

REPORT

FINAL REPORT

Ewing Marion Kauffman School Evaluation Impact Report Year 4

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EXECUTIVE SUMMARY

As part of its ongoing efforts to raise the academic achievement of children from low-income families in Kansas City, Missouri, the Ewing Marion Kauffman Foundation founded the Ewing Marion Kauffman School in fall 2011. The Kauffman School’s mission is “to prepare students to excel academically, graduate from college, and apply their unique talents in the world to create economically independent and personally fulfilling lives” (Ewing Marion Kauffman School 2013).

As a public charter school, the Kauffman School is tuition-free and serves students living in Kansas City. In the 2014–15 school year, the Kauffman School enrolled 561 students in grades 5-8; approximately 85 percent of them were low-income and 89 percent were black or Hispanic.

The Kauffman School has ambitious goals for its students, including accelerated learning, high attendance levels, and exemplary behavior. In this report, we summarize information about the impact of the Kauffman School on student achievement, attendance, and rate of suspensions.

Data and methods. Data used for this report came from the Missouri state department of education and included: student achievement on the Missouri Assessment Program (MAP) exams, attendance, suspensions, and demographic characteristics of the students. To estimate the impact of the Kauffman School on its students, we identified a group of similar students attending other Kansas City schools and then compared the two on key impact measures. More details on our analytic approach are provided in the full report.

Main findings. Our findings indicate that in the 2011–12 through 2014–15 school years, the Kauffman School had positive, statistically significant, and educationally meaningful impacts on student achievement growth in mathematics, ELA, and science beyond the growth achieved by students in other Kansas City public schools.

In Table ES.1 below, results are reported separately for students one, two, three, and four years after entering the Kauffman School in 5th grade. In every subject and year examined, the Kauffman School’s impact on test scores is positive and statistically significant, which indicates that it is outperforming other Kansas City schools serving similar students.

Table ES.1. Impact of Kauffman School on MAP test scores (citywide comparison group)¹

	Mathematics	ELA	Science
Impact one year after enrollment (5th grade)	0.22**	0.23**	0.46**
Impact two years after enrollment (6th grade)	0.35**	0.18**	n.a.
Impact three years after enrollment (7th grade)	0.68**	0.52**	n.a.
Impact four years after enrollment (8th grade)	0.96** ^a	0.53**	0.66**

Notes: There are no two- or three-year estimates for science, because the state does not have a science test for 6th or 7th graders.

**Significantly different from zero at the 1 percent level.

^a The four-year mathematics impact is based in part on imputed outcome data. See footnote 2 for details.

ELA = English language arts; n.a. = not applicable.

