schools that did not convert.

outside the neighborhood attracted to the magnet school are typically lower achieving and thus the main focus of policy interest.

The key to determining whether any improvement in the achievement of neighborhood students in traditional magnet schools might be due to the conversion is comparing changes in neighborhood student achievement in traditional magnet schools with what would be predicted if the schools had not converted, based on changes in neighborhood student achievement in neighborhood schools that did not convert. This strategy, a comparative interrupted time series (CITS) analysis, made it possible to investigate whether neighborhood student outcomes in magnet schools might have been related to factors affecting a wider set of schools across the district, rather than to the conversion. The approach used here was different from the one used to measure the achievement change in the magnet schools after conversion (described on prior pages) in order to better measure the improvement of individual students. In contrast to looking at whether a group of students in the postconversion years performed better than those in the same grades in the preconversion years, this analysis compared the annual gains of individual students before the conversion with the annual gains of individual students after the conversion.

For this analysis, the measures analyzed were student-level annual achievement gains:

- Individual student gains in ELA achievement from the previous year; and
- Individual student gains in mathematics achievement from the previous year.

Students' annual achievement gains– that is, their increases (or decreases) from one grade to the next—were used to focus the analysis on what students learned while attending a magnet school rather what they had learned before. Gains were reported as percentile increases (or decreases) from one grade to the next.[75] A positive annual gain in percentile rank indicates that students gained ground over the previous year relative to other students in the district; and a negative annual gain in percentile rank indicates that students lost ground. Accounting for students' past academic histories by examining gains in their own achievement rather than across groups of different students helps rule out changes in the achievement of the school's neighborhood students prior to attending as a reason for any observed change in achievement. For example, as noted previously, the students observed in a given grade in one year are not the same students observed in that grade in the previous year. Hence, the neighborhood students in a magnet school after conversion may be higher achieving than those who attended before conversion because of shifting residential patterns rather than as a result of conversion.

Similarly, it is possible that the social or economic background of the neighborhood students after conversion might be different than the background of those who attended before conversion. To further focus the analysis on achievement gains as a result of conversion rather than changes in student background, the CITS statistical model predicted achievement for neighborhood students in magnet schools had their schools not converted based on students *with similar background characteristics* in neighborhood schools that did not convert. The following

[75] Achievement scores analyzed here were standardized differently than in the analyses described above comparing achievement in magnet schools to achievement in their districts. Here students' achievement scores were expressed as percentiles within their district, grade, *and year* (see Appendix F.4.2.1 for further discussion).

characteristics were taken into account: race/ethnicity, economic disadvantage,[76] age, disability status, and ELL status.

Whereas in traditional magnet schools, the policy interest is the lower performing neighborhood students, in destination magnet schools the interest is the lower performing students from outside the neighborhood who were attracted to the schools after they converted. Using these methods to investigate the role of conversion in the outcomes of students from outside the destination schools' neighborhoods is inappropriate. There are better approaches for examining the effects of attending a converted magnet for these students, including the use of admission lotteries when there are more applicants than spaces available. However, the schools were newly converted, and the number of students who transferred to destination magnet schools in this study was too small for this type of analysis.

Additional details on the analysis for research question 3 are provided in section F.4. Section F.4.1 describes the first step of the analysis: the comparison of achievement in magnet schools to achievement in their districts. Section F.4.2 describes the second step of the analysis: the comparison of achievement in magnet schools to achievement in neighborhood schools in their districts that did not convert.

Additional Information About Methods

After describing the methods used to answer each of the research questions, Appendix F concludes with two supplemental sections. Section F.5 provides a discussion of potential bias in the analyses of change in diversity in magnet schools relative to change in neighborhood schools that did not convert. Section F.6 provides notes on supplementary analyses conducted to examine potential explanations for the ELA achievement results presented in Chapter 5.

F.1. Analysis Methods for Research Question 1

The analyses for research question 1 in Chapters 5 and 6 were conducted using annual school-level measures for each study magnet school. Student-level data were aggregated for each year for each study magnet school to generate school-level measures for two student groups: students from outside the neighborhood and neighborhood students. To simplify analysis, for these calculations students were assigned to the elementary school in which they were enrolled for the greatest portion of the school year (i.e., the dosages and test-to-test years described in Appendix B were not used).

The following annual measures were calculated separately for each study magnet school, for students from outside the neighborhood and neighborhood students:[77]

- Count of students
- Proportion of students from minority racial/ethnic backgrounds

[76] In three districts, data on economic disadvantage were not available. In one of those districts, information on the level of parent education was available and used as a substitute measure of socioeconomic status in this analysis.

[77] Students who did not have a known residency status were not included in the analysis reported for research question 1.

- Proportion of students from economically disadvantaged backgrounds
- Average ELA achievement
- Average mathematics achievement

These measures were then used to create additional school-level measures for each year. First, the annual counts of students were used to calculate the annual share of students in each school who were from outside the neighborhood. The share was calculated by dividing the count of students from outside the neighborhood by the sum of the count of students from outside of the neighborhood and the count of neighborhood students. Second, the following differences between students from outside the neighborhood and neighborhood students were calculated:

- Difference in the proportion of students from minority racial/ethnic backgrounds
- Difference in the proportion of students from economically disadvantaged backgrounds
- Difference in average ELA achievement
- Difference in average mathematics achievement

F.1.1. Standardized Achievement Scores

The analyses of achievement for research question 1 were conducted using test scores standardized within district within grade, with respect to the district's base year (first year of data for the district). Each student's test score was converted to a *z*-score by subtracting the district base-year mean for the student's grade level and dividing by the district base-year standard deviation for that grade level.

F.1.2. The Analysis Model

A two-factor ANOVA model was used to conduct the analyses reported for research question 1. The model was estimated using each of the measures described previously as the dependent variable and "period (pre-post)" and "school" as the two factors. Using period and school as factors allowed the analysis to pool data across years (e.g., the observations for two preconversion years and four postconversion years) and across schools (e.g., across 17 traditional magnet schools for analysis in Chapter 5 and across four destination schools in Chapter 6). Specifically, the following model was estimated:

$$y_{s,p,t} = \mu + \alpha_s + \beta_p + (\alpha\beta)_{s,t} + \epsilon_{s,p,t} \tag{F.1}$$

where

- $y_{s,p,t}$ = an outcome measure for school *s,* in period *p,* and year *t*
- s = index for schools
- p = "pre" for observations in the preconversion period (typically two years) or "post" for observations in postconversion years (typically four years)
- t = index for the year the data were observed
- μ = the overall mean

- α_s= the main effect for MSAP school *s*
- β_p = the main effect for period *p,* where *p* = "pre" for observations in the preconversion period or "post" for observations in postconversion years

The estimated coefficients from this model were used to provide averages across study magnet schools for the preconversion period ($\mu + \beta_{\text{pre}}$) and the postconversion period ($\mu + \beta_{\text{post}}$), as well as the average change from the preconversion to the postconversion period ($\beta_{\text{post}} - \beta_{\text{pre}}$) for each dependent variable.

First, equation F.1 was estimated using the annual share of students who were from outside the neighborhood as the dependent variable and tested whether the postconversion average share among magnet schools differed from the preconversion share (H_0: $\beta_{\text{post}} - \beta_{\text{pre}} = 0$).

Next, equation F.1 was estimated three times to determine whether there was a change in the proportion of students from outside the neighborhood who were from minority racial/ethnic backgrounds, a change in the proportion for students from the neighborhood, and a change in the difference between the two.[78]

- To test whether the postconversion average proportion of racial/ethnic minority students for students from outside the neighborhood differed from the preconversion average (H_0: $\beta_{\text{post}} - \beta_{\text{pre}} = 0$), equation F.1 was estimated using the proportion of students from minority racial/ethnic backgrounds outside the neighborhood as the dependent variable.
- To test whether there was a change for neighborhood students (H_0: $\beta_{\text{post}} - \beta_{\text{pre}} = 0$), equation F.1 was estimated again, using the proportion of racial/ethnic minority students for neighborhood students as the dependent variable.
- Finally, to test whether there was a preconversion difference between students from outside and inside the neighborhood (H_0: $\mu + \beta_{\text{pre}} = 0$), a postconversion difference (H_0: $\mu + \beta_{\text{post}} = 0$), and a change in the difference (H_0: $\beta_{\text{post}} - \beta_{\text{pre}} = 0$), the model was estimated a third time, using the difference in the proportion of racial/ethnic minority students (the proportion for students from outside the neighborhood minus the proportion for neighborhood students) as the dependent variable.

The same approach was used to analyze the proportion of students from economically disadvantaged backgrounds, average ELA achievement, and average mathematics achievement by estimating equation F.1 for students from outside the neighborhood, for neighborhood students, and for the difference between them.

[78] Estimating equation F.1 three times produced the results of the five different significance tests that are reported in Exhibit 5.2 (repeated as Exhibit F.2): the change in the proportion of students from outside the neighborhood from minority backgrounds, the change in the proportion of neighborhood students from minority backgrounds, the preconversion difference between students from outside the neighborhood and neighborhood students, the postconversion difference, and the change in the difference.

F.1.3. Exhibits

The exhibits in Chapters 5 and 6 under research question 1 present estimates and hypothesis tests based on equation F.1 and the analysis described in section F.1.2. Three examples from Chapter 5 illustrate how the exhibits were produced:

- The share of students who were from outside the neighborhood (Exhibit 5.1)
- The proportion of students from minority racial/ethnic backgrounds (Exhibit 5.2)
- The average ELA achievement (Exhibit 5.3)

Exhibit 5.1, reproduced here as Exhibit F.1, displays the share of students who were from outside the neighborhood. These results were generated by estimating equation F.1 using the annual share of students who were from outside the neighborhood as the dependent variable: the average share of students who were from outside the neighborhood was 21.0 percent before and 26.8 percent after conversion. The pre-post change in the average share ($\beta_{\text{post}} - \beta_{\text{pre}}$) is provided on the display (5.8 percentage points) between the preconversion and postconversion numbers. The statistical significance of the change (H_0: $\beta_{\text{post}} - \beta_{\text{pre}} = 0$) is indicated with an asterisk (*) if the change is statistically different than zero ($p < .05$) and no symbol if it is not different. In Exhibit 5.1, the change is significant.

Exhibit F.1. Reprint of Exhibit 5.1. Share of Students From Outside the Neighborhood in Traditional Magnet Schools (Average Across Schools)

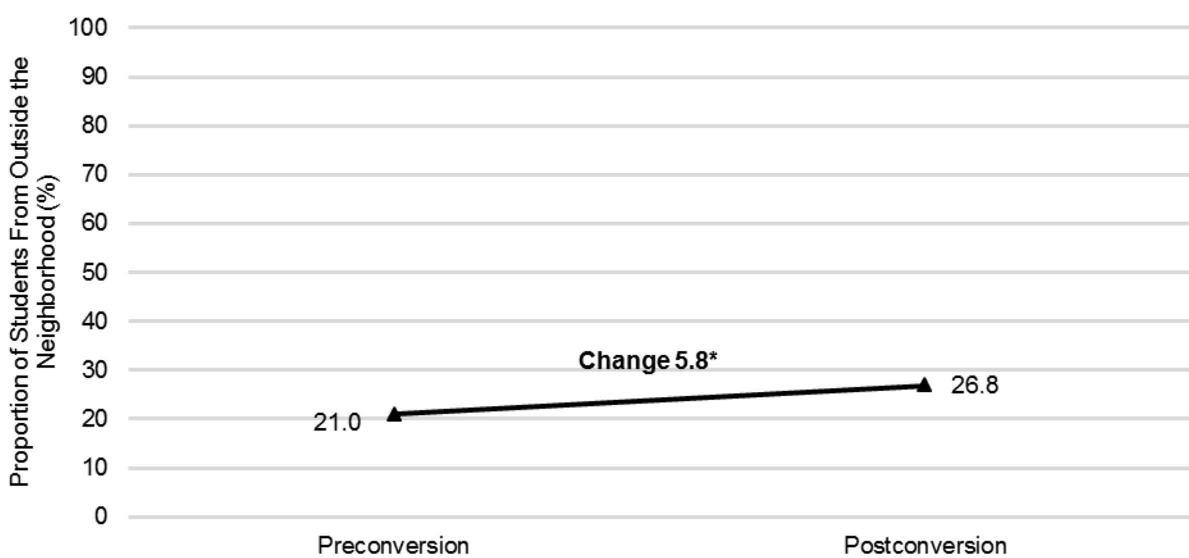
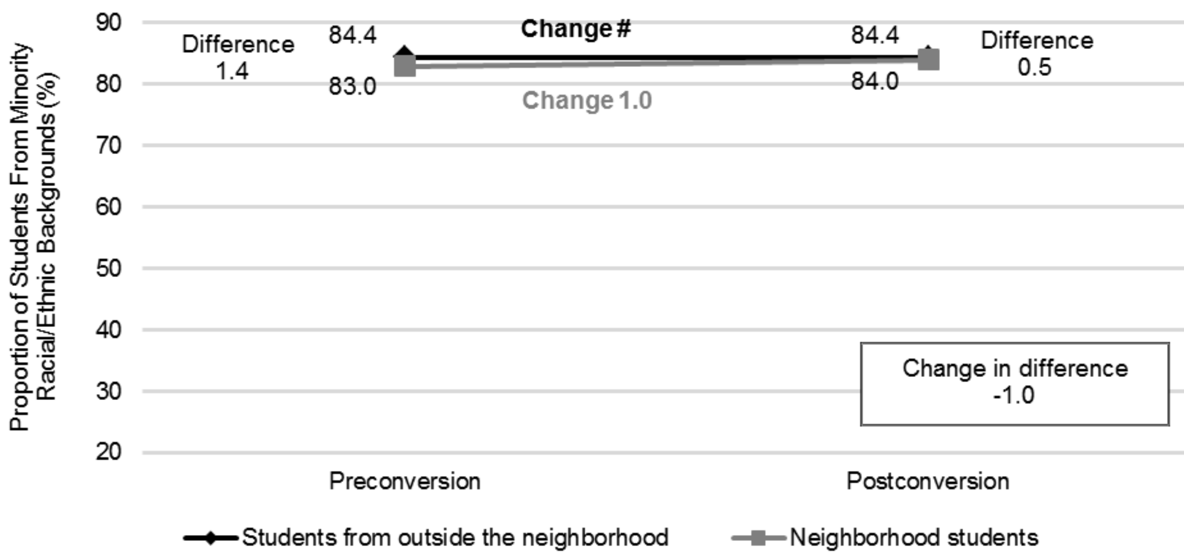


Exhibit 5.2, reproduced here as Exhibit F.2, presents the results for the proportion of students from minority racial/ethnic backgrounds in traditional magnet schools. First, based on equation F.1 using the annual proportion of racial/ethnic minority students for students from outside the neighborhood as the dependent variable, the average proportion of racial/ethnic minority students was 84.4 percent both before and after conversion. As in Exhibit 5.1, the pre-post change ($\beta_{\text{post}} - \beta_{\text{pre}}$) and significance test (H_0: $\beta_{\text{post}} - \beta_{\text{pre}} = 0$) are provided on the exhibit between the preconversion and postconversion numbers. The absence of an asterisk

(i.e., there is no *) next to the change (which rounds to zero) indicates that the postconversion average proportion was not statistically different from the preconversion average proportion ($p < .05$).

Second, based on equation F.1 and using the annual proportion of racial/ethnic minority students for neighborhood students as the dependent variable, the average minority proportion was 83.0 percent before and 84.0 percent after conversion. The absence of an asterisk (i.e., there is no *) next to the change (1.0 percentage points) indicates that this difference was not statistically significant (H_0: $\beta_{\text{post}} - \beta_{\text{pre}} = 0$; $p < .05$).

Exhibit F.2. Reprint of Exhibit 5.2. Characteristics of Neighborhood Students and Students From Outside the Neighborhood in the Traditional Magnet Schools (Average Across Schools) – Proportion From Minority Racial/Ethnic Backgrounds



NOTE: # = Rounds to zero.

Third, based on equation F.1 and using the annual difference in the proportion of racial/ethnic minority students between students from outside the neighborhood and neighborhood students as the dependent variable, the average difference in minority proportion was 1.4 percentage points before and 0.5 percentage points after conversion. The statistical significance of the difference in proportion between students from outside the neighborhood and neighborhood students, pre-conversion (H_0: $\mu + \beta_{\text{pre}} = 0$) and post-conversion ($H_0$: $\mu + \beta_{\text{post}} = 0$), respectively, is reported in the display using the following notation:

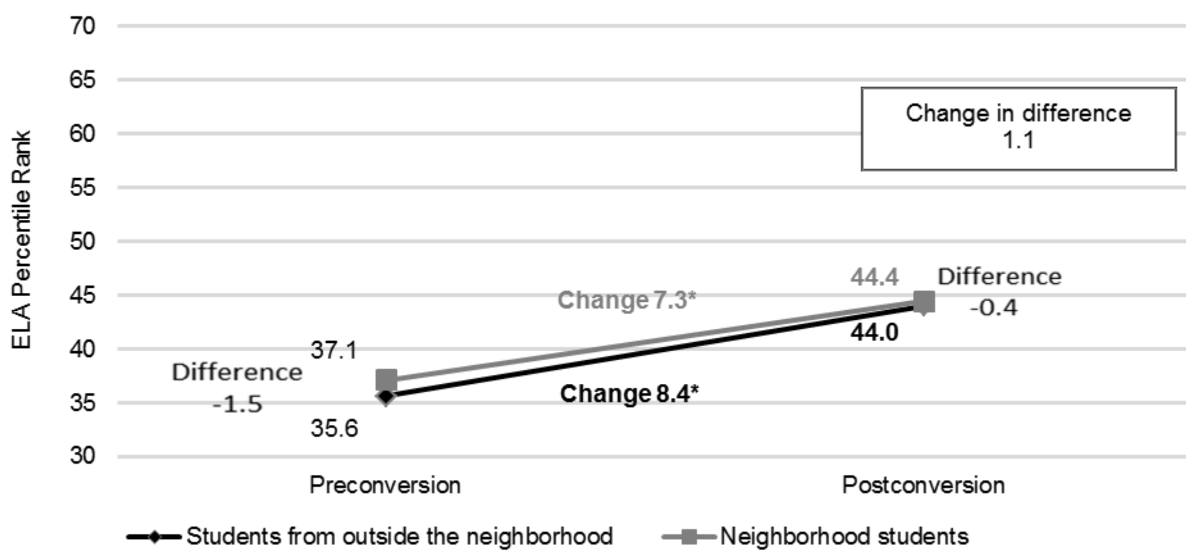
- An asterisk (*) next to the average preconversion difference or next to the average postconversion difference indicates that the average preconversion or postconversion difference was statistically different than zero ($p < .05$).
- No symbol next to the preconversion difference or the postconversion difference indicates that the average preconversion or postconversion difference was not statistically different than zero.

In Exhibit 5.2, the absence of an asterisk (i.e., there is no *) next to each average indicates that neither the difference before nor after conversion was statistically significant.

In addition, the change in the average difference from the preconversion to the postconversion period is reported in the text box in the display: -1.0 percentage point.[79] An asterisk (*) is used to indicate statistical significance (H_0: $\beta_{\text{post}} - \beta_{\text{pre}} = 0$). The absence of an asterisk (i.e., there is no *) beside the change in the difference indicates that the postconversion average difference was not statistically different from the preconversion average difference.

The numbers in Exhibit 5.3, reproduced as Exhibit F.3, present results for the average ELA achievement in traditional magnet schools for students from outside the neighborhood and neighborhood students. The displays for achievement results for research question 1 were constructed as described for the proportion of racial/ethnic minority students in reference to Exhibit F.2. Averages and hypothesis tests were generated by estimating equation F.1 using three different dependent variables: the average achievement for students from outside the neighborhood, the average achievement for neighborhood students, and the difference in average achievement between the two. However, the achievement displays require additional explanation because the achievement results were presented in terms of percentiles rather than the *z*-scores used for analysis.