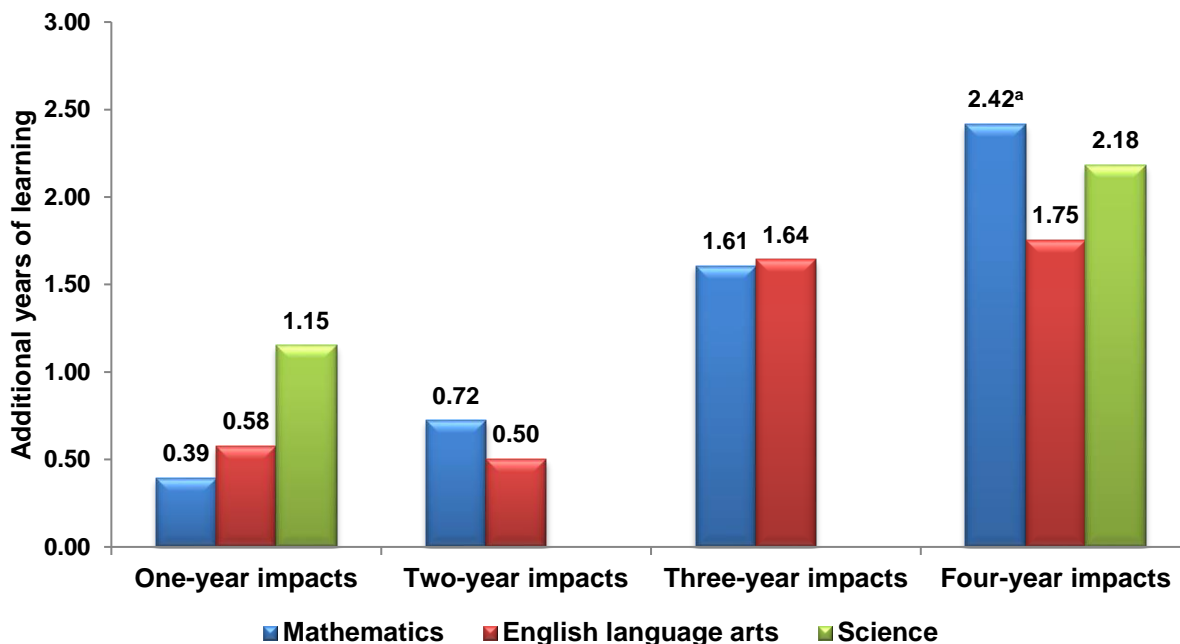
The effect-size units reported in Table ES.1 are useful but not very intuitive. To translate the results into units that are more readily interpretable, we turn the effect sizes into years of additional learning growth through a commonly used conversion method for effect sizes (Bloom et al. 2008). Figure ES.1 below displays these impact estimates converted to years of additional learning growth for Kauffman students.

Impacts on mathematics achievement growth. The estimated impact of the Kauffman School on student achievement in mathematics is substantial.² The magnitude of the effect size translates into approximately 1.61 additional years of learning growth three years after enrollment. Before entering the Kauffman School (that is, in 4th grade), the average Kauffman student is at the 39th percentile in the state in mathematics. These results suggest the average Kauffman student would move to the 65th percentile three years after enrollment at the Kauffman School. Moreover, the three-year mathematics effect is equal to approximately 84 percent of the test score achievement gap between black and white students in 7th grade in Kansas City.

¹ The impact of the Kauffman School on student achievement growth is reported in “effect size” units (fractions of standard deviations of student test scores) that are commonly used in education studies and that allow comparisons to other studies. We measure the average effect that attending the Kauffman School has on student test score growth beyond what students would have achieved if they had attended other Kansas City public schools. A positive effect size means that test score growth is higher for Kauffman students relative to comparison students, and vice versa.

² The four-year mathematics impact should be interpreted with caution, because not all of the students in the matched comparison group took the 8th-grade MAP: students who were taking Algebra I in 8th grade took a different test. To deal with this problem, we imputed missing 8th-grade mathematics MAP scores for 8th-grade students taking Algebra I. See section III.A for details on our imputation process. This imputation inherently adds some uncertainty to the exact size of the four-year mathematics impact, but we believe this approach provides a reasonable approximation. In this report we focus primarily on the three-year impact estimates for mathematics when discussing the magnitude of the effect of the Kauffman School on student achievement. To simplify the comparisons of these impacts with results from other studies, we will focus on the three-year ELA impact estimates as well. The three-year impact estimates in this report also have the advantage of being based on two cohorts of students rather than one.

Figure ES.1. Kauffman School estimates of additional years of learning growth on MAP exams



Notes: The additional growth for all impact estimates is significantly different from zero.

^a The four-year mathematics impact is based in part on imputed outcome data. See footnote 2 for details.

Impacts on ELA achievement growth. The effect size in ELA is substantial as well; the magnitude translates into approximately 1.64 additional years of learning growth by the end of the third year after enrolling. The average Kauffman student moves from the 39th percentile in the state in ELA before entering the school to the 60th percentile after three years. This effect is approximately 84 percent of the ELA test score achievement gap between black and white students in 7th grade in Kansas City.