Exhibit F.3. Reprint of Exhibit 5.3. Achievement of Neighborhood Students and Students From Outside the Neighborhood in Traditional Magnet Schools (Average Across Schools) – ELA



79 The value of -1.0 differs from 0.5 − 1.4 because of rounding.

In the report, the z-score results were transformed into percentiles for display to put the results in a policy-relevant metric. The transformation was conducted using the standard normal cumulative distribution function (CDF) to assign each z-score result a percentile rank:

$$\text{Percentile score} = \Phi(z\text{-score}) \qquad \text{(F.2)}$$

Because it was assumed that z-scores were normally distributed, each z-score should correspond to a percentile in the standard normal distribution that can be found using the standard normal CDF. For students from outside the neighborhood in traditional magnet schools, the preconversion average ELA z-score was -0.37, and the postconversion average z-score was -0.15; these achievement levels correspond to percentile ranks of 35.6 and 44.0, respectively (see Exhibit F.3). For neighborhood students, the preconversion average ELA z-score was -0.33, and the postconversion average z-score was -0.14; these achievement levels correspond to percentile ranks of 37.1 and 44.4, respectively (see Exhibit F.3).

Exhibit 5.3 also displays differences in average achievement between students from outside the neighborhood and neighborhood students. The average ELA z-score difference between students from outside the neighborhood and neighborhood students was -0.04 in the preconversion period and -0.01 in the postconversion period. However, rather than transforming these z-scores to percentiles, the percentiles for display in Exhibit 5.3 were calculated as the difference between the average percentile for students from outside the neighborhood and the average percentile for neighborhood students.[80] For the preconversion period, the difference was -1.5 percentile points (= 35.6 − 37.1), and for the postconversion period, the difference was -0.4 percentile points (= 44.0 − 44.4). The change in the difference, +1.1 percentile points (as reported in the text box), was calculated by subtracting the preconversion average difference in percentiles from the postconversion difference: 1.1 = -0.4 − (-1.5).

Although the results in Exhibit 5.3 are reported in percentiles, the statistical tests were conducted using the original z-scores. The results of the hypothesis test are reported in Exhibit 5.3, using asterisks (*) as described for Exhibit 5.2:

- **Pre-post change for students from outside the neighborhood.** The asterisk (*) that appears next to the change in average ELA percentile rank for students from outside the neighborhood (8.4 percentile points) indicates that the difference between the postconversion percentile rank, 44.0, and the preconversion percentile rank, 35.6, was statistically significant.
- **Pre-post change for students for neighborhood students.** The asterisk (*) that appears next to the change in average ELA percentile rank for neighborhood students

[80] As described in the text, the difference in z-scores was converted to a difference in percentiles by converting each of the two terms in the difference separately and then subtracting. This approach was used because the percentile difference corresponding to a given z-score difference differs depending on the base from which the z-score difference is measured. For example, consider a z-score difference of +0.1. If this difference is computed from a base of 0.0 to a value of 0.1, the change in percentile would be from the 50th to the 54th percentile, a difference of 4 percentile points. However, if the difference is computed from a base of -1.0 to a value of -0.9, the change in percentile would be from the 16th to the 18.4th percentiles, a difference of 2.4 percentile points.

(7.3 percentile points) indicates that the difference between the postconversion percentile rank, 44.4, and the preconversion percentile rank, 37.1, was statistically significant.

- **Preconversion difference between students from outside the neighborhood and neighborhood students.** The absence of an asterisk (i.e., there is no *) next to the preconversion average difference, -1.5, indicates that before conversion the average ELA percentile rank for students from outside the neighborhood was not statistically different than for neighborhood students.
- **Postconversion difference between students from outside the neighborhood and neighborhood students.** The absence of an asterisk (i.e., there is no *) next to the postconversion average difference, -0.4, indicates that after conversion the average ELA percentile rank for students from outside the neighborhood was not statistically different than for neighborhood students.
- **Pre-post change in the difference between students from outside the neighborhood and neighborhood students.** The absence of an asterisk (i.e., there is no *) beside the change in the difference of 1.1 points shown in the text box indicates that the postconversion average difference was not statistically different from the preconversion average difference.

F.2. Analysis Methods for Research Question 2 – Concentration of Students From Minority Racial/Ethnic Backgrounds

Research question 2 addresses the concentration of students from minority racial/ethnic groups and the concentration of students from economically disadvantaged backgrounds in schools relative to their districts. This section discusses methods for the analysis of minority concentration; the next section, F.3, discusses methods for the concentration of economically disadvantaged students. The analyses for this research question were conducted in two ways. The first set of analyses compared the proportion in magnet schools to the proportion in their districts; a description of these analyses appears in section F.2.1. The second set of analyses compared the difference between magnet schools and their districts to the difference between neighborhood schools that did not convert and their districts; a description of these analyses appears in section F.2.2.

F.2.1. Changes in Magnet Schools and Their Districts

The first step in the analysis of minority concentration for research question 2 used equation F.1 to compare study magnet schools to their districts overall. This analysis was similar to the comparison of students from outside the neighborhood to neighborhood students in research question 1. For each magnet school, student-level data for all students in the school were aggregated within the year to the school level to generate the annual measures. For each district, student-level data for all students in all public schools in the district (including study magnet schools) were aggregated within year to the district level. In some cases, multiple study magnet schools were located in the same district. When an average for the districts in which the study magnet schools were located was obtained, districts that had multiple study magnet schools were included multiple times, once for each study school in the district.[81]

The following annual measures were calculated for each study magnet school:

- Proportion of students from minority racial/ethnic backgrounds in the magnet school
- Proportion of students from minority racial/ethnic backgrounds in the magnet school's district

These annual measures were then used to calculate the following annual difference between each magnet school and its district:

- Difference in proportion of students from minority racial/ethnic backgrounds

F.2.1.1. The Analysis Model. As for research question 1, equation F.1 was used to analyze minority concentration for research question 2. To test whether the postconversion average proportion of students from minority racial/ethnic backgrounds for magnet schools differed from the preconversion average, equation F.1 was estimated once using the minority proportion for magnet schools as the dependent variable. Then equation F.1 was estimated again, based on the proportion of racial/ethnic minority students for the districts in which the magnet schools were located as the dependent variable. Finally, to test whether there was a difference in the proportion of racial/ethnic minority students between magnet schools and their districts in the preconversion period or in the postconversion period, and whether there was a change in the difference between the pre- and postconversion periods, the model was estimated a third time, using the difference in minority proportion, the proportion in each magnet school minus the proportion in its district, as the dependent variable.

F.2.1.2. Exhibits. Exhibit 5.4, reproduced here as Exhibit F.4, presents results for the proportion of students from minority racial/ethnic backgrounds in traditional magnet schools and their districts. The presentation of results is similar to the presentation of results for students from outside the neighborhood and neighborhood students as described in section F.1.2. First, based on equation F.1 using the annual proportion of racial/ethnic minority students for students in study magnet schools as the dependent variable, the average minority proportion was 84.5 percent before and 84.9 percent after conversion. As in Exhibit 5.2, the pre-post change in the average proportion (0.4 percentage points) is provided on this display between the preconversion and postconversion numbers. The absence of an asterisk (i.e., there is no *) next to the change indicates that it was not statistically different than zero.

Second, based on equation F.1 using the annual proportion of racial/ethnic minority students in the districts of traditional magnet schools as the dependent variable, the average minority proportion was 64.1 percent before and 66.3 percent after conversion. The asterisk (*) next to

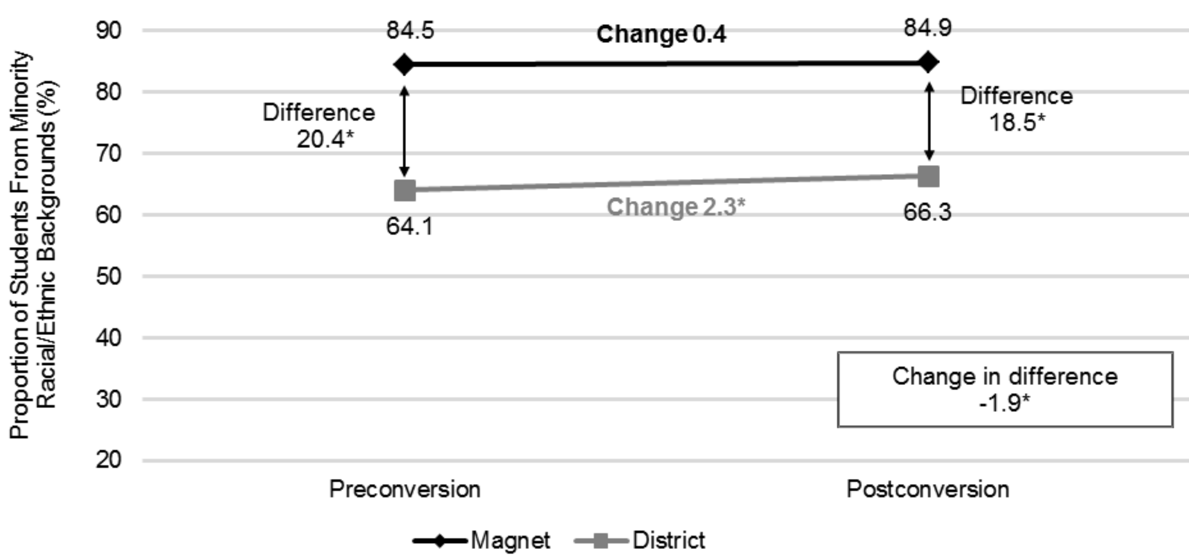
[81] As an example, District D contained three traditional study magnet schools. Hence, when the average concentration of students from a minority racial/ethnic background across study districts for traditional magnet schools was obtained, the District D concentration entered the analysis three times, once for each traditional magnet school.

pre-post change in the average proportion (2.3 percentage points) indicates that the change was statistically different than zero.

Third, based on equation F.1 using the annual difference between the proportion of racial/ethnic minority students in magnet schools and their districts as the dependent variable, the average difference in minority proportion was 20.4 percentage points before and 18.5 percentage points after conversion. As in Exhibit 5.2, asterisks report the results of hypothesis tests:

- The asterisk (*) next to the preconversion average difference, 20.4, indicates that before conversion the average proportion of racial/ethnic minority students in magnet schools was statistically different from the proportion in their districts.
- The asterisk (*) next to the postconversion average difference, 18.5, indicates that after conversion the average proportion of racial/ethnic minority students in magnet schools was statistically different from the proportion in their districts.
- The asterisk (*) next to the change in the difference, -1.9, indicates that the postconversion average difference was statistically different from the preconversion average difference.

Exhibit F.4. Reprint of Exhibit 5.4. Concentration of Racial/Ethnic Minority Students in Traditional Magnet Schools (Average Across Schools)



F.2.2. Investigating the Role of Magnet Conversion

This section describes the methods for the second step in the analyses of the concentration of students from minority racial/ethnic backgrounds for research question 2 in Chapters 5 and 6. As discussed in Chapter 2, the primary approach for determining whether magnet conversion played a role in the observed outcomes was to use a CITS analysis to compare changes in study magnet schools to what would be predicted had they not converted. The prediction is based on changes in neighborhood public schools in the same district that did not convert to magnet schools. Section F.2.2.1 discusses the construction of the comparison group used in the analysis, and section F.2.2.2 provides details of the analysis. Section F.2.2.3 explains the meta-analysis used to aggregate the findings across districts, and section F.2.2.4 discusses the displays.

F.2.2.1. Construction of the Comparison Group for Predictions. The comparison schools used in the analyses for research question 3 were defined as public elementary schools in the district that were never charter or magnet schools and were in continuous operation throughout the years of the study. The study magnet schools were all noncharter, nonmagnet schools prior to conversion, and it was believed that the trajectory for these schools would serve as a reasonable representation of what might have happened in magnet schools had they not converted.

The decision to use all regular (i.e., noncharter, nonmagnet) neighborhood schools in the district that did not convert as a comparison group rather than an alternative approach was made based on the realities of the data available for this study and results from a simulation study that investigated alternatives (Betts et al. 2009). The original study design proposed to use an individually matched comparison school from within the district for each study school as a control group. However, the identification of close matches proved to be difficult for some magnet schools located in districts with a small total number of schools. The small number of schools in some districts also made the propensity score matching method for creating a control group infeasible.

The simulation study, Betts et al. 2009, was conducted as a companion to this study to investigate various methods for establishing a control group. Four methods were compared: using regressions to individually match study schools to a comparison school, a synthetic control group method (Abadie and Gardeazabal 2003), propensity score matching, and using all other neighborhood public schools. The simulation study was based on school-level data for schools in 24 districts located in three states. Data on school-level ELA and mathematics test scores were obtained from the National Longitudinal School Level State Assessment Score Database (NLSLSASD), and data on demographics were obtained from the National Center for Education Statistics (NCES) Common Core of Data for school years 2001–02 through 2006–07. The study used a "falsification" approach to study each method. Within each of the 24 districts, a school was randomly selected to be designated as having converted to a magnet school, with probability related to the school's prior achievement, to reflect the idea that lower performing schools are more likely to be selected for magnet conversion. A comparison school or group was then selected according to each of the four methods; and finally a regression model was used to estimate the hypothetical relationship between magnet status and achievement. Since in the simulation there was no true effect of magnet status, the models should not find a significant association between conversion and achievement. This approach was repeated 1,000 times for each method, drawing different pseudo-magnet schools in each district, to determine which method most accurately rejected the hypothesis that the (false) conversion was associated with a change in achievement. Using all other neighborhood public elementary schools in the district as a comparison group was found to minimize the estimation error.

F.2.2.2. Analysis Model. To assess whether there was an association between magnet conversion and a change in the proportion of students from minority racial/ethnic backgrounds, the analysis was based on the absolute value of the difference (AVD) in the proportion of racial/ethnic minority students (AVD_M), expressed as follows:

$$AVD_M = |\text{ minority proportion in the school} - \text{minority proportion in its district }|$$

The absolute value of these differences was calculated because, as noted in Chapter 2, even within traditional or destination magnet schools, there were some schools with proportions greater than their district and some less than their district. In addition, AVD was calculated for each of the neighborhood schools that did not convert, some of which had proportions greater than their districts and some less. Taking the absolute value of the difference put all of the schools onto the same metric of diversity: size of the distance from the district proportion.

The following CITS model for AVD_M was estimated:[82]

$$\mathrm{AVD}_{\mathrm{M}st} = \sum_{s=1}^{S} \mu_s + \pi_1 F_{2t} + \pi_2 F_{3t} + \pi_3 F_{4t} + \pi_4 F_{5t} + \pi_5 F_{6t} + \theta \mathrm{TREAT}_{st} + \varepsilon_{st} \qquad \text{(F.3)}$$

where

- s = index for schools
- t = index for the year the data were observed
- μ_s = an indicator variable for school s
- F_{2t} ... F_{6t} = year indicator variables for Years 2 through 6, respectively
- π_1 ... π_5 = estimated year effects
- TREAT_{st} = 1 if school s is an MSAP school in year t when the program was active; 0 otherwise

The coefficient on TREAT, θ, represents the association between magnet conversion and the change in AVD between the postconversion and preconversion period for magnet schools. The error term—ε_{st}—represents variation in AVD within each school across years. In estimating the model, clustering at the school level was allowed to account for time-varying correlations within the set of observations for a given school that are not captured by the fixed effects.

The models were estimated separately for each district, to allow for complete flexibility in the coefficients across districts.

Equation F.3 produced a single estimate θ for each district, representing the association between conversion to a magnet school and change in the absolute value of the difference between the school and the district across all study magnet schools in the district. These estimates were used in the meta-analysis reported in research question 2 and described in section F.2.2.3.

[82] The CITS model shown in F.2 also included a "trend" variable that was set equal to zero for each year in the preconversion period and -1.5, -0.5, 0.5, and 1.5 for postconversion Years 1, 2, 3, and 4, respectively. The analysis included interaction terms between the trend variables and the TREAT variables to examine whether the changes associated with magnet school conversion increased or declined during the postconversion period. For simplicity, the trend variable is not shown in equation F.3, but the results for the trend are reported in Exhibit I.19 for traditional magnets and Exhibit J.13 for destination magnets. The coding of the trend variable was designed so that its inclusion in the model would not affect the estimate for the TREAT variable.

F.2.2.3. Meta-Analysis of District-Level Results. For aggregating results across districts, the study used a meta-analysis of the district-specific estimates to produce overall study average estimates. The meta-analysis treats each district model as a separate study and obtains an overall coefficient based on coefficients from the separate studies.

The meta-analysis was based on a random-effects model, which assumes that the separate district estimates represent a population of districts with magnet programs that may vary in their effects, and the focus is on estimating the population average association between magnet conversion and change in the absolute value of the difference in the proportion of students from minority racial/ethnic or economically disadvantaged backgrounds. The assumption of varying effects was based on a recently conducted meta-analysis of the literature on charter schools. In their analysis, Betts and Tang (2011) reasoned that "[g]iven that charter schools are afforded considerable freedom to experiment, and that the regulatory framework for charter schools varies across states, and surely across individual districts as well, it would seem untenable to make the alternative assumption that there is a single fixed impact of charter schools on achievement." It was reasoned that these same points apply to magnet schools.[83] The random effects meta-analysis approach produces an overall estimate and standard error for the population treatment coefficient, and in addition, it provides statistics on the extent to which variation in these coefficients across districts is real rather than due to sampling variation.

In a random effects meta-analysis, the population estimate is based on a weighted average of the effect sizes across studies. If θ_i is the effect size for the ith of k studies and W_i is the weight for each study, the overall estimated effect size M is as follows:

$$M = \frac{\sum_{i=1}^{k} W_i \theta_i}{\sum_{i=1}^{k} W_i} \tag{F.4}$$

For example, for the analysis of the absolute value of the difference between the magnet school and its district in proportion of racial/ethnic minority students ($\mathrm{AVD_M}$), the study calculated the overall effect size, M, across all the district coefficients, θ_i, estimated by equation F.4. The weight for each district (i.e., study), W_i, was computed as the inverse of the sum of the within-study variance V_{θ_i} (based on the standard error) and an estimate of the true between-study variance, T^2:

$$W_i = \frac{1}{V_{\theta_i} + T^2} \tag{F.5}$$

The between-study variance estimate, T^2, is based on a method-of-moments estimate of the variance of true effect sizes. If T^2 is large relative to the average within-study variance estimate, the approach produces roughly equal weights across studies, whereas if T^2 *is* relatively small, the approach produces unequal weights, with heavier weight given to studies with the lowest sampling variance.

[83] For a review of the random-effects approach to meta-analysis and measures of heterogeneity, see Borenstein et al. (2009), Chapters 12 through 16.

This study reports the I^2 statistic introduced by Higgins et al. (2003), which provides an estimate of the percentage of the variation in effect sizes that reflects true underlying variation (as opposed to sampling variation).

The standard meta-analytical approach assumes that the studies are drawn from independent samples. Some of the study districts have two or three MSAP-funded (study) magnet schools. Even though the analysis controlled for school and residency effects and district time trends as shown in equation F.3, there may be a nonzero covariance in effect for estimates across study magnet schools operating in the same district. If the analysis were to treat each study magnet school estimate as an independent study, then the analysis would likely overstate the precision with which it estimated our overall effect. Thus, in the case of districts with more than one study magnet school, the analysis used the districtwide estimate described previously that pools the magnet schools within a district together. This approach ensures that results do not overstate the number of studies and thus overstate the precision of the overall meta-analytic estimate.

F.2.2.3.1 Power Analysis for Racial/Ethnic Diversity CITS Estimates. Exhibit F.5 shows the post-hoc minimum detectable effect (MDE) for the estimates of the "change associated with magnet conversion" reported for traditional magnet schools in Chapter 5 and destination magnet schools in Chapter 6. The post-hoc MDE is a measure of the MDE actually realized by the study design and sample. The estimated MDE is derived by multiplying the empirical standard error of each coefficient from the models described previously (equation F.4) by a factor of 2.8.[84] This calculation is based on a two-sided *t*-test of the coefficient at the 5 percent level, setting power to 0.8.

Exhibit F.5. MDE for Estimates of the Role of Magnet Conversion in the Concentration of Racial/Ethnic Minority Students in Traditional Magnet Schools (Alpha = 0.05, Power of 0.8)

Subject	Standard Error	MDE
Traditional magnet schools: Minority proportion (AVDM) (%)	0.740	2.07
Destination magnet schools: Minority proportion (AVDM) (%)	1.880	5.26

SOURCE: District administrative data.

F.2.2.4 Exhibits. The CITS estimates derived from the meta-analysis were illustrated with a three-point graph. In this section, the analysis of AVD_M between traditional magnet schools and their districts is used as an example to illustrate how the graphs were constructed.

[84] The factor of 2.8 is the sum of $t_{alpha/2}$ and t_{1-beta}, where alpha is the intended significance level for the test (0.05), and 1 − beta is the intended power (0.80). For large degrees of freedom, $t_{alpha/2} = 1.96$ and $t_{1-beta} = 0.84$. See Bloom (2006).

Exhibit F.6. Reprint of Exhibit 5.5. The Role of Magnet Conversion in the Concentration of Racial/Ethnic Minority Students in Traditional Magnet Schools (Average Across Schools)

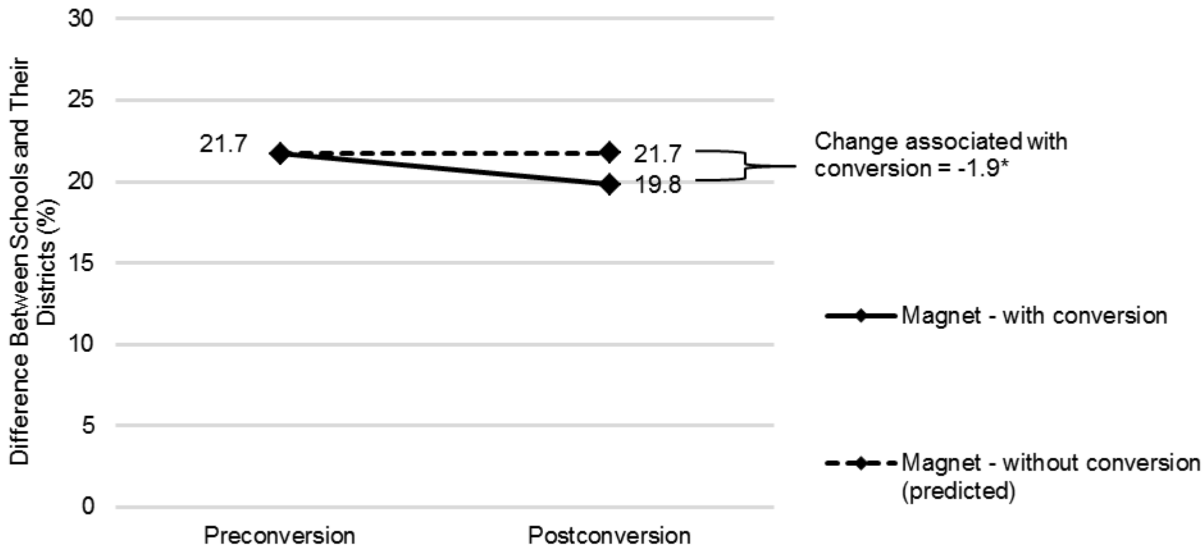


Exhibit 5.5, reproduced as Exhibit F.6, shows the CITS estimate (*M* in equation F.4) for the association between magnet conversion and the absolute value of the difference in proportion of students from minority racial/ethnic backgrounds between traditional magnet schools and their districts (AVD_M): -1.9 percentage points. The CITS result can be interpreted as the difference between the actual AVD_M for traditional magnet school in the postconversion period and the predicted AVD_M in the postconversion period had the schools not converted. In Exhibit F.6, we present the CITS result using this interpretation as the rationale for a three-point display. The display shows the level of AVD_M in magnet schools as well as the level of AVD_M that our analysis predicted for magnet schools in the postconversion period had they not converted. The remainder of this section describes the derivation of the numbers displayed in Exhibit F.6: two of the three points were derived from a descriptive analysis, while the remaining point was calculated from the other two numbers in the display and the CITS estimate.[85] Exhibit F.7 summarizes the derivation of each point.

[85] In a typical CITS analysis, a display similar to Exhibit F.6 could be constructed directly from the regression coefficients, using regression-adjusted preconversion and postconversion averages for magnet and comparison schools. This study, however, has an additional complication because the CITS estimate was generated using meta-analysis, by aggregating separate CITS estimates based on separate regression for each district (see section F.2.2.3). To simplify construction of the display, preconversion and postconversion averages generated by the ANOVA model (equation F.1) were used as the basis for the display, rather than aggregated regression-adjusted averages across districts.

Exhibit F.7. Derivation of Numbers in Exhibit 5.5

Description	Number	Derivation
CITS estimate: Change associated with conversion	-1.9	M estimated from equation F.4
Study magnet schools: Preconversion	21.7	Equation F.1 with AVD as dependent variable
Study magnet schools: Postconversion	19.8	Equation F.1 with AVD as dependent variable
Study magnet schools: Postconversion—without conversion (predicted)	21.7	(Study magnet postconversion) − (CITS estimate)

The average AVD_M for study magnet schools in the preconversion period, 21.7 percentage points, was obtained by estimating equation F.1 (the ANOVA model used to generate results for the first part of research question 2) using school-level AVD_M as the dependent variable. The study used this approach because the meta-analysis that aggregated results across districts provided only the CITS estimate and not the other data points in Exhibit F.6. Equation F.1 provides the appropriate preconversion and postconversion averages for magnet schools, employing the same method used to produce the averages presented for the comparison of magnet schools to their districts in section F.2.1.[86] The same approach was used to estimate the average AVD_M for study magnet schools in the postconversion period, 19.8.

The predicted AVD_M for study magnet schools in the postconversion period had they not converted, 21.7 percentage points, was calculated as the average postconversion AVD_M for study magnet schools minus the CITS estimate (21.7 = 19.8 − [-1.9]). Hence, the CITS estimate appears in the graph as the difference between the observed postconversion average for study magnet schools and the predicted postconversion average had they not converted.

F.3. Analysis Methods for Research Question 2 – Concentration of Students From Economically Disadvantaged Backgrounds

Research question 2 also addresses the concentration of students from economically disadvantaged backgrounds. As with the analyses of the concentration of racial/ethnic minority students, the analyses for disadvantaged students were conducted in two steps. The first step compared the proportion in magnet schools to the proportion in their districts; a description of these analyses appears in section F.3.1. The second step compared the difference between magnet schools and their districts to the difference between neighborhood schools that did not convert and their districts; a description of these analyses appears in section F.3.2.

[86] Although the method is the same, the dependent variable used for the comparison of magnet schools to their districts is different than the dependent variable used here. For comparisons of magnet schools to their districts, the exhibits report the average difference between the magnet school concentration and the district concentration, whereas for predicting what would have happened to magnet schools had they not converted based on neighborhood schools that did not convert (the CITS analysis), exhibits report the average of the size (absolute value) of the difference between magnet schools and their districts.

F.3.1. Comparing Changes in Magnet Schools and Their Districts

The first step in the analysis of the concentration of economically disadvantaged students for research question 2 was the same as the analysis of minority concentration (as described in section F.2.1) but used the proportion of students from economically disadvantaged backgrounds instead of the proportion from minority racial/ethnic backgrounds.

Similar to the analysis in section F.2.1, the following annual measures were calculated for each study magnet school:

- Proportion of students from economically disadvantaged backgrounds in the magnet school
- Proportion of students from economically disadvantaged backgrounds in the magnet school's district

These annual measures were then used to calculate the following annual difference between each magnet school and its district:

- Difference in proportion of students from economically disadvantaged backgrounds

The same analysis model, as described in section F.2.1.1, and displays, as described in section F.2.1.2, were used with these measures.

F.3.2. Investigating the Role of Magnet Conversion

The second step in the analyses of disadvantaged concentration for research question 2 in Chapters 5 and 6 was also conducted using a CITS analysis, as was done for the analyses of minority concentration, as described in section F.2.2. Here, however, the analysis used the proportion of students from economically disadvantaged backgrounds instead of the proportion from minority racial/ethnic backgrounds. The same comparison group, as described in section F.2.2.1, was used. In addition, the same analysis model (as described in section F.2.2.2), meta-analysis (as described in section F.2.2.3), and exhibits (as described in section F.2.2.4) were used, but with the absolute value of the difference between the school proportion and district proportion of students from economically disadvantaged backgrounds, AVD_D, as the key measure:

> AVD_D = | free or reduced-price lunch proportion in the school − free or reduced-price lunch proportion in its district |

As done for the analyses of minority concentration, the CITS analysis of AVD_D was conducted using equation F.2.

F.3.2.1 Power Analysis for Socioeconomic Diversity CITS Estimates. Exhibit F.8 shows the post-hoc minimum detectable effect (MDE) for the estimates of change associated with magnet conversion reported for traditional magnet schools in Chapter 5 and destination magnet schools in Chapter 6. The post-hoc MDE was calculated as described in section F.2.2.3.1.

Exhibit F.8. MDE for Estimates of the Role of Magnet Conversion in the Concentration of Economically Disadvantaged Students in Traditional Magnet Schools (Alpha = 0.05, Power of 0.8)

Subject	Standard Error	MDE
Traditional magnet schools: Disadvantaged proportion (AVDD) (%)	1.608	4.50
Destination magnet schools: Disadvantaged proportion (AVDD) (%)	3.092	8.66

SOURCE: District administrative data.

F.4. Analysis Methods for Research Question 3

Research question 3 addresses student achievement in ELA and mathematics. The analyses for this research question were conducted in two ways. The first set of analyses compared the achievement in magnet schools to the achievement in their districts; a description of these analyses appears in section F.4.1. The second set of analyses compared the annual gain in achievement for neighborhood students in magnet schools to the annual gain in achievement for neighborhood students in neighborhood schools that did not convert; a description of these analyses appears in section F.4.2.

F.4.1. Changes in Magnet Schools and Their Districts

The analyses comparing magnet schools to their districts for research question 3 in Chapters 5 and 6 were conducted using an approach similar to that used for analyses for research questions 2 and 3. Like those for research question 2, these analyses used annual measures for study magnet schools and their districts. Whereas the exhibits for research questions 2 and 3 present results for concentrations of racial/ethnic minority students and economically disadvantaged students, respectively, the exhibits for research question 3 present results for average ELA and mathematics achievement. As for research question 2, equation F.1 and associated hypothesis tests were used to generate results for the exhibits for research question 3.

The achievement analysis comparing magnet schools to their districts for research question 3 was conducted using achievement *z*-scores standardized on a base year. A description of this approach appears in section F.1.1. As in the achievement exhibits for research question 1, such as Exhibit F.3, the exhibits in this section display results in terms of percentile ranks. A description of the conversion of *z*-scores to percentile ranks appears in section F.1.3.

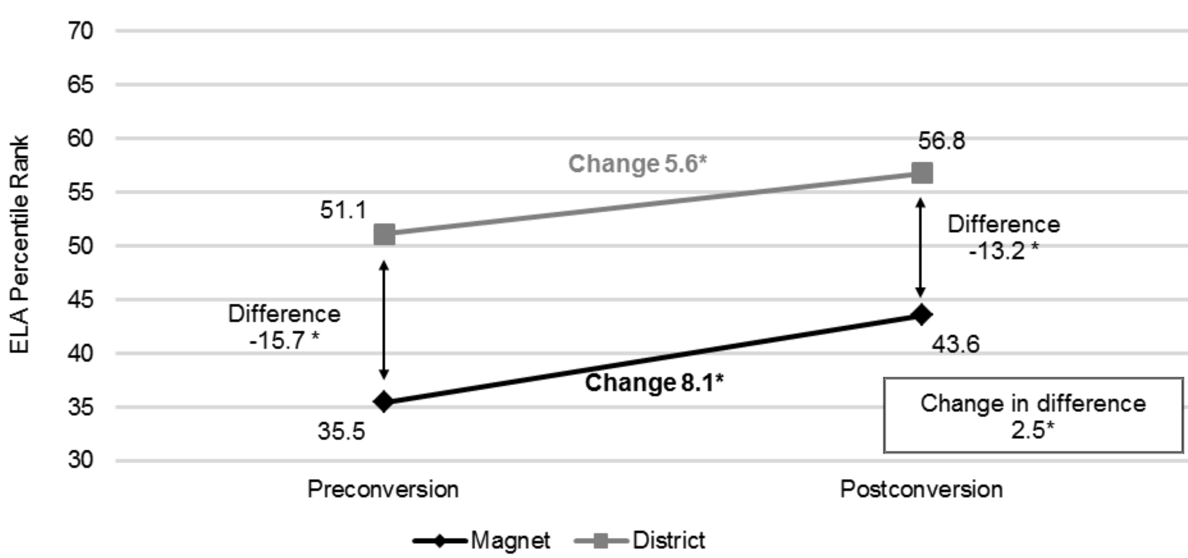
Exhibit 5.8, reproduced here as Exhibit F.9, presents results for the average ELA percentile rank in traditional magnet schools and their districts. The presentation of results is similar to the presentation of results for the concentration of students from minority racial/ethnic backgrounds in magnet schools and their districts described in section F.2.1.2. First, equation F.1 was estimated using the annual average ELA *z*-score in study magnet schools (traditional magnet schools in Chapter 5 and destination magnet schools in Chapter 6) as the dependent variable. *Z*-score results were then transformed into percentile ranks for display. The average ELA achievement in traditional magnet schools was at the 35.5th percentile before and the 43.6th percentile after conversion. As in Exhibit 5.3, the pre-post change in the average ELA achievement (8.1 percentile points) and significance test are provided in the exhibit between the preconversion and postconversion numbers. The asterisk (*) next to the change indicates that it was statistically significant.

Second, equation F.1 was estimated using the annual average ELA *z*-score in the districts of neighborhood magnet schools as the dependent variable. *Z*-score results were then transformed into percentile ranks for the display. The average ELA achievement in the districts of traditional magnet schools was at the 51.1th percentile before and 56.8th percentile after conversion. The asterisk (*) next to the change (5.6 percentile points) indicates it was statistically significant.

Third, as described in section F.1.3, differences in average achievement between magnet schools and their districts were calculated as the difference between the displayed percentiles for magnet schools and their districts. The preconversion difference in ELA achievement was -15.7 percentile points (= 35.5 − 51.1); the postconversion difference in ELA achievement was -13.2 percentile points (= 43.6 − 56.8). Like the analyses described in section F.1.3, all statistical tests were conducted using the original *z*-scores; the arrow symbols and asterisks in Exhibit 5.7 provide information about statistical significance:

- The asterisk (*) next to the preconversion average difference, -15.7, indicates that before conversion the average ELA achievement in magnet schools was statistically different from the average in their districts.
- The asterisk (*) next to the postconversion average difference, -13.2, indicates that after conversion the average ELA achievement in magnet schools was statistically different from the average in their districts.
- The asterisk (*) next to the change in the difference, 2.5 percentile points, indicates that the postconversion average difference was statistically different from the preconversion average difference.

Exhibit F.9. Reprint of Exhibit 5.8. Achievement in Traditional Magnet Schools and Their Districts (Average Across Schools) – ELA



F.4.2. Investigating the Role of Magnet Conversion

This section describes the methods for the CITS analyses of achievement in the magnet schools for research question 3 in Chapter 5. Like the comparison group of schools described in sections F.2.2.1 and F.3.2, the comparison group of schools used in the achievement analysis is the set of elementary public schools in the district that were never charter schools, never magnet schools, and in continuous operation throughout the years of the study. The analysis model used for the CITS analysis in research question 3, however, differed from that used for similar analyses in research questions 2 and 3; details of the model are provided in section F.4.2.1. The exhibits corresponding to the CITS analysis for research question 3, however, were constructed similar to those constructed for the CITS analyses in research question 2; a description follows in section F.4.2.2.

For two reasons, the analysis of the association between conversion and achievement of neighborhood students was limited to traditional magnet schools and, hence, the CITS analysis for research question 3 appears in Chapter 5 but not in Chapter 6. First, the analysis focused on neighborhood students because the challenges in predicting how students from outside the neighborhood might have performed in the absence of conversion were prohibitive.[87] Second, the analysis was limited to traditional magnet schools because neighborhood students in destination schools were already higher achieving than average for their districts before conversion. At destination schools, the policy interest is largely in the students from outside the neighborhood who likely seek attendance at the magnet school because their neighborhood school is underperforming.

F.4.2.1. The Analysis Model. To examine the association between magnet conversion and neighborhood student achievement, the analysis used a CITS approach that predicted the achievement for neighborhood students in study magnet schools had the school not converted, based on the achievement for similar students in neighborhood schools that did not convert. This analysis used the same comparison group as in the analysis for research questions 2 and 3 (described in sections F.2.2 and F.3.2) but was conducted at the student level rather than the school level. Conducting analysis at the student level had two benefits. First, although the analysis included all students in the schools, the model was designed to identify the association of magnet conversion with changes in achievement for neighborhood students rather than students from outside the neighborhood or students for whom a residency status could not be determined. Student-level data were necessary to differentiate between neighborhood students and students from outside the neighborhood. Second, using student-level data made it possible to control for differences in student characteristics across the schools and changes in those characteristics over time. The model can more accurately account for changes in these

[87] The analysis of outcomes for students from outside the neighborhood is more challenging than the analysis of neighborhood student outcomes because students from outside the neighborhood have chosen to attend the magnet school. Those students from outside the neighborhood may have been higher achieving than other similar students because they or their families had prior knowledge that they would benefit most from the specialized theme or instruction of the magnet school. When researchers observe only those who will benefit most from an intervention, as in this case with students from outside the neighborhood, this may introduce selection bias and make it difficult to identify an appropriate comparison group. Analysis of neighborhood students does not suffer from selection bias to the same degree because in general neighborhood students did not choose their neighborhood schools.

characteristics using the information at the student level rather than using the information aggregated to the school level.

The following model was estimated:[88]

$$\Delta Y_{igt} = \sum_{q=1}^{Q} \beta_q X_{qigt} + \sum_{g=4}^{5} \lambda_g + \sum_{s=1}^{S} \delta_s NBH_{igst} + \sum_{s=1}^{S} \phi_s NON_{igst} + \sum_{s=1}^{S} \varphi_s UNK_{igst} + \pi_1 F_{2t} + \pi_2 F_{3t} + \pi_3 F_{4t} + \pi_4 F_{5t} + \pi_5 F_{6t} + \theta_{NBH} NBH_{s=m,t} TREAT_{igst} + \theta_{NON} NON_{s=m,t} TREAT_{igst} + \theta_{UNK} UNK_{s=m,t} TREAT_{igst} + \varepsilon_{igst} \quad \text{(F.6)}$$

where

- ΔY_{igt} is the one-year gain in achievement z-score for student i, in grade g, in year t.
- X_{qigt} is a vector of q student demographic indicators for student i, in grade g, in year t.
- λ_g is a set of grade indicators.
- F_{2t} ... F_{7t} are year indicator variables for Years 2 through 6, respectively.
- NBH_{igst}, NON_{igst}, and UNK_{igst} represent the dosage for school s (proportion of the year spent in school s) for neighborhood students, students from outside the neighborhood, and students with unknown residency status, respectively (see Appendix B for discussion of dosages).
- $NBH_{s=m,t}$, $NON_{s=m,t}$, and $UNK_{s=m,t}$ represent the dosage at each study magnet school for neighborhood students, students from outside the neighborhood, and students with unknown residency status, respectively.
- $TREAT_{igst} = 1$ if school s is an MSAP school in year t when the program was active; 0 otherwise.

The achievement measures used for this CITS analysis were standardized differently than the achievement measures used in the comparisons of magnet schools to their districts. In the analysis comparing magnet schools to their districts, achievement z-scores were standardized relative to a base-year (see section F.1.1). For the construction of the one-year gain in achievement z-score, ΔY_{igst}, achievement z-scores were standardized within year. Hence, the achievement gain scores do not show overall growth in achievement but instead show growth relative to other students in the district.

The first summation term in equation F.6 includes Q student demographic variables (which are further described in Exhibit F.10). The second summation includes grade indicator variables, and

[88] Similar to the CITS used to analyze the concentration of racial/ethnic minority students and economically disadvantaged students for research question 2 (equation F.3), the CITS model shown in equation F.6 also included a trend variable and interaction terms between the trend variables and the TREAT variables. For simplicity, the trend variable is not shown in equation F.6, but the results for the trend are reported in Exhibit I.19 for traditional magnets. As in equation F.3, the coding of the trend variable was designed so that its inclusion in the model would not affect the estimate for the TREAT variable.

the third through fifth contain the enrollment dosages at each of S schools. Note that the model includes separate enrollment dosage coefficients for students depending on the school(s) in which they were enrolled and whether they were enrolled as neighborhood students, students from outside the neighborhood, or students with unknown residency status. The enrollment dosage variables—*NBH, NON,* and *UNK*—indicate the proportion of the test-to-test year that student i was enrolled at school s as a neighborhood student, as a student from outside the neighborhood, or as a student with unknown residence status, respectively. The variables F_{jt}, $j = 2, 3,\ldots 6$ are year dummies that capture districtwide time trends in a flexible way.[89] The analysis allowed for clustering at the school-level based on the school in which each student was enrolled for the greatest part of the test-to-test school year. Exhibit F.10 shows the list of student characteristics in the vector X.