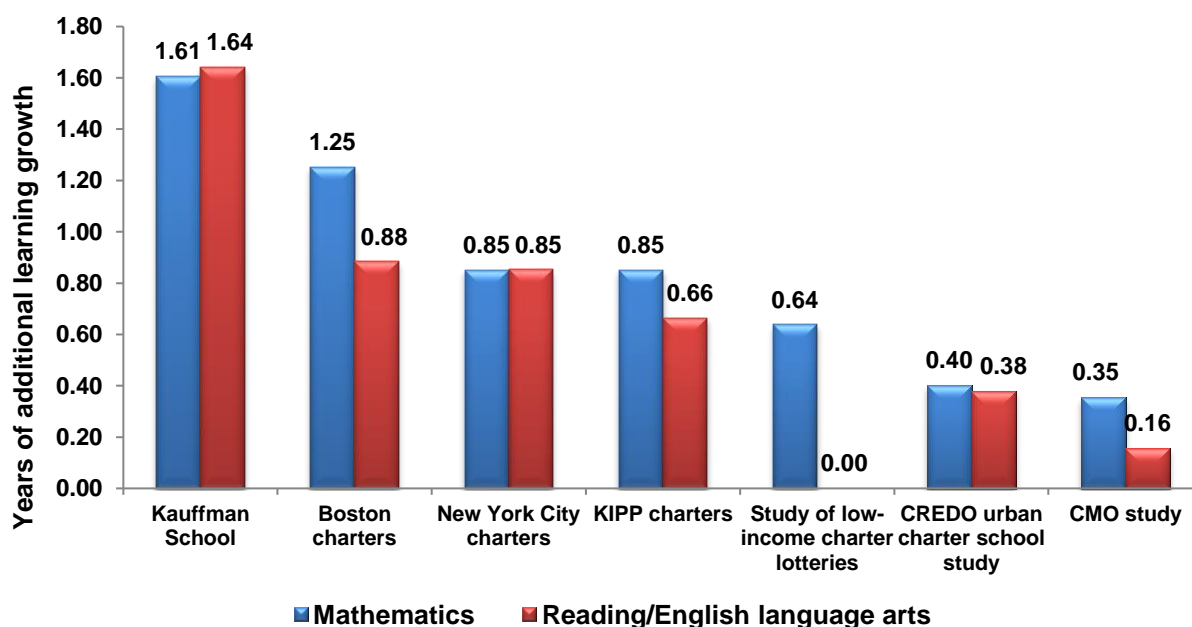
Impacts on science achievement growth. The impact of the Kauffman School in science is also large. Four years after enrolling in the Kauffman School, students achieved approximately 2.18 additional years of learning in science compared with students at other Kansas City schools. This is equivalent to approximately 58 percent of the local science test score achievement gap between black and white students in 8th grade. However, the science impact estimate should be interpreted with caution, because there was no 4th-grade science exam that could be used in the analysis; instead, 4th-grade ELA and mathematics scores were used as baseline controls.

Comparison to other charter schools. The Kauffman School's achievement impacts in mathematics and ELA three years after enrollment are larger than the average effects observed for other highly successful charter school programs (Figure ES.2), including: the average Boston charter school analyzed by Abdulkadiroglu et al. (2009), the average Knowledge Is Power Program (KIPP) middle school studied by Tuttle et al. (2013), and the average New York City charter school analyzed by Hoxby et al. (2009) (although some *individual* schools in those studies achieved higher impacts than the Kauffman School). The estimated two-year impacts of

the Kauffman School are smaller, but within the range of these highly successful charter school programs. See section III.C for further details.

Moreover, the Kauffman School is strongly outperforming broader samples of charter schools nationwide. The effects of the Kauffman School are substantially larger than those of the average oversubscribed charter school serving a large fraction of low-income students analyzed by Gleason et al. (2010), the average urban charter school in the 41 regions analyzed by the Center for Research on Education Outcomes (CREDO 2015), and the average school in a nationwide group of charter school management organizations (CMOs) studied by Furgeson et al. (2012).

Figure ES.2. Charter school three-year impact estimates from various studies represented as years of additional learning growth³



Notes: Figure ES.2 contains three-year effect size estimates converted to years of additional learning growth.