Exhibit F.10. Student-Level Characteristics Included as Control Variables in Equation F.6

Variable	Details on Coding
Age	Two indicators for greater than and less than the normal two-year age range for the grade
Free or reduced-price lunch eligibility	Indicator for eligibility for free or reduced-price lunch (not available for Districts G, J, and K)
Special education	Indicator for designation as a special education student—typically students with an individualized education program
ELL	Indicator for designation as an ELL
Race or ethnicity	Indicators for Asian, black, Hispanic, or other
Gender	Indicator for females
Parental education	Indicators for level of parental education: not high school graduate, high school graduate, some college, college graduate, and graduate school (data available only for District J)

The coefficient θ_{NBH} in equation F.6 is the estimated coefficient on the interaction between the indicators for neighborhood students and for attending a conversion magnet school after it had converted. The coefficient is interpreted as the average change in annual achievement gain associated with magnet conversion for neighborhood students. As noted in equation F.6, we estimated similar coefficients for those who were enrolled in study magnet schools as for students from outside the neighborhood (θ_{NON}) and with unknown residence status (θ_{UNK}) but did not report them. In particular, for students from outside the neighborhood, there is a potential bias in the estimate θ_{NON} due to self-selection: Students from outside the neighborhood may have been more likely to choose to enroll at an MSAP school if they believed they were likely to benefit from the school's specialized theme or instructional practice.

F.4.2.1.1 Power Analysis for CITS Estimates. Exhibit F.11 shows the post-hoc MDE for the average relationship between magnet conversion and ELA and mathematics achievement

[89] There is no year dummy for Year 1 because no gain in test score is available in that year. We also exclude a year dummy in Year 2 because otherwise the sum of the year dummies would be perfectly collinear with the grade dummies that already take the place of the intercept.

reported in Chapter 5 (Exhibits 5.8 and 5.9 for ELA and mathematics estimates).[90] As described in section F.2.2.3.1 for research question 2, the estimated MDE is derived from the empirical standard errors from the models multiplied by a factor of 2.8. This calculation is based on a two-sided *t*-test of each coefficient at the 5 percent level, with a power of 0.8.

Exhibit F.11. MDE for Estimates of the Role of Magnet Conversion in ELA and Mathematics Achievement for Neighborhood Students in Traditional Magnet Schools (Alpha = 0.05, Power = 0.8)

Subject	Standard Error	MDE
ELA gain (*z*-score units)	0.052	0.14
Mathematics gain (*z*-score units)	0.047	0.13

SOURCE: District administrative data.

F.4.2.2. Displays. The exhibits reporting results for the CITS analysis of achievement for research question 3 in Chapter 5 *were constructed in the same manner as the exhibits for the CITS analysis for research question 2 (as described in sections F.2.2.4 and F.3.2). A few extra steps were required, however, because the analyses were conducted using z-score gains, but the exhibits report gains in percentiles.*

In the analysis, an annual gain is defined as the change in a student's achievement from one grade to the next (e.g., from grade 3 to grade 4). One complication in presenting results as a percentile gain was that the transformation of a gain in *z*-score to a gain in percentiles depends on the prior achievement level (i.e., the *z*-score in the starting grade). Transforming an average *z*-score gain into percentile units required the identification of a prior achievement level to use as the basis for transforming each measure. To ensure that the relative ranking of average *z*-score gains, as used in the exhibits, was preserved after transforming the *z*-score gains into percentile gains, it was necessary to use the same prior achievement *z*-score for each point in the graph that was transformed.[91] For simplicity, it was assumed that the prior achievement for each average *z*-score gain in the first column of F.10 was at the middle of the distribution, which would be a prior *z*-score of 0.0 (or in percentile terms, a prior achievement at the 50th percentile). Hence, the annual gain was interpreted as change from a prior *z*-score of 0 to a current *z*-score of "0 plus the estimated gain."

This process is captured in equation F.7:

$$\text{Percentile gain} = \text{percentile}(\text{ZCurrentAchievement}) - \text{percentile}(\text{ZPriorAchievement})$$

[90] As described later in section F.5.2, the CITS estimates reported in Exhibits 5.8 and 5.9 were converted from *z*-score units to percentile gain units. The standard errors and MDEs reported in Exhibit F.10 are in *z*-score gain units. For comparison purposes, the ELA gain CITS estimate (Exhibit 5.8) in *z*-score units was -0.033 and the mathematics gain CITS estimate was 0.002.

[91] To illustrate why the *z*-score for average prior achievement matters, consider a student with a *z*-score gain of 0.1 from third to fourth grade. If the student started with a *z*-score of 0.0 in third grade, leading to a *z*-score of 0.1 in fourth grade, the student would move from the 50th to the 54th percentile, a gain of 4 percentile points. If the student started with a *z*-score of -1.0 in third grade, leading to a *z*-score of -0.9 in fourth grade, the student would move from the 16th percentile in third grade to the 18.4th percentile in fourth grade, a gain of 2.5 percentile points.

$$
\begin{aligned}
&= \text{percentile}(\text{ZGain} + \text{ZPriorAchievement}) \\
&\qquad\qquad - \text{percentile}(\text{ZPriorAchievement}) \\
&= \Phi(\text{ZGain} + \text{ZPriorAchievement}) - \Phi(\text{ZPriorAchievement}) \\
&= \Phi(\text{ZGain} + 0) - \Phi(0) \\
&= \Phi(\text{ZGain}) - 50 \qquad\qquad \text{(F.7)}
\end{aligned}
$$

where

- ZCurrentAchievement = achievement in the current grade in *z*-scores
- ZPriorAchievement = achievement in the prior grade in *z*-scores (assumed to be 0)
- ZGain = the gain from the prior to the current grade in *z*-scores
- $\Phi(.)$ = the standard normal CDF function

Exhibit F.12, reprinted from Exhibit 5.9, displays the ELA achievement results in percentile gain units. Exhibit F.13 provides details on how the numbers were derived. The first column of F.12 contains the numbers as originally calculated using z-score gains. The second column provides the derivation for each of the numbers in the first column following the procedure described in section F.2.2.4. The third column has the corresponding numbers from the first column expressed as percentile gains (as reported in Exhibit F.12). The first three rows of Exhibit F.13 correspond to the 3 points in the display and the final row contains the CITS estimate (displayed as the change associated with conversion in the Exhibit F.12).

Exhibit F.12. Reprint of Exhibit 5.9. The Role of Magnet Conversion in ELA Achievement for Neighborhood Students in Traditional Magnet Schools (Average Across Schools)

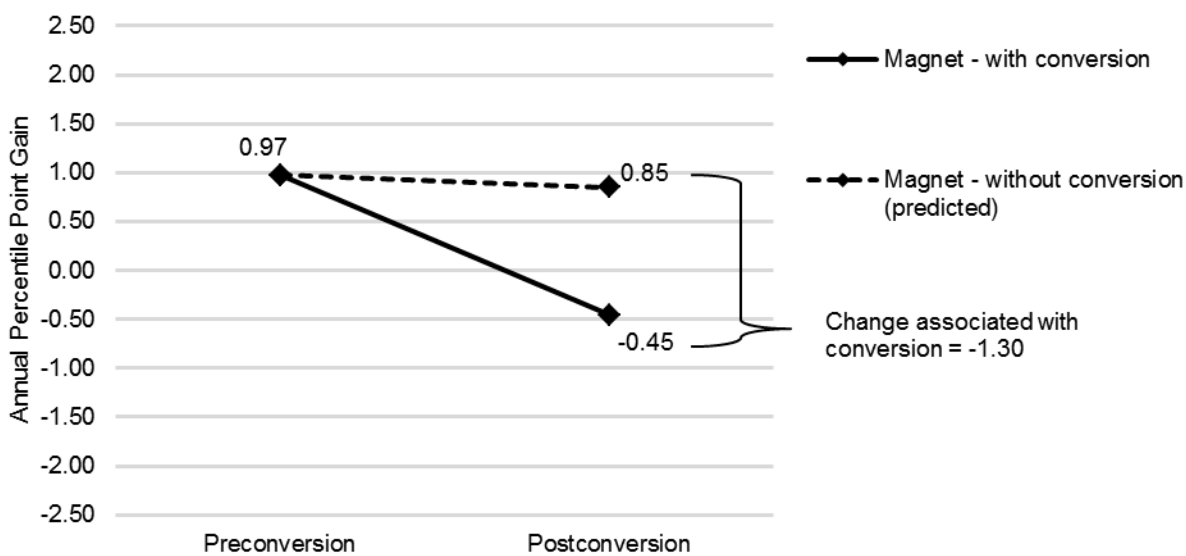


Exhibit F.13. Average Annual Percentile Point Gain in ELA for Neighborhood Students, for Traditional Magnet Schools and Neighborhood Schools That Did Not Convert, in *z*-Score and Percentile Terms

Component	Annual z-Score Gain		Annual Percentile Gain Equivalent	
	Number	**Derivation**	**Number**	**Derivation**
Study magnet schools: Preconversion	0.02	Equation F.1 with annual *z*-score gain as dependent variable	0.97	Computed Based on z-Score Gain: Φ(ZScoreGain) − 50
Study magnet schools: Postconversion	-0.01	Equation F.1 with annual *z*-score gain as dependent variable	-0.45	Computed Based on z-Score Gain: Φ(ZScoreGain) − 50
Study magnet schools: Postconversion (without conversion, predicted)	0.02	(Study magnet postconversion) − (CITS estimate)	0.85	Computed Based on z-Score Gain: Φ(ZScoreGain) − 50
CITS estimate	-0.03	*M* estimated from equation F.6	-1.30	Computed as Postconversion Study Magnet—With Conversion − Postconversion Study Magnet—Without Conversion (Predicted), Both in Percentile Units

The *z*-scores shown in Exhibit F.13 were computed exactly as described in Exhibit F.7. Equation F.7 was then used to transform the first three *z*-score values shown in Exhibit F.13 into percentiles.

The CITS estimate shown in the final row of Exhibit F.13 was converted to percentiles by subtraction rather than by using equation F.7. The CITS estimate, by design, is the difference between the magnet schools postconversion actual average gain and the predicted average gain had the schools not converted. Hence, once these two numbers were transformed from *z*-scores into percentiles, the difference between them provided the CITS estimate in percentile form. In Exhibit F.12, the CITS estimate appears as an annual percentile gain of -1.3 percentile points, obtained by subtracting the magnet school predicted postconversion average (0.85) from the magnet school actual postconversion average (-0.45).

F.5. Potential for Bias in the CITS Estimates for Concentrations of Students From Minority Racial/Ethnic and Economically Disadvantaged Backgrounds

A somewhat unusual feature of the CITS estimate for student diversity is that movements of students from the other neighborhood public schools to the magnet school also affect changes in the dependent variable—AVD in equation F.3—for the other neighborhood schools (schools in the district that did not convert to magnet schools). Magnet schools by design are intended to draw students from other schools in the district. If magnet schools are successful in drawing such students, one would expect a change in the composition of other neighborhood schools. Thus, if the magnet schools are effective, the difference across time for the other neighborhood schools will not quite equal zero, all else held constant, as assumed by the study's CITS methods.

This possible impact on other neighborhood public schools can create a bias in the estimator because the motivation for using CITS is that any change in other neighborhood schools would be wholly unrelated to the change in study schools. It is easiest to show the source of the bias by calculating the CITS as a difference in differences as shown in Exhibit F.14. The regression framework that we actually used (equation F.3) was slightly different than the simplification in Exhibit F.14 (equation F.3 controlled for year effects, whereas calculations in Exhibit F.14 do not), but it produced something very similar.

Exhibit F.14. Schematic Diagram of How the CITS Estimate Is Calculated as a Difference in Differences

Group	Period-Specific Outcomes		Difference
	Postconversion	Preconversion	
Magnet schools	A	B	$A - B$
Comparison schools	C	D	$C - D$
Difference	$A - C$	$B - D$	$(A - B) - (C - D)$

To restate the problem in terms of the notation used in Exhibit F.14, the model calculates $A - B$ correctly, but $C - D$ will be shown to be a second-order bias because, in the postconversion period, the proportion of students from minority racial/ethnic or economically disadvantaged backgrounds in the other neighborhood schools is changed slightly by movements of students to the study magnet school.

Suppose that in the absence of the magnet school there would be no districtwide trends in the average across other neighborhood schools of the dependent variable—that is, in the absolute value of the difference between the proportion of racial/ethnic minority students, for example, in each neighborhood school and in the district. In this case, we would obtain $C - D = 0$.[92] Instead, however, if the magnet school is effective, $C - D$ may be biased away from zero because of the impact of the study magnet school on the other neighborhood schools' set of students.

The magnitude of the bias in $C - D$ can be calculated with the help of some notation. Let there be N other neighborhood public schools, with school $N + 1$ being the magnet school. Further, let

- m_i = number of minority students at school i
- w_i = number of nonminority students at school i

and suppose that in the postconversion period, some number $\gamma_j > 0$ of nonminority students leave other neighborhood school j, $j \in (1, N)$, and enroll in the magnet school.

Let ρ = proportion of racial/ethnic minority students in the district:

$$\rho = \frac{\sum_{i=1}^{N+1} m_i}{\sum_{i=1}^{N+1}(m_i + w_i)} \qquad \text{(F.8)}$$

And, let ρ_i = proportion of racial/ethnic minority students in school i:

$$\rho_i = \frac{m_i}{m_i + w_i} \qquad \text{(F.9)}$$

For school i, our measure of absolute value of the difference between the school and the district is as follows:

$$ABS_i = |\rho_i - \rho| \qquad \text{(F.10)}$$

Now, suppose the following:

- In the study magnet school, school $N + 1$, γ_j nonminority students are attracted to the school after conversion from school $j \in (1, N)$ (i.e., γ_j nonminority students move from school j to the study school $N + 1$).
- No other students change schools.
- The proportion of racial/ethnic minority students in the district does not change.

[92] If there were time trends in the average value across schools of our measure of imbalance, it would complicate the calculations slightly but would not change the result, under the assumption maintained in a CITS analysis of parallel trends in the comparison and treated schools. In such a case, the change in the later period, say, Q, would be added to both A and C and therefore would be first-differenced out in the calculation of $(A - B) - (C - D)$. Similarly, our assumption that a single school sends all the students to the magnet school does not matter. As long as all sending schools are either greater or less than the district concentration of racial/ethnic minority students, the result will be identical to that shown here.

The CITS estimate of the change in diversity is as follows:

$$\Delta_{CITS} = \Delta_{N+1} - \Delta_{Comparison} \tag{F.11}$$

where the first term is $A - B$, showing the change at the study magnet school, and the second term subtracts $C - D$, which represents the change at the comparison schools.

At the study magnet school $N + 1$,

$$\begin{aligned}\Delta_{N+1} &= ABS_{N+1,t+1} - ABS_{N+1,t} = \left|\rho_{N+1,t+1} - \rho\right| - \left|\rho_{N+1,t} - \rho\right| \\ &= \left|\frac{m_{N+1}}{m_{N+1}+w_{N+1}+\gamma_j} - \rho\right| - \left|\frac{m_{N+1}}{m_{N+1}+w_{N+1}} - \rho\right|\end{aligned} \tag{F.12}$$

There are two cases for Δ_{N+1}:

- Case 1 (typical case): $\rho_{N+1,t} > \rho$ (i.e., the study magnet school has a higher proportion of students from minority racial/ethnic backgrounds than the district)

$$\begin{aligned}\Delta_{N+1} &= \left|\frac{m_{N+1}}{m_{N+1}+w_{N+1}+\gamma_j} - \rho\right| - \left|\frac{m_{N+1}}{m_{N+1}+w_{N+1}} - \rho\right| \\ &= \frac{m_{N+1}}{m_{N+1}+w_{N+1}+\gamma_j} - \rho - \left(\frac{m_{N+1}}{m_{N+1}+w_{N+1}} - \rho\right) \\ &= \frac{-m_{N+1}\gamma_j}{(m_{N+1}+w_{N+1}+\gamma_j)(m_{N+1}+w_{N+1})} < 0\end{aligned} \tag{F.13}$$

  Thus imbalance falls at the study magnet school when γ_j nonminority students move from school j to the study school $N + 1$. (This ignores the unlikely possibility that so many nonminority students transfer that the study magnet school now has a lower value for proportion of racial/ethnic minority students than the district.)

- Case 2 (atypical case): $\rho_{N+1,t} \leq \rho$ (i.e., the study magnet school has equal or lower proportion of racial/ethnic minority students than the district)

  In this case,

$$\Delta_{N+1} = \frac{m_{N+1}\gamma_j}{(m_{N+1}+w_{N+1}+\gamma_j)(m_{N+1}+w_{N+1})} > 0 \tag{F.14}$$

  Thus the absolute value of the difference rises at the study magnet school when γ_j nonminority students move from school j to the study school $N + 1$.

  Next, the key question is the sign of $-\Delta_{Comparison}$ in equation F.11:

$$\Delta_{CITS} = \Delta_{N+1} - \Delta_{Comparison}$$

It is assumed that the average school deviation from the district mean has not shown a trend, so that $C - D = 0$ is what should be obtained from the other neighborhood schools were there no bias. But the actual value will differ due to some nonminority students leaving school j for the study magnet school. Hence, the sign and magnitude of $-\Delta_{Comparison}$ in this example will constitute the bias.

Let there be an indicator variable—SENDING%MIN

- = 1 if the sending school has a proportion of racial/ethnic minority students less than or equal to the district average
- = -1 if the sending schools has a proportion of racial/ethnic minority students greater than the district average

Proposition: The value of $C - D$ depends on the numbers of minority and nonminority students at sending comparison school j, the number of nonminority students who transfer, and, importantly, the number of other neighborhood schools. The magnitude of bias in the estimated association between change in imbalance and magnet conversion will be as follows:

$$BIAS \equiv -\Delta_{CITS} = \text{ SENDING\%MIN} \frac{1}{N} \frac{\gamma_j m_j}{(m_j + w_j)(m_j + w_j - \gamma_j)} \qquad \text{(F.15)}$$

Thus the sign of the bias in the difference in difference estimated is the same as the sign of SENDING%MIN.

Proof: The bias is given by the extent to which the change in the other neighborhood public schools deviates from zero.

$$\Delta_{Comparison} = \frac{1}{N} \sum_{i=1}^{N} \{ |\rho_{i,t+1} - \rho| - |\rho_{i,t} - \rho| \} = \frac{1}{N} \{ |\rho_{j,t+1} - \rho| - |\rho_{j,t} - \rho| \} \qquad \text{(F.16)}$$

because only school j undergoes a change.

- Case 1' (typical case): $\rho_{j,t} \leq \rho$ (i.e., sending neighborhood school has a lower proportion of racial/ethnic minority students than the district)

$$\Delta_{Comparison} = \frac{1}{N} \{ (\rho - \rho_{j,t+1}) - (\rho - \rho_{j,t}) \}$$

$$= \frac{1}{N} \left\{ \frac{m_j}{m_j + w_j} - \frac{m_j}{m_j + w_j - \gamma_j} \right\}$$

$$= \frac{1}{N} \left\{ \frac{-\gamma_j m_j}{(m_j + w_j)(m_j + w_j - \gamma_j)} \right\} < 0 \qquad \text{(F.17)}$$

Thus school j has become less imbalanced as the proportion of racial/ethnic minority students increases.

But in $\Delta_{CITS} = \Delta_{N+1} - \Delta_{Comparison,}$ changes at school *j* imply that $\Delta_{CITS} > \Delta_{N+1}$, because $-\Delta_{Comparison} > 0$. There is a positive bias equal to $-\Delta_{Comparison}$.

- Case 2' (atypical case): $\rho_{j,t} > \rho$ (i.e., comparison sending school has a higher proportion of racial/ethnic minority students than the district)

$$\Delta_{Comparison} = \frac{1}{N}\left\{\frac{\gamma_j m_j}{(m_j+w_j)(m_j+w_j-\gamma_j)}\right\} > 0 \qquad \text{(F.18)}$$

School *j* has become more imbalanced as the proportion of racial/ethnic minority students increased even greater than the district average, but $-\Delta_{Comparison} < 0$ indicates a drop in imbalance. There is a negative bias equal to $\Delta_{Comparison}$.

Putting the two cases together leads directly to equation F.12.

The most important insight from this proposition is that the bias is proportional to 1/*N*. On average, in the study data, *N* = 65.

Here is a numerical example. Let initial enrollment at the sending school *j* be as follows:

- m_j = number of minority students at school *j* =150
- w_j = number of nonminority students at school *j* = 300

And let initial enrollment at the study magnet school *N* + 1 be as follows:

- m_{N+1} = number of minority students at school *N* + 1 = 300
- w_{N+1} = number of nonminority students at school *N* + 1 = 150

In our actual sample, the increase in the share of students who are from outside the neighborhood at the magnet school is about 7.5 percent on average. If the magnet school has 450 students with 300 minority and 150 nonminority students, then about 34 nonminority students (about 7.5 percent of 450) would transfer from school *j*.

In this case,

$$BIAS = -\Delta_{Comparison} = -\frac{1}{N}\left\{\frac{-m_j\gamma_j}{(m_j+w_j)(m_j+w_j-\gamma_j)}\right\}$$

$$= \frac{1}{65}\left\{\frac{34*150}{(150+300)(150+300-34)}\right\} = 0.000419 \qquad \text{(F.19)}$$

At the magnet school, N + 1, then,

$$\Delta_{N+1} = \frac{-m_{N+1}\gamma_j}{(m_{N+1}+w_{N+1}+\gamma_j)(m_{N+1}+w_{N+1})}$$

$$= \frac{-34*150}{(300+150+34)(300+150)} = -0.02342 \qquad \text{(F.20)}$$

If BIAS = 0.000419 and the true effect $(A - B)$ = 0.02342, then the absolute value of the bias as a percentage of the true effect is

$$100 \times \frac{0.000419}{0.02342} = 1.79\% \tag{F.21}$$

In this case, the bias is small.

More generally, one can calculate the absolute value of the bias as a proportion of the overall "true" CITS estimate by dividing the absolute value of the bias in equation F.12 by the absolute value of the expression for the magnet school change in equation F.13 or F.14. Call this proportional bias PropBias:

$$PropBias = \frac{1}{N}\frac{\frac{m\gamma_j}{(m_j+w_j)(m_j+w_j-\gamma_j)}}{\frac{m_{N+1}\gamma_j}{(m_{N+1}+w_{N+1}+\gamma_j)(m_{N+1}+w_{N+1})}} \tag{F.22}$$

This equation makes clear that a variety of parameters will affect the bias as a proportion of the actual change in the magnet school: the number of nonminority students who transfer, the number of minority and nonminority students at the sending school, *j,* and at the magnet school, $N + 1$. But most important by far, the absolute value of the bias as a proportion of the actual magnet school change in imbalance is proportional to $1/N$, where N is the number of other neighborhood public schools. The movement of nonminority students decreases the minority share by roughly N times as much at the magnet school as it increases the minority share on average at the N other neighborhood schools. This is the essential reason why the bias will be limited.

F.6. Potential Explanations for the ELA Achievement Results Presented in Chapter 5

In Chapter 5, the analysis of ELA achievement levels (Exhibit 5.8) found that achievement levels in traditional magnet schools increased after conversion relative to their districts, while the analysis of annual ELA achievement gains (Exhibit 5.9) found a negative, but not significant, association between conversion and neighborhood students' annual gains in ELA achievement. One hypothesis that might explain this pattern of results was provided in the chapter: the traditional magnet schools might have attracted academically stronger neighborhood students to the schools after conversion, who otherwise would have attended other school choice options.

It is difficult to test this hypothesis, because it would require data on students' achievement before they entered magnet schools which we cannot have for most students because not all grades were assessed (e.g., we typically can only observe three years of test scores for students). Three other potential explanations were explored, however, pertaining to differences in the way the samples were defined for the analysis of achievement levels and gains.

1. The analysis of achievement levels in Exhibit 5.8 compared magnet schools to all schools in the district, including other magnet and charter schools, while the analysis of gains in Exhibit 5.9 included only neighborhood schools that did not convert.

2. The comparison of achievement levels in magnet schools to the district in Exhibit 5.8 included all students, while the comparison of gains to students in neighborhood schools in Exhibit 5.9 was specific to neighborhood students.

3. The sample of students with an annual gain score differed from the sample of students with a current year test score, because gain scores require the students to have both a current year score and a prior year score, and some students were missing a prior year score.

To test whether these differences in the sample might have accounted for the pattern of results observed, the relevant analyses were conducted using a common sample. For example, to test explanation 1, the average preconversion and postconversion annual achievement gains for magnet schools were compared to their districts, the same comparison group used in the analysis in Exhibit 5.8. The result was that even when ELA achievement gains in magnet schools were compared to ELA achievement gains in their districts, a similar difference in results was found: While the analysis of ELA levels showed an increase in magnet schools relative to their districts, the analysis of ELA gains showed a decrease relative to their districts. For each of the explanations listed, the difference in results was similar when a common sample was used, implying that differences in the sample do not explain the observed patterns.

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Appendix G: Subgroup Analyses

G.1. Variation in the Relationship Between Magnet Conversion and Student Achievement by Demographic Subgroup

The components of the magnet conversion implemented at a school, such as the specialized curricula or instructional practices, may have different relationships with achievement for different types of students. To supplement the achievement CITS analysis reported in Chapter 5, the study examined whether the estimated effects of conversion might differ for the following subgroups:

- Minority and nonminority students
- Disadvantaged and nondisadvantaged students
- Students with disabilities (SWDs) and students who were not SWDs
- Students who were ELLs and students who were not ELLs

This analysis was conducted for traditional magnet schools only, because the number of destination schools (four) was too small to support the analysis.

To examine results for subgroups, equation G.1 was used, a modification of the main achievement CITS regression model (equation F.6 in Appendix F.4.2.1). The model was estimated separately for each of the four sets of subgroups listed previously. In equation G.1, *S*1 indicates one of the subgroups in each pair listed earlier (e.g., the minority subgroup) and *S*2 indicates the other (e.g., the nonminority subgroup).

$$\begin{aligned}\Delta Y_{igt} = {} & \sum_{q=1}^{Q} \beta_q X_{qigt} + \sum_{g=2}^{5} \lambda_g + \sum_{s=1}^{S} \delta_s RES_{igst} + \sum_{s=1}^{S} \phi_s NON_{igst} + \sum_{s=1}^{S} \varphi_s UNK_{igst} + \\ & \pi_1 F_{3t} + \pi_2 F_{4t} + \pi_3 F_{5t} + \pi_4 F_{6t} + \pi_5 F_{7t} + \\ & \theta_{RES}^{S1} RES_{s=m,t} TREAT_{igst} + \theta_{NON}^{S1} NON_{s=m,t} TREAT_{igst} + \theta_{UNK}^{S1} UNK_{s=m,t} TREAT_{igst} \\ & \theta_{RES}^{Dif12} RES_{s=m,t} TREAT_{igst} S2_{igst} + \theta_{NON}^{Dif12} NON_{s=m,t} TREAT_{igst} S2_{igst} + \\ & \theta_{UNK}^{Dif12} UNK_{s=m,t} TREAT_{igst} S2_{igst} + \varepsilon_{igst} \end{aligned} \qquad \text{(G.1)}$$

where

- $S2_{igst}$ = 1 if student *s* is in subgroup *S*2 and 0 otherwise[93]
- θ_{RES}^{S1} = the estimate of the relationship of change in achievement gain and magnet conversion for neighborhood students in subgroup *S*1
- θ_{RES}^{Dif12} = the estimated difference between the relationship for subgroup *S*1 and subgroup *S*2

[93] Indicators for the subgroups also are included among the demographic variables in the X_{qigst} term as discussed in Appendix F.

Separate estimates of the association between achievement and magnet conversion were obtained for subgroup *S*2 by modifying equation G.1 to use *S*1 as the interaction variable:

$$\Delta Y_{igt} = \sum_{q=1}^{Q} \beta_q X_{qigt} + \sum_{g=2}^{5} \lambda_g + \sum_{s=1}^{S} \delta_s RES_{igst} + \sum_{s=1}^{S} \phi_s NON_{igst} + \sum_{s=1}^{S} \varphi_s UNK_{igst} + \pi_1 F_{3t} + \pi_2 F_{4t} + \pi_3 F_{5t} + \pi_4 F_{6t} + \pi_5 F_{7t} + \theta_{RES}^{S2} RES_{s=m,t} TREAT_{igst} + \theta_{NON}^{S2} NON_{s=m,t} TREAT_{igst} + \theta_{UNK}^{S2} UNK_{s=m,t} TREAT_{igst} + \theta_{RES}^{Dif21} RES_{s=m,t} TREAT_{igst} S1_{igst} + \theta_{NON}^{Dif21} NON_{s=m,t} TREAT_{igst} S1_{igst} + \theta_{UNK}^{Dif21} UNK_{s=m,t} TREAT_{igst} S1_{igst} + \varepsilon_{igst} \qquad \text{(G.2)}$$

where

- $S1_{\mathrm{igst}}$ = 1 if student *s* is in subgroup *S*1 and 0 otherwise
- θ_{RES}^{S2} = the estimate of the relationship of change in achievement gain and magnet conversion for neighborhood students in subgroup *S*2

In equations G.1 and G.2, the coefficients $\theta_{RES}^{Dif21} = -\theta_{RES}^{Dif12}$ by construction.

Analysis of results across all traditional study magnet schools was conducted using the same meta-analysis techniques used for results reported in Chapters 5 and 6 and described in Appendix F.2.2.3. The meta-analysis was conducted separately first using the θ_{RES}^{S2} coefficients from each district and then the θ_{RES}^{Dif21} coefficients.

G.2. Results by Demographic Subgroup

Meta-analysis results by subgroup are presented in Exhibit G.1. The estimated relationship between magnet conversion and achievement gains for neighborhood students was not statistically significant for any subgroup. The difference between subgroups in the relationship between magnet conversion and achievement gains for neighborhood special education students compared to nonspecial education students was statistically significant. However, because the estimates were not significant for either subgroup, this finding was not explored further or included in the body of the report.

Exhibit G.1. Estimates of the Role of Magnet Conversion in ELA and Mathematics Achievement for Neighborhood Students in Traditional Magnet Schools, by Subgroup and Difference Between Complementary Subgroups

Subgroup	ELA *Estimate* (*p*-value)	Mathematics *Estimate* (*p*-value)
Minority	-0.03 (0.504)	# (0.999)
Nonminority	0.06 (0.457)	0.05 (0.122)
Difference	-0.09 (0.353)	-0.06 (0.067)
Disadvantaged	-0.06 (0.357)	-0.01 (0.851)
Nondisadvantaged	-0.05 (0.550)	-0.05 (0.466)
Difference	# (0.974)	0.02 (0.515)
ELL	-0.08 (0.200)	-0.04 (0.407)
Non-ELL	-0.03 (0.667)	0.01 (0.846)
Difference	-0.06 (0.149)	-0.05 (0.108)
Special education	-0.07 (0.295)	0.06 (0.406)
Nonspecial education	-0.03 (0.564)	# (0.925)
Difference	-0.06* (0.001)	0.05 (0.541)

* = statistically significant ($p < 0.05$). # = rounds to zero.

NOTE: ELA and mathematics achievement measures are annual *z*-score gains. N = 17 study magnet schools in 10 districts except for analysis of disadvantaged and nondisadvantaged where N = 11 study magnet schools in seven districts.

SOURCE: District administrative data.

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Appendix H: Sensitivity Analyses for CITS Findings

H.1. Sensitivity Analysis for Diversity CITS Findings

The theory of action underlying magnet conversion contends that schools undergoing magnet conversion will be able to attract students from outside the neighborhood attendance zone, which will increase the schools' racial/ethnic or socioeconomic diversity. However, the theory of action depends on the assumption that a pool of students exists elsewhere in the district who could be attracted to the magnet schools and make the schools more diverse.

As shown Exhibit 3.1, three traditional magnet schools were in study districts (one in district A, one in district B for the 2004 cohort, and one in district B for the 2007 cohort) that had a high proportion of students from minority racial/ethnic backgrounds in the year prior to conversion (more than 80 percent), which may have made it difficult for the study magnet schools in these districts to attract large numbers of nonminority students because there were few such students to attract. In addition, one destination study school was in a district (district F) that had a low proportion (less than 20 percent) of racial/ethnic minority and disadvantaged students. The sensitivity of analysis results to the inclusion of these schools in the study was investigated by conducting the analyses for research questions 2 and 3 in Chapters 5 and 6 after dropping these schools from the study sample.

Exhibit H.1 shows that dropping these schools from the analysis did not change the pattern of statistically significant results, except in one case, discussed below. For the concentration of minority students in traditional magnet schools, the results of the primary and sensitivity analyses were similar: magnet conversion was statistically significantly associated with bringing the proportion of students from a racial/ethnic minority background in the traditional magnet schools closer to the district proportion. For the proportion of students from economically disadvantaged backgrounds in traditional magnet school, a sensitivity test was not conducted because no conversion magnet schools were located in districts that had a high proportion of economically disadvantaged students.

For the proportion of racial/ethnic minority students in destination magnet schools, the estimated association between magnet conversion and change in the concentration of minority students was not statistically significant in either the primary or sensitivity analysis. For the proportion of students from economically disadvantaged backgrounds in destination magnet schools, the primary estimate (including all four destination schools) was negative and not statistically significant. The sensitivity estimate (which removed one of the destination schools) also was negative, but larger in magnitude and statistically significant, indicating that magnet conversion was associated with bringing the proportion of economically disadvantaged students in the destination magnet schools closer to the district proportion.

Exhibit H.1. Primary Estimates of the Role of Magnet Conversion in the Concentration of Racial/Ethnic Minority and Economically Disadvantaged Students (as Reported in Chapters 5 and 6) and Results of Sensitivity Analyses Dropping Schools in Districts With Small Populations of Students Whom the Schools Were Trying to Attract, for Traditional and Destination Schools

Analysis	Traditional (Chapter 5)		Destination (Chapter 6)	
	Absolute Value of the Difference in Minority Concentration *Estimate* (*p*-value)	Absolute Value of the Difference in Disadvantaged Concentration *Estimate* (*p*-value)	Absolute Value of the Difference in Minority Concentration *Estimate* (*p*-value)	Absolute Value of the Difference in Disadvantaged Concentration *Estimate* (*p*-value)
Primary estimate (%)	-1.90* (0.01)	-2.51 (0.12)	-1.14 (0.54)	-5.68 (0.07)
Sensitivity analysis—Dropping schools in districts with small populations of students whom the schools were trying to attract (%)	-2.25* (0.04)	(†)	1.22 (0.20)	-7.82* (0.01)

* = statistically significant with $p < 0.05$, two-tailed test. † = Not applicable; no schools were excluded in sensitivity analysis.

NOTE: For traditional schools: N = 17 study magnet schools in 10 districts for the AVD_M primary estimate and N = 14 study magnet schools in eight districts for the AVD_M sensitivity analysis; N = 11 study magnet schools in seven districts for the AVD_D primary estimate. For destination schools: N = 4 study magnet schools in three districts for the AVD_M primary estimate and N = 3 study magnet schools in two districts for the AVD_M sensitivity analysis; N = 4 study magnet schools in three districts for the AVD_D primary estimate and N = 3 study magnet schools in two districts for the AVD_D sensitivity analysis. AVD is the absolute value of the difference between a school's concentration and the district's concentration.

SOURCE: District administrative data.

H.2. Sensitivity Analysis for Achievement CITS Findings

The achievement CITS analysis (research question 3 in Chapter 5, comparison to neighborhood schools in the district that did not convert) incorporated student dosage variables that measured the proportion of the year that students were enrolled in each school within the district. To check the sensitivity of study results to this specification, a sensitivity analysis was conducted in which students were assigned to only one school per year based on their school of maximum enrollment dosage. Modifying the model to allow for this change involved replacing the school-specific enrollment dosage variables *RES, NON,* and *UNK* in the original equation (see equation F.6 in Appendix F.4.2.1) with 0/1 dummy indicators *RESDUM, NONDUM,* and *UNKDUM* denoting which school a student attended longest each year as a neighborhood student, student from outside the neighborhood, or student with unknown residency, respectively. Equation H.1 provides the model used for this sensitivity check:

$$\begin{aligned}\Delta Y_{igt} = {} & \textstyle\sum_{q=1}^{Q} \beta_q X_{qigt} + \sum_{g=2}^{5} \lambda_g + \\ & \sum_{s=1}^{S} \delta_s RESDUM_{igst} + \sum_{s=1}^{S} \phi_s NONDUM_{igst} + \sum_{s=1}^{S} \varphi_s UNKDUM_{igst} + \\ & \pi_1 F_{3t} + \pi_2 F_{4t} + \pi_3 F_{5t} + \pi_4 F_{6t} + \pi_5 F_{7t} + \\ & \theta_{RES} RESDUM_{s=m,t} TREAT_{igst} + \theta_{NON} NONDUM_{s=m,t} TREAT_{igst} + \\ & \theta_{UNK} UNKDUM_{s=m,t} TREAT_{igst} + \varepsilon_{igst} \end{aligned} \qquad \text{(H.1)}$$

where

- θ_{RES} = estimate of the average relationship of change in achievement gain and magnet conversion for neighborhood students.

The results of the primary analysis and the sensitivity analysis for student achievement appear in Exhibit H.2. The alternative specification did not change the results. Like the primary estimates, in the sensitivity analysis, the estimated relationship between conversion and change in the annual achievement gain in ELA and mathematics was close to zero and not statistically significant.

Exhibit H.2. Primary Estimates of Role of Magnet Conversion in ELA and Mathematics Achievement for Neighborhood Students in Traditional Magnet Schools (as Reported in Chapters 5) and Results of Sensitivity Analyses for Achievement Outcomes Where Students Were Assigned to Only One School per Year

Analysis	ELA Estimate (p-value)	Mathematics Estimate (p-value)
Primary estimate (*z*-score equivalent of results reported in Chapter 5)	-0.03 (0.52)	# (0.97)
Sensitivity analysis—assigning students to school of maximum enrollment dosage (percentile points)	-0.03 (0.67)	0.01 (0.87)

* = statistically significant with $p < 0.05$, two-tailed test.

NOTE: # = Rounds to zero. N = 17 study magnet schools in 10 districts. The dependent variable was the annual change in a student's achievement *z*-score.

SOURCE: District administrative data.

Appendix I: Supporting Exhibits for Chapter 5

This appendix provides additional details for the results presented in Chapter 5. For each exhibit in Chapter 5, the appendix contains one or more supporting exhibits with the estimates in Chapter 5 and *p*-values for each statistical test. In addition, for the analyses comparing change in magnet schools and neighborhood public schools (CITS analysis), two additional supporting exhibits are provided. The first (e.g., Exhibit I.5) contains baseline averages showing the mean of the key variables (percentage minority, percentage disadvantaged, average ELA and mathematics annual gain) for each magnet conversion school and the other neighborhood schools in its district for the year just before conversion. The second (e.g., Exhibit I.7) is a "forest" plot of results from the meta-analysis. The plot displays the estimate of the association between magnet conversion and change in the outcome for each district separately and for the average across districts, along with 95-percent confidence intervals. The final section provides the estimates of the trend over the postconversion period in the association between outcomes and magnet school conversion, which were estimated as part of each CITS model (described in a footnote to equation F.3 in section F.2.2.2 for the diversity CITS analysis and a footnote to equation F.6 in section F.4.2.1 for the achievement CITS analysis).

Exhibits I.1, I.2, and I.3 support exhibits in Chapter 5 for research question 1. Exhibits I.4 through I.7 support exhibits in Chapter 5 for the research question 2 analysis of the concentration of racial/ethnic minority students. Exhibits I.8 through I.11 support exhibits in Chapter 5 for the research question 2 analysis of the concentration of economically disadvantaged students. Exhibits I.12 through I.18 support exhibits in Chapter 5 for research question 3. Exhibit I.19 reports CITS trend estimates.

Supporting Exhibits for Research Question 1

Exhibit I.1. Share of Students From Outside the Neighborhood in Traditional Magnet Schools, Pre- and Postconversion (Average Across Schools)

Share of Students From Outside the Neighborhood (%)		
Preconversion ***Estimate***	**Postconversion** ***Estimate***	**Change** ***Estimate*** **(*p*-value)**
21.0	26.8	5.8* (0.000)

* = statistically significant ($p < 0.05$).

NOTE: N = 17 schools in 10 districts.

SOURCE: District administrative data.