The impact of charter schools on science achievement is less widely reported because science tests are administered in fewer grades in most states. The Kauffman School, with an estimated four-year effect size of 0.66, is performing well compared to KIPP middle schools which are estimated to have a cumulative average impact of 0.33 standard deviations in science for students three to four years after enrollment (Tuttle et al. 2013).

³ Effect size estimates for the average Boston charter school as reported in Abdulkadiroglu et al. (2009), for the average KIPP charter school analyzed by Tuttle et al. (2013), the average New York City charter school in grades 4 through 8 as reported in Hoxby et al. (2009), the average charter school with a lottery admission process serving a large fraction of low-income students analyzed by Gleason et al. (2010), the average urban charter school in the 41 regions analyzed by the Center for Research on Education Outcomes (CREDO 2015), and the average school in the charter school management organizations (CMOs) studied by Furgeson et al. (2012). See Section III.C for further details.

Alternate comparison groups in Kansas City. The main findings summarized here are a result of comparing Kauffman students with a matched comparison group of students from all public schools in Kansas City. We also compared Kauffman students with two subgroups of children—(1) similar students attending district-operated schools in Kansas City and (2) similar students attending other Kansas City charter schools. The estimated effect sizes are generally higher when the Kauffman School is compared only with district-operated schools and lower when compared only with other charter schools. All the effect size estimates for both comparison groups are positive and significant, indicating that the Kauffman School is outperforming the average charter school and the average district school in Kansas City in all three tested subjects.

Changes in effectiveness of the Kauffman School over time. We analyzed whether the impact of the Kauffman School on student achievement changed during the first four years of operation by examining changes over time. The Kauffman School’s estimated impacts in year four (2014–15) were higher in almost all grades and subjects compared to previous years. Even though the Kauffman School was producing significant achievement impacts in earlier years, it appears to have substantially accelerated its achievement impacts in the most recent year. The significant increase may be related to the change in standards tested on the state standardized exams to align with the Common Core State Standards. The Kauffman School had already changed its curricula to align with the Common Core standards prior to year four, which likely positioned students to perform well on the new state tests. It is also possible that the increased impacts in year four were related to other factors, such as improved teacher or school effectiveness.

State test proficiency goal. One of the goals of the Kauffman School is for at least 75 percent of students enrolled for three consecutive years to score proficient or advanced on “all” subjects of the state test (MAP). According to school staff, the original intent of the goal is that 75 percent of students would achieve proficiency on each state test administered to its students. This is an ambitious goal, as only 39 percent of incoming 5th-grade students in the 2011–12 and 2012–13 school years had achieved at the proficient or advanced levels in mathematics and 36 percent in ELA. Among students who were enrolled for three consecutive years, 68 percent achieved proficient or advanced in mathematics and 67 percent in ELA in 2014–15. In addition, 57 percent of students scored proficient or better on both exams. Of note, the first cohort of students achieved 75 percent proficiency on each state test by the end of their fourth year, with 81 percent of students scoring proficient or better in mathematics, 76 percent in ELA, and 78 percent in science. Overall, 64 percent of students reached proficiency on all three exams.

Attendance and suspensions. The Kauffman School had a positive and significant impact on student attendance during the 2014–15 school year, with attendance rates 0.9 percentage points higher than those of comparison students. The results varied across grades, with positive and significant impacts for 5th- and 6th-grade students and impacts that were not significantly different from zero for 7th- and 8th-grade students.

During 2014–15, Kauffman students were 9 percentage points more likely to receive at least one suspension relative to comparison students. The higher overall suspension rate was driven mainly by higher rates of in-school suspensions for 5th and 8th graders. Of note, the average number of days suspended *among students who receive at least one suspension* is not significantly different between Kauffman and matched comparison students in any of the grades

examined. In addition, among Kauffman students who received at least one suspension during 2014–15, the average number of days missed was less than 3. Students at the Kauffman School receive the equivalent of approximately 5 weeks of additional schooling per year relative to other public school students in Kansas City. The average number of days suspended is therefore small relative to the increased instructional time offered.