Exhibit I.2. Characteristics of Neighborhood Students and Students From Outside the Neighborhood in the Traditional Magnet Schools (Average Across Schools)

a. Proportion of Students From Minority Racial/Ethnic Backgrounds (%)

Population	Preconversion *Estimate* (*p*-value)	Postconversion *Estimate* (*p*-value)	Change *Estimate* (*p*-value)
Neighborhood students	83.0 (†)	84.0 (†)	1.0 (0.333)
Students from outside the neighborhood	84.4 (†)	84.4 (†)	# (0.987)
Difference	1.4 (0.405)	0.5 (0.698)	-1.0 (0.645)

b. Proportion of Students From Disadvantaged Backgrounds (%)

Population	Preconversion *Estimate* (*p*-value)	Postconversion *Estimate* (*p*-value)	Change *Estimate* (*p*-value)
Neighborhood students	70.1 (†)	73.8 (†)	3.7* (0.009)
Students from outside the neighborhood	65.4 (†)	71.2 (†)	5.8* (0.008)
Difference	-4.7* (0.026)	-2.6 (0.072)	2.1 (0.403)

* = statistically significant ($p < 0.05$). † = Not applicable; statistical testing was not conducted for this estimate.

NOTE: # = Rounds to zero. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown in the table. For the proportion of students from minority racial/ethnic backgrounds, N = 17 schools in 10 districts; for the proportion of students from economically disadvantaged backgrounds, N = 11 schools in seven districts.

SOURCE: District administrative data.

Exhibit I.3. Achievement of Neighborhood Students and Students From Outside the Neighborhood in Traditional Magnet Schools (Average Across Schools)

a. ELA Percentile Rank

Population	Preconversion *Estimate* (*p*-value)	Postconversion *Estimate* (*p*-value)	Change *Estimate* (*p*-value)
Neighborhood students	37.1 (†)	44.4 (†)	7.3* (0.000)
Students from outside the neighborhood	35.6 (†)	44.0 (†)	8.4* (0.012)
Difference	-1.5 (0.545)	-0.4 (0.854)	1.1 (0.697)

b. Mathematics Percentile Rank

Population	Preconversion *Estimate* (*p*-value)	Postconversion *Estimate* (*p*-value)	Change *Estimate* (*p*-value)
Neighborhood students	39.2 (†)	48.1 (†)	8.9* (0.000)
Students from outside the neighborhood	35.1 (†)	48.1 (†)	13.0* (0.000)
Difference	-4.1* (0.048)	# (0.903)	4.1 (0.091)

* = statistically significant ($p < 0.05$). † = Not applicable; statistical testing was not conducted for this estimate.

NOTE: # = Rounds to zero. Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown in the table. *N* = 17 schools in 10 districts.

SOURCE: District administrative data.

Supporting Exhibits for Research Question 2 – Concentration of Racial/Ethnic Minority Students

Exhibit I.4. Concentration of Racial/Ethnic Minority Students in Traditional Magnet Schools (Average Across Schools)

Population	Preconversion *Estimate* (*p*-value)	Postconversion *Estimate* (*p*-value)	Change *Estimate* (*p*-value)
Magnet School (%)	84.5 (†)	84.9 (†)	0.4 (0.565)
District (%)	64.1 (†)	66.3 (†)	2.3* (0.000)
Difference (%)	20.4* (0.000)	18.5* (0.000)	-1.9* (0.008)

* = statistically significant ($p < 0.05$). † = Not applicable; statistical testing was not conducted for this estimate.

NOTE: Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown in the table. *N* = 17 schools in 10 districts.

SOURCE: District administrative data.

Exhibit I.5. Percentage of Students From Minority Racial/Ethnic Backgrounds for the Magnet School and Other Neighborhood Schools in the Year Before Conversion, by Traditional Magnet School

School	Magnet		Other Neighborhood Schools (Combined)	
	Percentage	Standard Deviation	Percentage	Standard Deviation
A001	96.4	18.6	89.1	31.2
B002	91.2	28.4	88.9	31.4
B003	87.8	32.8	91.4	28.1
C001	83.6	37.3	61.2	48.7
D001	95.8	20.0	55.6	49.7
D002	90.8	29.1	55.6	49.7
D003	99.3	8.2	55.6	49.7
F002	49.5	50.2	20.2	40.2
F003	45.3	50.1	20.2	40.2
G001	71.9	45.1	51.2	50.0
G002	97.4	15.8	51.2	50.0
H001	95.5	20.8	72.5	44.7
I001	98.8	10.8	55.6	49.7
J001	62.0	48.8	72.7	44.6
J002	82.1	38.4	72.7	44.6
K001	95.0	21.8	71.4	45.2
K002	90.7	29.2	71.4	45.2

NOTE: *N* = 17 schools in 10 districts.

SOURCE: District administrative data.

Exhibit I.6. The Role of Magnet Conversion in the Concentration of Racial/Ethnic Minority Students in Traditional Magnet Schools (Average Across Schools)

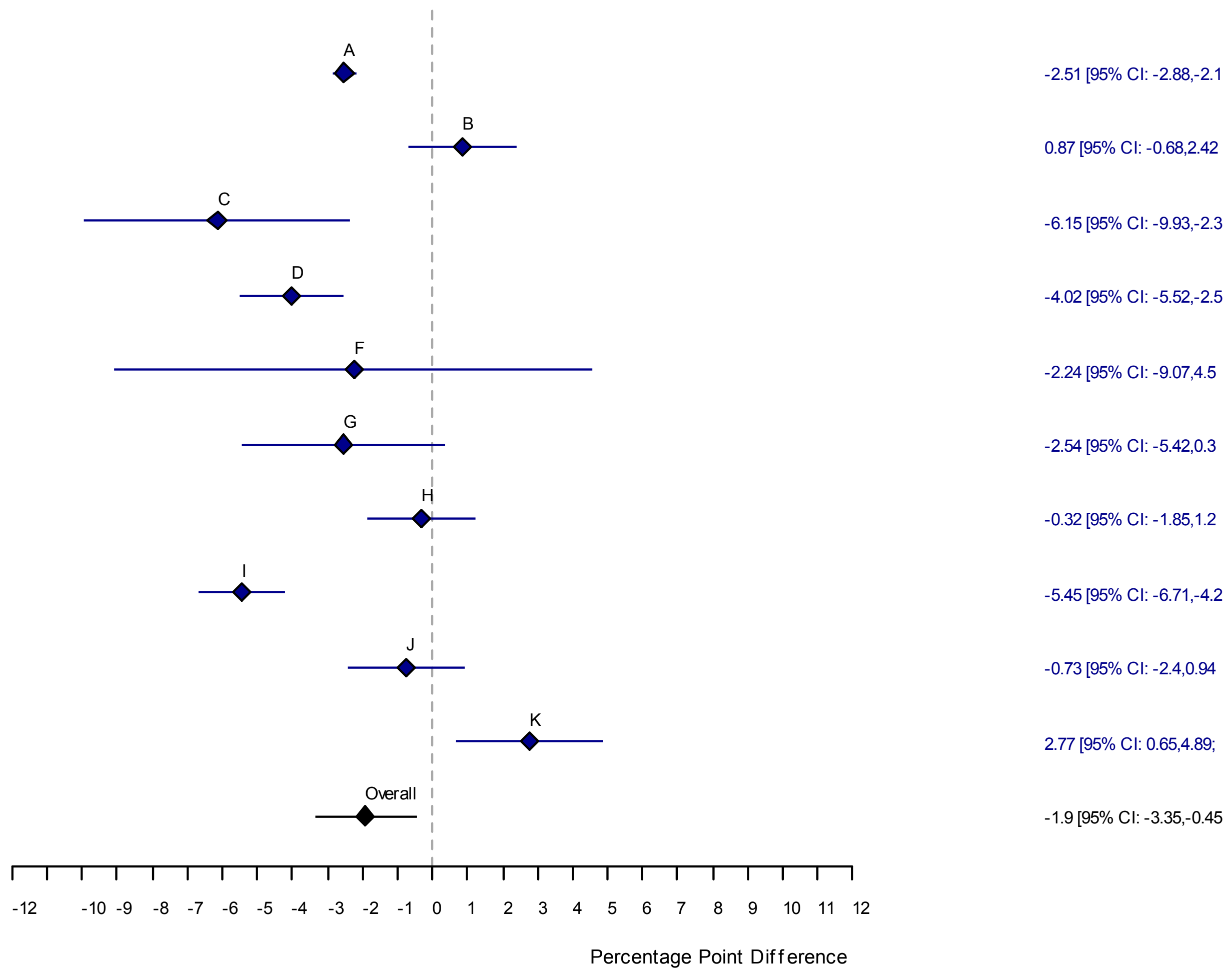
Difference Between Schools and Their Districts (%)		
Component	*Estimate*	*p*-value
Change associated with conversion from CITS	-1.9*	0.010
Percentage of variation in results across districts that is not due to error (I^2)	89.1	(†)
Test of heterogeneity	(†)	0.000

* = statistically significant ($p < 0.05$). † = Not applicable; category does not exist.

NOTE: *N* = 17 schools in 10 districts. CITS = comparative interrupted time series..

SOURCE: District administrative data.

Exhibit I.7. Plot for Meta-analysis of the Role of Magnet Conversion in the Concentration of Racial/Ethnic Minority Students in Traditional Magnet Schools



NOTE: *N* = 10 districts.

SOURCE: District administrative data.

Supporting Exhibits for Research Question 2 – Concentration of Economically Disadvantaged Students

Exhibit I.8. Concentration of Economically Disadvantaged Students in Traditional Magnet Schools (Average Across Schools)

Population	Preconversion *Estimate* (*p*-value)	Postconversion *Estimate* (*p*-value)	Change *Estimate* (*p*-value)
Magnet School (%)	71.4 (†)	74.2 (†)	2.8* (0.015)
District (%)	46.1 (†)	50.1 (†)	3.9* (0.000)
Difference (%)	25.3* (0.000)	24.1* (0.000)	-1.2 (0.278)

* = statistically significant ($p < 0.05$). † = Not applicable; statistical testing was not conducted for this estimate.

NOTE: Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown in the table. *N* = 11 schools in seven districts.

SOURCE: District administrative data.

Exhibit I.9. Percentage of Students From Economically Disadvantaged Backgrounds for the Magnet School and Other Neighborhood Schools in the Year Before Conversion, by Traditional Magnet School

School	Magnet		Other Neighborhood Schools (Combined)	
	Percentage	Standard Deviation	Percentage	Standard Deviation
A001	86.7	33.6	68.9	46.1
B002	63.9	48.1	45.7	49.8
B003	59.5	48.9	43.7	49.5
C001	90.9	29.0	75.2	43.2
D001	94.4	22.7	46.9	49.8
D002	77.2	41.5	46.9	49.8
D003	93.2	25.3	46.9	49.8
F002	45.0	48.6	11.6	31.3
F003	25.6	42.8	11.6	31.3
G001	—	—	—	—
G002	—	—	—	—
H001	79.1	40.6	48.7	50.0
I001	84.9	35.4	48.3	49.5
J001	—	—	—	—
J002	—	—	—	—
K001	—	—	—	—
K002	—	—	—	—

— = Not available; data were not collected or not reported.

NOTE: *N* = 11 schools in seven districts.

SOURCE: District administrative data.

Exhibit I.10. The Role of Magnet Conversion in the Concentration of Economically Disadvantaged Students in Traditional Magnet Schools (Average Across Schools)

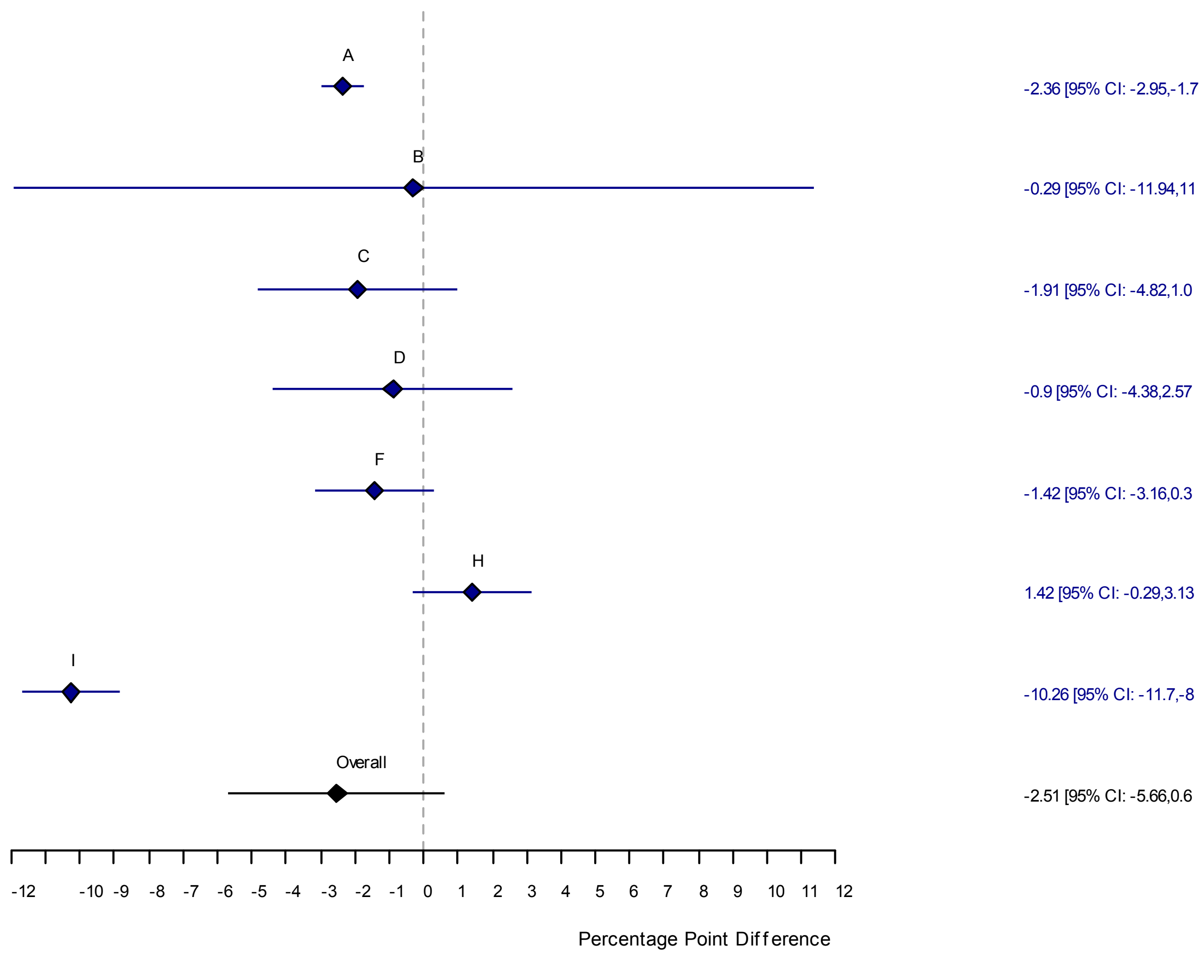
Difference Between Schools and Their Districts (%)		
Component	***Estimate***	***p*-value**
Change associated with conversion from CITS	-2.5	0.118
Percentage of variation in results across districts that is not due to error (I^2)	95.5	(†)
Test of heterogeneity	(†)	0.000

* = statistically significant ($p < 0.05$). † = Not applicable; category does not exist.

NOTE: N = 11 schools in seven districts. CITS = comparative interrupted time series.

SOURCE: District administrative data.

Exhibit I.11. Plot for Meta-analysis of the Role of Magnet Conversion in the Concentration of Economically Disadvantaged Students in Traditional Magnet Schools



NOTE: N = seven districts.

SOURCE: District administrative data.

Supporting Exhibits for Research Question 3

Exhibit I.12. Achievement in Traditional Magnet Schools and Their Districts (Average Across Schools)

a. ELA Percentile Rank

Population	Preconversion Estimate (p-value)	Postconversion Estimate (p-value)	Change Estimate (p-value)
Magnet School	35.5 (†)	43.6 (†)	8.1* (0.000)
District	51.1 (†)	56.8(†)	5.6* (0.000)
Difference	-15.7* (0.000)	-13.2* (0.000)	2.5* (0.024)

b. Mathematics Percentile Rank

Population	Preconversion Estimate (p-value)	Postconversion Estimate (p-value)	Change Estimate (p-value)
Magnet School	37.6 (†)	47.6 (†)	10.0* (0.000)
District	52.0 (†)	60.0 (†)	8.0* (0.000)
Difference	-14.4* (0.000)	-12.4* (0.000)	2.0 (0.133)

* = statistically significant ($p < 0.05$). † = Not applicable; statistical testing was not conducted for this estimate.

NOTE: Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown in the table. *N* = 17 schools in 10 districts.

SOURCE: District administrative data.

Exhibit I.13. Annual English Language Arts *z*-Score Gain for the Magnet School and Other Neighborhood Schools in the Year Before Conversion, by Traditional Magnet School

School	Magnet		Other Neighborhood Schools (Combined)	
	Average	Standard Deviation	Average	Standard Deviation
A001	-0.142	0.604	-0.082	0.616
B002	-0.045	0.458	-0.027	0.523
B003	-0.085	0.447	0.031	0.513
C001	0.108	0.648	-0.038	0.571
D001	0.012	0.885	-0.014	0.632
D002	0.019	0.654	-0.014	0.632
D003	-0.211	0.848	-0.014	0.632
F002	0.276	0.545	0.073	0.739
F003	-0.117	0.719	0.073	0.739
G001	0.156	0.714	0.083	0.708
G002	-0.002	0.631	0.083	0.708
H001	0.015	0.578	0.004	0.548
I001	0.322	0.843	-0.039	0.658
J001	-0.011	0.546	0.007	0.570
J002	0.019	0.467	0.007	0.570
K001	0.096	0.654	0.127	0.749
K002	0.124	0.768	0.127	0.749

NOTE: *N* = 17 schools in 10 districts.

SOURCE: District administrative data.

Exhibit I.14. The Role of Magnet Conversion in ELA Achievement for Neighborhood Students in Traditional Magnet Schools (Average Across Schools)

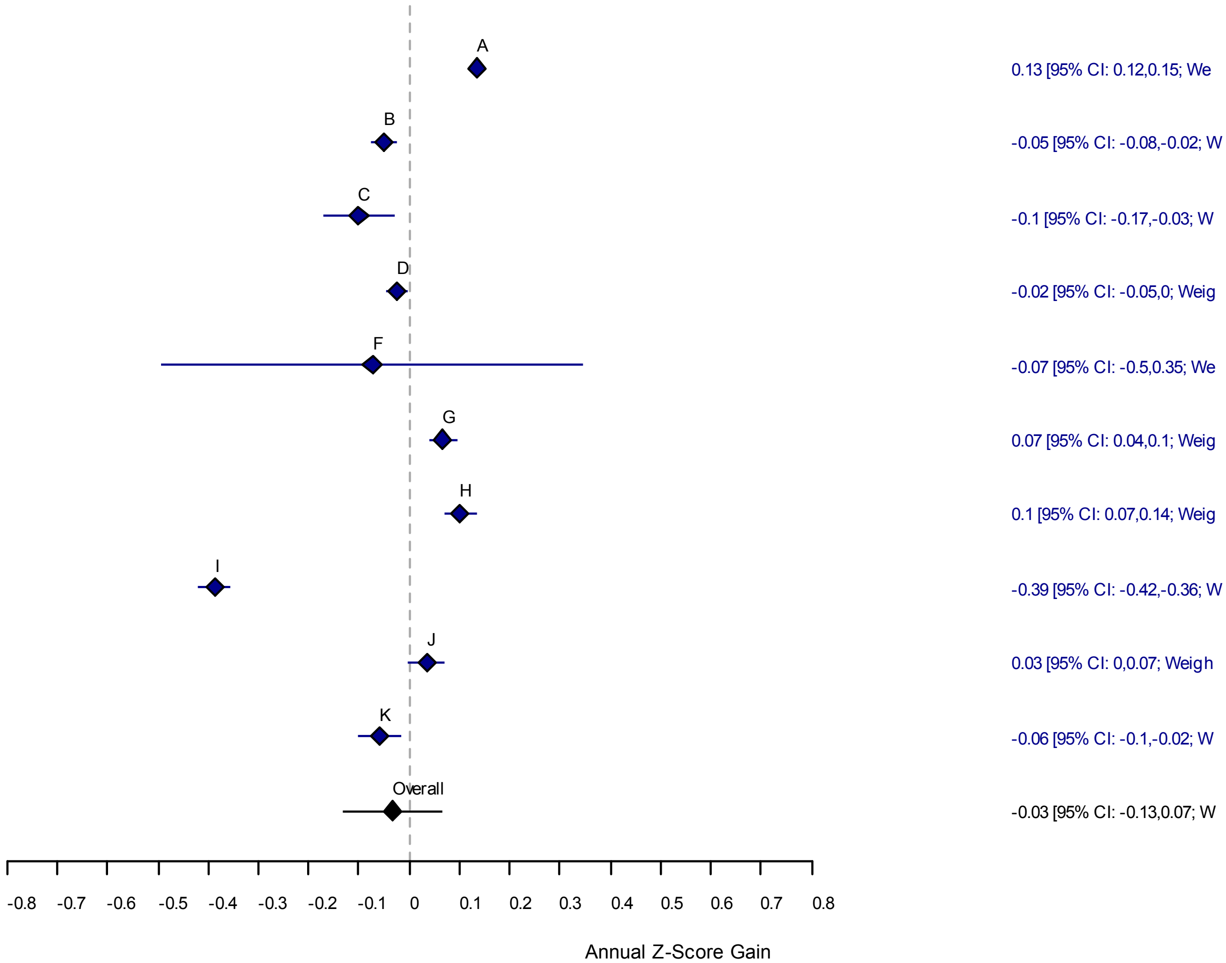
Annual Percentile Point Gain		
Component	*Estimate*	*p*-value
Change associated with conversion from CITS	-1.30	0.527
Percentage of variation in results across districts that is not due to error (I^2)	99.0	(†)
Test of heterogeneity	(†)	0.000

* = statistically significant ($p < 0.05$). † = Not applicable; category does not exist.

NOTE: *N* = 17 schools in 10 districts. CITS = comparative interrupted time series.

SOURCE: District administrative data.

Exhibit I.15. Plot for Meta-analysis of the Role of Magnet Conversion in ELA Achievement for Neighborhood Students in Traditional Magnet Schools



NOTE: *N* = 10 districts. Estimates in this exhibit are in terms of *z*-score gains rather than percentile point gains.

SOURCE: District administrative data.

Exhibit. I.16. Annual Mathematics *z*-Score Gain for the Magnet School and Other Neighborhood Schools in the Year Before Conversion, by Traditional Magnet School

School	Magnet		Other Neighborhood Schools (Combined)	
	Average	Standard Deviation	Average	Standard Deviation
A001	-0.082	0.791	-0.074	0.636
B002	-0.101	0.479	-0.021	0.603
B003	-0.213	0.641	0.015	0.585
C001	-0.214	0.915	-0.005	0.600
D001	0.081	0.717	-0.019	0.604
D002	0.024	0.672	-0.019	0.604
D003	-0.171	0.498	-0.019	0.604
F002	-0.193	0.601	0.091	0.691
F003	-0.244	0.741	0.091	0.691
G001	0.145	0.571	0.003	0.657
G002	0.043	0.568	0.003	0.657
H001	0.165	0.608	0.005	0.661
I001	0.488	0.887	-0.046	0.642
J001	-0.066	0.699	0.002	0.656
J002	0.095	0.665	0.002	0.656
K001	-0.064	0.636	-0.005	0.650
K002	-0.046	0.643	-0.005	0.650

NOTE: *N* = 17 schools in 10 districts.

SOURCE: District administrative data.

Exhibit I.17. The Role of Magnet Conversion in Mathematics Achievement for Neighborhood Students in Traditional Magnet Schools (Average Across Schools)

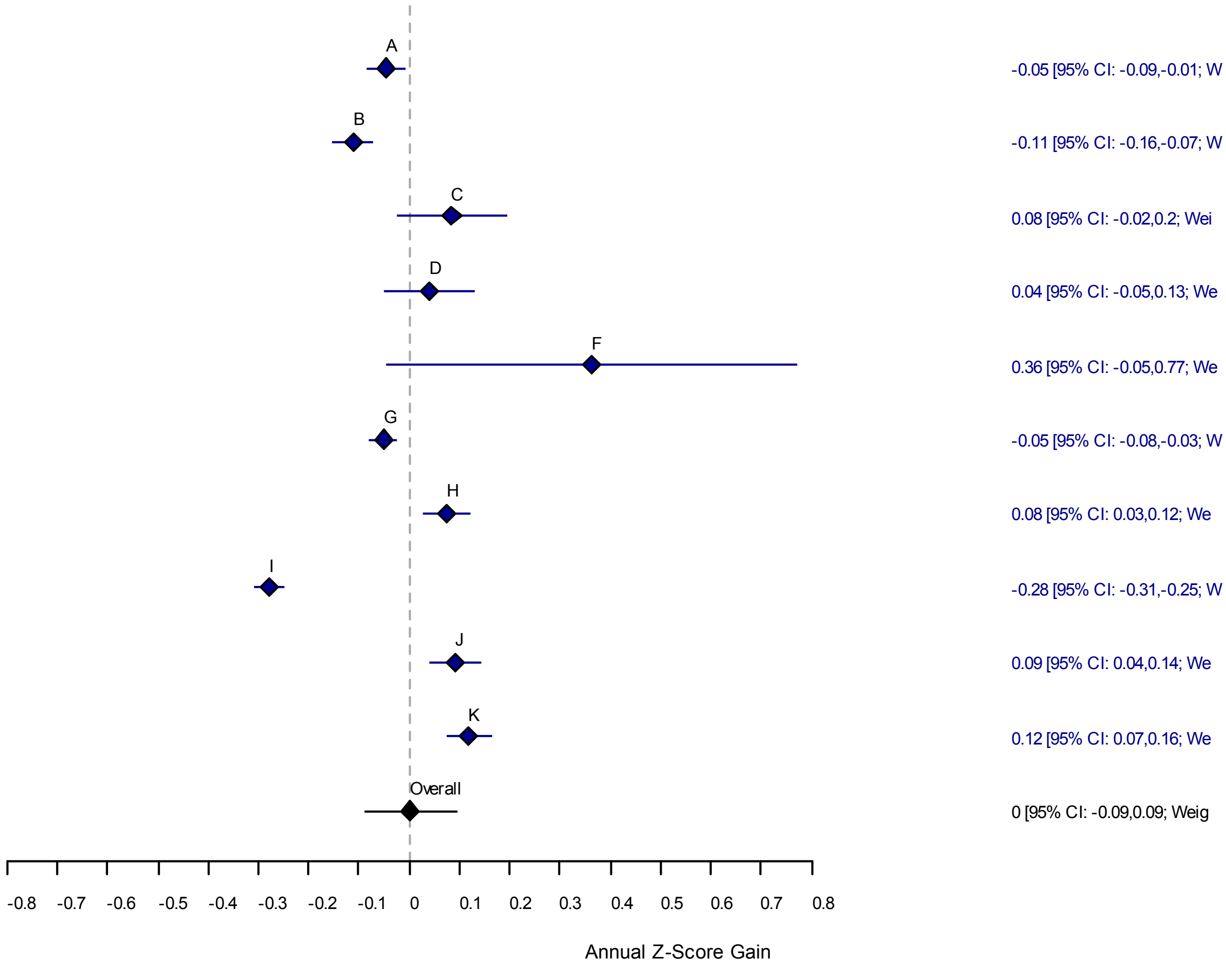
Annual Percentile Point Gain		
Component	*Estimate*	*p*-value
Change associated with conversion from CITS	0.08	0.967
Percentage of variation in results across districts that is not due to error (I^2)	97.4	(†)
Test of heterogeneity	(†)	0.000

* = statistically significant ($p < 0.05$). † = Not applicable; category does not exist.

NOTE: *N* = 17 schools in 10 districts. CITS = comparative interrupted time series.

SOURCE: District administrative data.

Exhibit I.18. Plot for Meta-analysis of the Role of Magnet Conversion in Mathematics Achievement for Neighborhood Students in Traditional Magnet Schools



NOTE: *N* = 10 districts. Estimates in this exhibit are in terms of *z*-score gains rather than percentile point gains.

SOURCE: District administrative data.

Postconversion Trend Analysis for Chapter 5

Exhibit I.19. Trend Over the Postconversion Period for the Role of Magnet Conversion in Changes in Traditional Magnet Schools

CITS Model	Trend *Estimate* (*p*-value)
Minority (percentage point)	-0.91* (0.004)
Disadvantaged (percentage point)	-1.12 (0.197)
ELA (annual *z*-score gain)	-0.006 (0.789)
Mathematics (annual *z*-score gain)	0.015 (0.336)

* = statistically significant ($p < 0.05$).

NOTE: N = 17 schools in 10 districts for minority, ELA, and mathematics analysis. N = 11 schools in seven districts for disadvantaged analysis. CITS = comparative interrupted time series.

SOURCE: District administrative data.

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Appendix J: Supporting Exhibits for Chapter 6

This appendix provides additional details for the results presented in Chapter 6. For each exhibit in Chapter 6, the appendix contains one or more supporting exhibits with the estimates in Chapter 6 and *p*-values for each statistical test. In addition, for the analyses comparing change in magnet schools and neighborhood public schools (CITS analysis), two additional supporting exhibits are provided. The first (e.g., Exhibit J.5) contains baseline averages showing the mean of the key variables (percentage minority, percentage disadvantaged, average ELA and mathematics annual gain) for each magnet conversion school and the other neighborhood schools in its district for the year just before conversion. The second (e.g., Exhibit J.7) is a "forest" plot of results from the meta-analysis. The plot displays the estimate of the association between magnet conversion and change in the outcome for each district separately and for the average across districts, along with 95-percent confidence intervals. The final section provides the estimates of the trend over the postconversion period in the association between outcomes and magnet school conversion, which were estimated as part of each CITS model (described in a footnote to equation F.3 in section F.2.2.2 for the diversity CITS analysis and a footnote to equation F.6 in section F.4.2.1 for the achievement CITS analysis).

Exhibits J.1, J.2, and J.3 support exhibits in Chapter 6 for research question 1. Exhibits J.4 through J.7 support exhibits in Chapter 6 for the research question 2 analysis of the concentration of racial/ethnic minority students. Exhibits J.8 through J.11 support exhibits in Chapter 6 for the research question 2 analysis of the concentration of economically disadvantaged students. Exhibits I.12 supports the exhibit in Chapter 6 for research question 3. Exhibit J.13 reports CITS trend estimates.

Supporting Exhibits for Research Question 1

Exhibit J.1. Share of Students From Outside the Neighborhood in Destination Magnet Schools, Pre- and Postconversion (Average Across Schools)

Share of Students From Outside the Neighborhood (%)		
Preconversion *Estimate*	Postconversion *Estimate*	Change *Estimate* (*p*-value)
34.2	41.4	7.3* (0.005)

* = statistically significant ($p < 0.05$).

NOTE: *N* = four schools in three districts.

SOURCE: District administrative data.

Exhibit J.2. Characteristics of Neighborhood Students and Students From Outside the Neighborhood in the Destination Magnet Schools (Average Across Schools)

a. Proportion of Students From Minority Racial/Ethnic Backgrounds (%)

Population	Preconversion *Estimate* (*p*-value)	Postconversion *Estimate* (*p*-value)	Change *Estimate* (*p*-value)
Neighborhood students	70.9 (†)	74.6 (†)	3.7* (0.002)
Students from outside the neighborhood	73.6 (†)	77.1 (†)	3.5 (0.053)
Difference	2.7 (0.088)	2.5* (0.017)	-0.2 (0.918)

b. Proportion of Students From Disadvanaged Backgrounds (%)

Population	Preconversion *Estimate* (*p*-value)	Postconversion *Estimate* (*p*-value)	Change *Estimate* (*p*-value)
Neighborhood students	25.8 (†)	29.7 (†)	3.9 (0.087)
Students from outside the neighborhood	24.7 (†)	35.6 (†)	10.8* (0.011)
Difference	-1.0 (0.762)	5.9* (0.012)	6.9 (0.095)

* = statistically significant ($p < 0.05$). † = Not applicable; statistical testing was not conducted for this estimate.

NOTE: Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown in the table. *N* = four schools in three districts.

SOURCE: District administrative data.

Exhibit J.3. Achievement of Neighborhood Students and Students From Outside the Neighborhood in the Destination Magnet Schools (Average Across Schools)

a. ELA Percentile Rank

Population	Preconversion *Estimate* (*p*-value)	Postconversion *Estimate* (*p*-value)	Change *Estimate* (*p*-value)
Neighborhood students	59.1 (†)	60.2 (†)	1.2 (0.550)
Students from outside the neighborhood	55.7 (†)	58.2 (†)	2.5 (0.520)
Difference	-3.3 (0.230)	-2.0 (0.247)	1.3 (0.686)

b. Mathematics Percentile Rank

Population	Preconversion *Estimate* (*p*-value)	Postconversion *Estimate* (*p*-value)	Change *Estimate* (*p*-value)
Neighborhood students	60.2 (†)	63.3 (†)	3.1 (0.317)
Students from outside the neighborhood	51.4 (†)	58.3 (†)	6.9 (0.092)
Difference	-8.8* (0.018)	-5.0* (0.028)	3.8 (0.359)

* = statistically significant ($p < 0.05$). † = Not applicable; statistical testing was not conducted for this estimate.

NOTE: Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown in the table. *N* = four schools in three districts.

SOURCE: District administrative data.

Supporting Exhibits for Research Question 2 – Concentration of Students From Minority Racial/Ethnic Backgrounds

Exhibit J.4. Concentration of Racial/Ethnic Minority Students in the Destination Magnet Schools (Average Across Schools)

Population	Preconversion *Estimate* (*p*-value)	Postconversion *Estimate* (*p*-value)	Change *Estimate* (*p*-value)
Magnet school (%)	71.6 (†)	74.9 (†)	3.3* (0.001)
District (%)	72.0 (†)	73.8 (†)	1.8* (0.002)
Difference (%)	0.4 (0.512)	1.1* (0.008)	0.7 (0.302)

* = statistically significant ($p < 0.05$). † = Not applicable; statistical testing was not conducted for this estimate.

NOTE: Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown in the table. *N* = four schools in three districts.

SOURCE: District administrative data.

Exhibit J.5. Percentage of Students From Minority Racial/Ethnic Backgrounds for the Magnet School and Other Neighborhood Schools in the Year Before Conversion, by Destination Magnet School

School	Magnet Schools		Other Neighborhood Schools (Combined)	
	Percentage	Standard Deviation	Percentage	Standard Deviation
B001	86.9	33.8	88.9	31.4
B004	91.5	27.9	91.4	28.1
E001	91.7	27.8	85.4	35.3
F001	14.7	35.6	20.2	40.2

NOTE: *N* = four schools in three districts.

SOURCE: District administrative data.

Exhibit J.6. The Role of Magnet Conversion in the Concentration of Students From Minority Racial/Ethnic Backgrounds in Destination Magnet Schools (Average Across Schools)

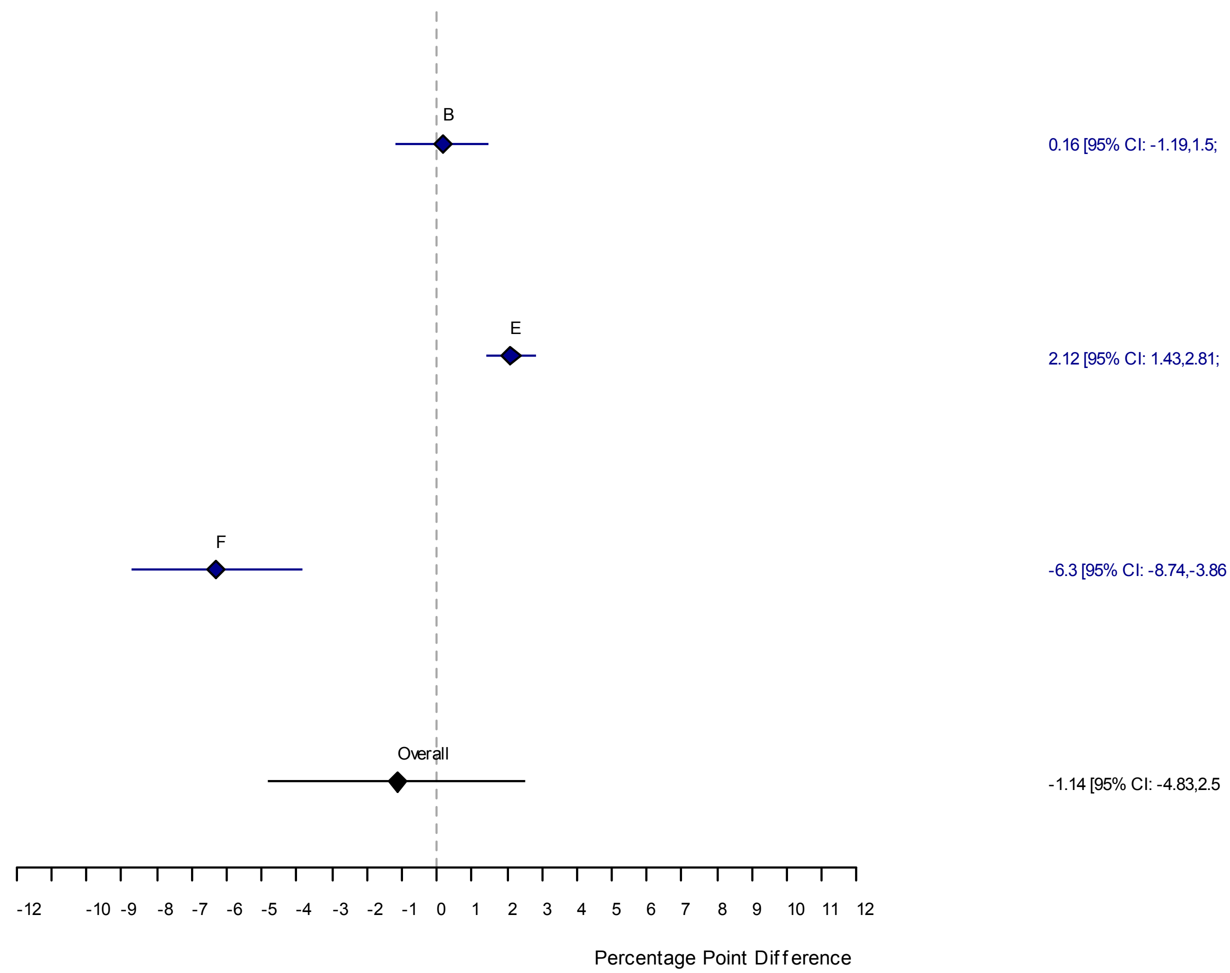
Difference Between Schools and Their Districts (%)		
Category	*Estimate*	*p*-value
Change associated with conversion from CITS	-1.1	0.543
Percentage of variation in results across districts that is not due to error (I^2)	95.6	(†)
Test of heterogeneity	(†)	0.000

* = statistically significant ($p < 0.05$). † = Not applicable; category does not exist.

NOTE: *N* = four schools in three districts. CITS = comparative interrupted time series.

SOURCE: District administrative data.

Exhibit J.7. Plot for Meta-analysis of the Role of Magnet Conversion in the Concentration of Students From Minority Racial/Ethnic Backgrounds in Destination Magnet Schools (Average Across Schools)



NOTE: *N* = three districts.

SOURCE: District administrative data.

Supporting Exhibits for Research Question 2 – Concentration of Students From Economically Disadvantaged Backgrounds

Exhibit J.8. Concentration of Students From Economically Disadvantaged Students in the Destination Magnet Schools (Average Across Schools)

Population	Preconversion *Estimate* (*p*-value)	Postconversion *Estimate* (*p*-value)	Change *Estimate* (*p*-value)
Magnet school (%)	25.0 (†)	31.8 (†)	6.8* (0.005)
District (%)	38.1 (†)	41.1 (†)	3.0* (0.033)
Difference (%)	13.1* (0.000)	9.3* (0.000)	-3.8* (0.019)

* = statistically significant ($p < 0.05$). † = Not applicable; statistical testing was not conducted for this estimate.

NOTE: Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown in the table. N = four schools in three districts.

SOURCE: District administrative data.

Exhibit J.9. Percentage of Students From Economically Disadvantaged Backgrounds for the Magnet School and Other Neighborhood Schools in the Year Before Conversion, by Destination Magnet School

School	Magnet Schools		Other Neighborhood Schools (Combined)	
	Percentage	Standard Deviation	Percentage	Standard Deviation
B001	46.1	50.0	45.7	49.8
B004	8.6	27.9	43.7	49.5
E001	33.7	46.9	51.5	49.1
F001	11.5	31.0	11.6	31.3

NOTE: N = four schools in three districts.

SOURCE: District administrative data.

Exhibit J.10. The Role of Magnet Conversion in the Concentration of Economically Disadvantaged Students in Destination Magnet Schools (Average Across Schools)

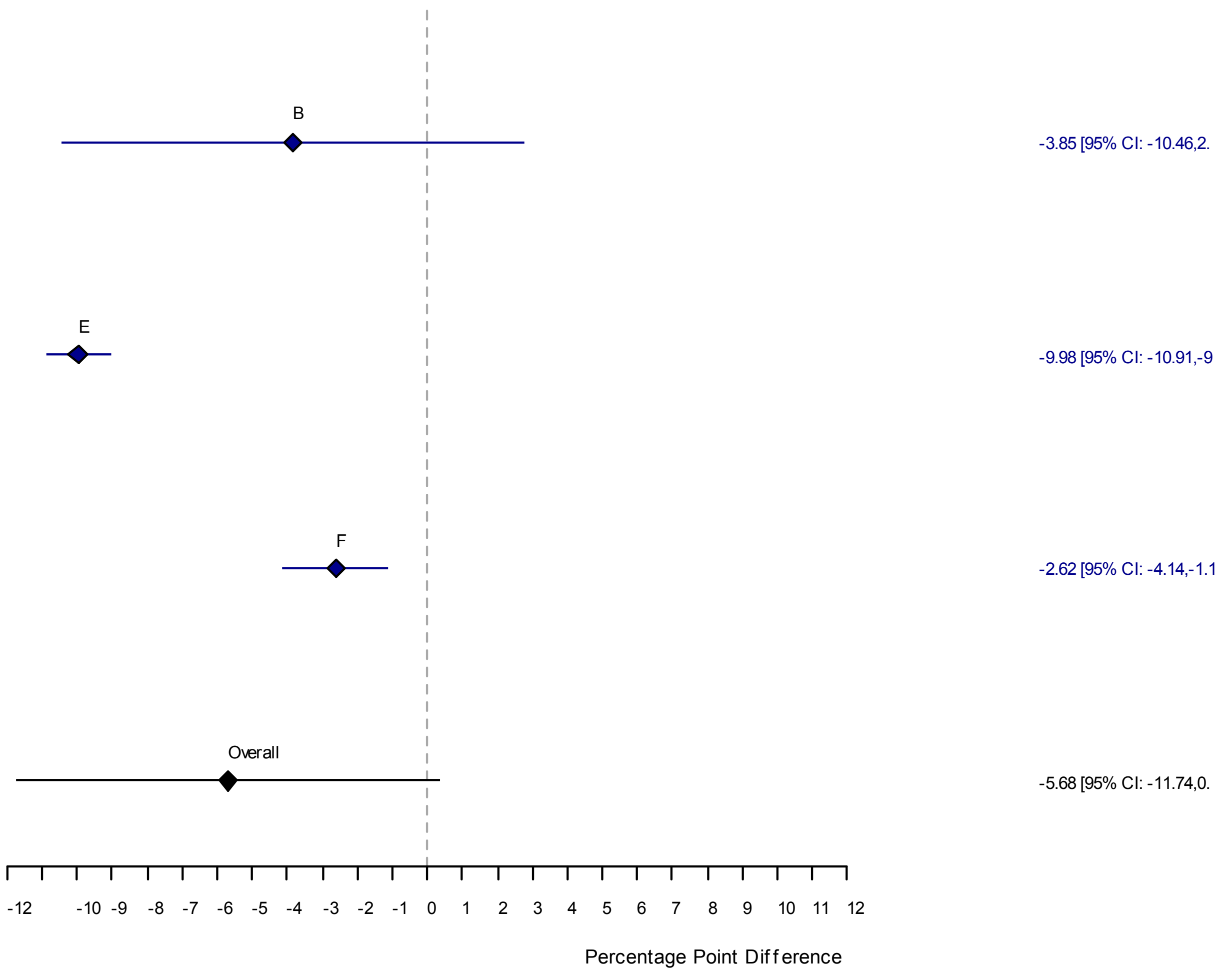
Difference Between Schools and Their Districts (%)		
Component	*Estimate*	*p*-value
Change associated with conversion from CITS	-5.7	0.066
Percentage of variation in results across districts that is not due to error (I^2)	97.0	(†)
Test of heterogeneity	(†)	0.000

* = statistically significant ($p < 0.05$). † = Not applicable; category does not exist.

NOTE: N = four schools in three districts. CITS = comparative interrupted time series.

SOURCE: District administrative data.

Exhibit J.11. Plot for Meta-analysis of the Role of Magnet Conversion in the Concentration of Economically Disadvantaged Students in Destination Magnet Schools (Average Across Schools)



NOTE: *N* = three districts.

SOURCE: District administrative data.

Supporting Exhibits for Research Question 3

Exhibit J.12. Achievement in Destination Magnet Schools and Their Districts (Average Across Schools)

a. ELA Percentile Rank

Population	Preconversion *Estimate* (*p*-value)	Postconversion *Estimate* (*p*-value)	Change *Estimate* (*p*-value)
Magnet school	58.8 (†)	60.2 (†)	1.4 (0.502)
District	51.6 (†)	58.5 (†)	6.9* (0.001)
Difference	7.2* (0.000)	1.7 (0.064)	-5.5* (0.004)

b. Mathematics Percentile Rank

Population	Preconversion *Estimate* (*p*-value)	Postconversion *Estimate* (*p*-value)	Change *Estimate* (*p*-value)
Magnet school	58.4 (†)	62.2 (†)	3.9 (0.189)
District	51.6 (†)	60.5 (†)	8.9* (0.002)
Difference	6.8* (0.004)	1.7 (0.181)	-5.1 (0.051)

* = statistically significant ($p < 0.05$). † = Not applicable; statistical testing was not conducted for this estimate.

NOTE: Differences were calculated using unrounded numbers and may not equal differences calculated from numbers shown in the table. *N* = four schools in three districts.

SOURCE: District administrative data.

Postconversion Trend Analysis for Chapter 6

Exhibit J.13. Trend Over the Postconversion Period for the Role of Magnet Conversion in Changes in Destination Magnet Schools

CITS Model	Trend *Estimate* (*p*-value)
Minority (percentage point)	-0.08 (0.453)
Disadvantaged (percentage point)	-1.84* (0.046)

* = statistically significant ($p < 0.05$).

NOTE: *N* = four schools in three districts. CITS = comparative interrupted time series.

SOURCE: District administrative data.

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Appendix K: Analysis Methods and Supporting Exhibits for Chapter 7

This appendix provides details on the methods and displays used for the analysis presented in Chapter 7 examining the variability across study schools in the estimated role of conversion in the change in achievement and diversity.

K.1. The Analysis Models

For results presented in Chapters 5 and 6, the CITS models—equation F.3 for the diversity CITS analysis for research question 2 and equation F.6 for the achievement CITS analysis for research question 3—produced combined estimates across all magnet schools within a district when there was more than one magnet school in the district. Hence, the meta-analysis was conducted across *district* results rather than across *school* results. As explained in Appendix F.2.2.3, the rationale for combining estimates is that separate estimates for study magnet schools operating in the same district may be correlated and this could lead to a false sense of precision.

Because the focus in Chapter 7 is on variability in results across magnet schools, equations F.3 and F.6 were modified to allow for separate estimates for each study magnet school in instances where multiple study magnet schools were located in the same district. For the school-by-school analysis of the absolute value of the difference (AVD) in the proportion of students from minority racial/ethnic backgrounds and disadvantaged backgrounds, equation F.3 was modified to the following:

$$\mathrm{AVD}_{st} = \sum_{s=1}^{S} \mu_s + \pi_1 F_{2t} + \pi_2 F_{3t} + \pi_3 F_{4t} + \pi_4 F_{5t} + \pi_5 F_{6t} + \sum_{m=1}^{M} \theta_m \mathrm{TREAT}_{s=m,t} + \varepsilon_{st} \tag{K.1}$$

where:

- m = indexes magnet schools in the district
- $\mathrm{TREAT}_{s=m,t}$ = (1 if school s is an MSAP school m in year t when the program was active; 0 otherwise)

The coefficient on TREAT, θ_m, represents the association between magnet school conversion and the change in the absolute value of the difference, AVD, between the postconversion and preconversion periods for study magnet school m. As with equation F.3, equation K.1 was estimated separately for each district.[94]

[94] The number of magnet schools in each district and their classification as traditional or destination can be seen in Exhibit A.6. Six of the 10 study districts with at least one traditional magnet school contained more than one. One of the three study districts with at least one destination magnet school contained more than one.

Similarly, for the CITS analysis of annual achievement gains, equation F.6 was modified to the following:

$$\Delta Y_{igt} = \sum_{q=1}^{Q} \beta_q X_{qigt} + \sum_{g=2}^{5} \lambda_g + \sum_{s=1}^{S} \delta_s NBH_{igst} + \sum_{s=1}^{S} \phi_s NON_{igst} + \sum_{s=1}^{S} \varphi_s UNK_{igst} + \pi_1 F_{2t} + \pi_2 F_{3t} + \pi_3 F_{4t} + \pi_4 F_{5t} + \pi_5 F_{6t} + \sum_{m=1}^{M} \{\theta_{NBH,m} NBH_{s=m,t} TREAT_{igst}\} + \sum_{m=1}^{M} \{\theta_{NON,m} NON_{s=m,t} TREAT_{igst}\} + \sum_{m=1}^{M} \{\theta_{UNK,m} UNK_{s=m,t} TREAT_{igst}\} + \varepsilon_{igst} \tag{K.2}$$

The coefficient on TREAT, $\theta_{NBH,m}$, represents the average change in annual achievement gain for neighborhood students associated with being enrolled in study magnet school *m.* As with equation F.6, equation K.2 was estimated separately for each district.

The tests of variation across schools reported in Chapter 7 were obtained from a meta-analysis of the school-level results. The methods used for the meta-analysis of these school-level results were the same as the methods used for district-level results described in Appendix F.2.2.3. The results of tests of variation across schools, reported below in Exhibits K.6 and K.7, were similar to tests of variation across districts reported in Appendices I and J (see Exhibits I.6, I.10, I.14, and I.17 for traditional schools and Exhibits J.6 and J.10 for destination schools).

K.2. Exhibits

The first exhibit in Chapter 7—Exhibit 7.1—reports school-by-school CITS results for the concentration of racial/ethnic minority students (AVD_M) and of economically disadvantaged students (AVD_D) for traditional magnet schools, based on the estimated coefficients θ_m from equation K.1. For example, for the first school in Exhibit 7.1 (reprinted as Exhibit K.1), the bar on the left, demonstrates the magnitude of the estimated change in AVD_M for that school associated with magnet conversion. For this school, conversion was associated with a significant drop in AVD_M (-2.5 percentage points). The bar on the right demonstrates the magnitude of the estimated change in AVD_D associated with magnet conversion (-2.4 percentage points). The asterisk (*) at the end of the bars indicates that the magnitudes were statistically significant ($p < 0.05$).

Exhibit. K.1. Reprint for First School in Exhibit 7.1. Change in Diversity Associated With Magnet School Conversion

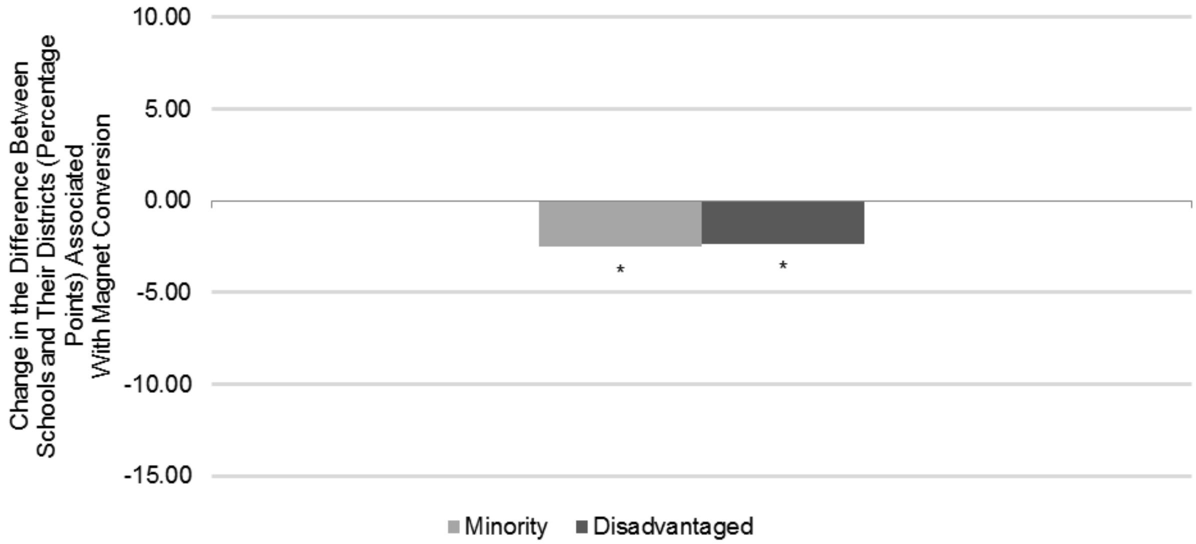

Exhibit 7.2 reports school-by-school CITS results for the average annual ELA achievement gain and the average annual mathematics achievement gain associated with magnet conversion, based on the estimated coefficient $\theta_{NBH,m}$ from equation K.2. Although equation K.2 was estimated using *z*-scores, results in Exhibit K.2 are presented in terms of the annual percentile gain, using a process similar to that described in section F.4.2.2. As an example, results for the first school presented in Exhibit 7.2 are reprinted in Exhibit K.2 with the estimated value of $\theta_{NBH,m}$ for ELA achievement gain represented by the bar on the left and for mathematics achievement gain represented by the bar on the right. As in Exhibit K.1, the asterisk (*) at the end of the bars indicates that the magnitudes were statistically significant ($p < 0.05$).

The *z*-score gain results from the estimation of equation K.2 were converted to percentile points in a manner similar to conversion of meta-analysis achievement described in section F.5.2. Using the ELA estimate to illustrate this, the process was as follows:

- First, the average postconversion ELA *z*-score gain for the school was computed by averaging across the four postconversion years. That value was 0.06. We then transformed this into percentile units using equation F.9. That value was 2.5.
- Second, the average postconversion ELA *z*-score gain if the school had not converted was estimated by subtracting the CITS estimate for the school, 0.13, from the average postconversion *z*-score gain (0.06 − 0.13 = -0.07). This gain score was then transformed into percentile units using equation F.9. That value was -2.8.
- Finally, the CITS estimate for the school in terms of a percentile point gain was calculated by computing the difference between the average postconversion percentile gain and the postconversion percentile gain if the school had not converted. That value was 5.3 (= 2.5 − [-2.8]), and is represented by the bar on the left of Exhibit K.2. The asterisk (*) at the end of the bar indicates that the magnitude was statistically significant ($p < 0.05$).

Exhibit. K.2. Reprint for School A001 of Exhibit 7.2. Change in Learning Associated With Magnet School Conversion, for Neighborhood Students

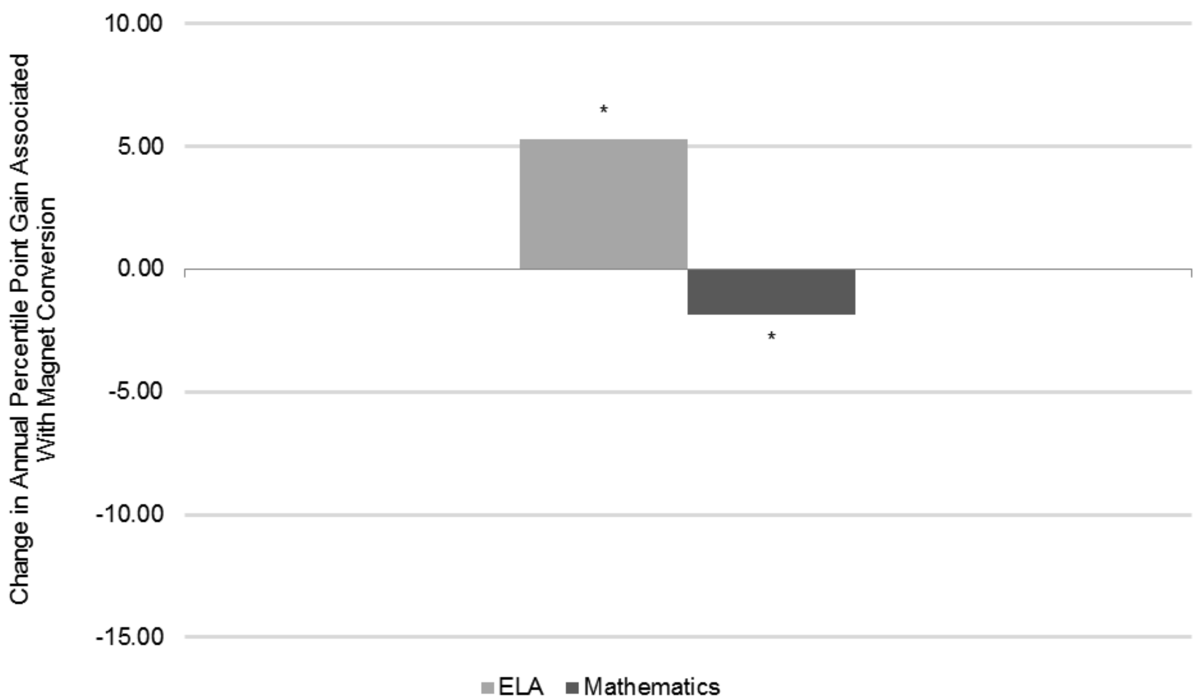

Exhibit 7.3 was constructed in the same way as Exhibit 7.1 but with results for destination magnet schools.

K.3. Supporting Exhibits

Exhibit K.3. Number of Traditional Magnet Schools With a Significant Change in Diversity Associated With Magnet School Conversion, by Outcome Variable

Outcome	Significant Decrease[a]	No Significant Change	Significant Increase
Difference between the magnet school and the district in proportion minority	9	5	3
Difference between the magnet school and the district in proportion disadvantaged	6	3	2

[a] A decrease is expected based on the theory of action.

NOTE: *N* = 17 study magnet schools in 10 districts for the proportion minority difference from the district; *N* = 11 study magnet schools in seven districts for the proportion disadvantaged difference from the district. Statistical significance was determined using the criterion $p < .05$ using a two-tailed test.

SOURCE: District administrative data.

Exhibit K.4. Number of Traditional Magnet Schools With a Significant Change in Learning for Neighborhood Students Associated With Magnet School Conversion, by Outcome Variable

Outcome	Significant Decrease	No Significant Change	Significant Increase[a]
ELA annual gain for neighborhood students	7	5	5
Mathematics annual gain for neighborhood students	6	2	9

[a] An increase is expected based on the theory of action.

NOTE: *N* = 17 study magnet schools in 10 districts. The dependent variable was the annual change in a student's achievement percentile. The only statistical test conducted for numbers in this exhibit was whether the "change associated with conversion" was significantly different from zero. Statistical significance was determined using the criterion $p < .05$ using a two-tailed test.

SOURCE: District administrative data.

Exhibit K.5. Number of Destination Magnet Schools With a Significant Change in Diversity Associated With Magnet School Conversion, by Outcome Variable

Outcome	Significant Decrease[a]	No Significant Change	Significant Increase
Difference between the magnet school and the district in proportion minority	1	2	1
Difference between the magnet school and the district in proportion disadvantaged	3	1	0

[a] A decrease is expected based on the theory of action.

NOTE: *N* = four study magnet schools in three districts. The analysis for this display was conducted using the annual absolute value of the difference between each school and its district. Statistical significance was determined using the criterion $p < .05$ using a two-tailed test.

SOURCE: District administrative data.

Exhibit K.6. Variation in Results Across Traditional Magnet Schools

Percentage of Variation in Results Across Schools That Is Not Due to Error		
CITS Model	I^2	***p*-value for Test of Heterogeneity**
Minority	94.8	0.000
Disadvantaged	96.4	0.000
ELA	98.6	0.000
Mathematics	98.3	0.000

SOURCE: District administrative data.

Exhibit K.7. Variation in Results Across Destination Magnet Schools

Percentage of Variation in Results Across Schools That Is Not Due to Error		
CITS Model	I^2	***p*-value for Test of Heterogeneity**
Minority	94.5	0.000
Disadvantaged	96.8	0.000

SOURCE: District administrative data.