Conclusions. The Kauffman School has ambitious goals for its students: accelerated learning and high levels of attendance. An analysis of data from the Kauffman School’s first four years shows significant positive impacts on student’s academic achievement growth. While the Kauffman School did not meet its goal of 75 percent of students scoring proficient or advanced on the MAP exams after three years, its first cohort of students did reach that mark at the end of their fourth year (81 percent proficient in mathematics, 76 percent in ELA, and 78 percent in science). During 2014–15, students at the Kauffman School had average attendance rates 0.9 percentage points higher than those of comparison students. Though the Kauffman School suspended students at a statistically significantly higher rate than other schools in Kansas City, there was a substantial decrease in the 2014–15 suspension rate relative to the previous year. The average number of days missed due to suspensions was also small relative to the additional instructional time received by Kauffman students (less than 3 days missed compared to approximately 5 weeks of additional schooling).

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I. INTRODUCTION

A. Background about the Kauffman School

For many years, the Kauffman Foundation has focused on improving education for children in Kansas City. Before opening the Kauffman School, the Kauffman Foundation operated several programs that addressed the challenges faced in urban education, such as Project Early (an early childhood program), Project Choice (a high school dropout prevention program), and the Kauffman Scholars program (an after-school college preparatory program). The success of these programs led Foundation leaders to consider the impact they might have on students in Kansas City if they established a charter school. In March 2009, the Foundation established its school design team, composed of Foundation education experts and the founding executive director of the Missouri Charter Public School Association. This team engaged in a three-step process of exploration and decision making before establishing the Kauffman School.

Step 1. Analyzing Kansas City's educational landscape. From a review of Kansas City assessment data, the school design team learned that during the 2008–2009 school year, charter school enrollment accounted for one-third of all public school enrollment in Kansas City (North 2009), and that, among Kansas City's charter and non-charter schools, only 16 percent of the middle schools and 7 percent of the high schools had at least 50 percent of students reaching proficient or better on statewide mathematics assessments in 2009 (Richardson 2009).

From the Foundation's perspective, these data suggested that Kansas City families had a desire for alternatives to the city's regular public schools, and that current charter and non-charter public schools were struggling to help students achieve. In light of students' low academic performance, the Foundation determined that 5th grade was the optimal grade for students to enter its charter school, which provided have ample time to prepare struggling students for a college preparatory program that would begin in 9th grade.

Step 2. Selecting a location. The Foundation intended that the Kauffman School serve Kansas City's low-income families. From a review of demographic data on Kansas City, the school design team learned that most of the city's low-income population lives in the eastern part of the city, yet the majority of the city's 23 charter schools were located in the western part. In response, the Foundation selected a site in the eastern part of the city, so that the Kauffman School would be near its target students. Using data on household income by zip code, the design team identified five sections of the city with high concentrations of low-income families.

Students living within these five (since expanded to six) zip codes are given first preference for enrollment.⁴

In August 2013, the Kauffman School moved to its permanent location, in the same section of the city. The campus has three buildings: a middle school, a high school, and a gymnasium-cafeteria-commons. The high school, which was built last, opened in August 2014, so all classes were held in the middle school building during year 3. Design elements of the new buildings reflect the Kauffman School's key values and activities. For example, the new buildings have interior windows to facilitate classroom observations, a central feature of the Kauffman School's professional development model. According to the Kauffman School's website, the interior windows create "an environment that is transparent" and encourage "staff, faculty, parents, and visitors to observe classroom instruction as they walk through the building" (Kauffman School 2013). The Kauffman School also offers teacher workrooms and community spaces for small- and large-group meetings, such as the weekly professional development meetings and community events.

Step 3. Identifying best practices. Before the school opened, the design team made extensive efforts to learn about the best practices of successful charter schools, a process the team described as the "year of learning." The team reviewed research on charter schools and visited successful charter schools in New York, Massachusetts, Illinois, and Wisconsin to learn more about the variables that contributed to the success of those schools.

B. Characteristics of the Kauffman School

The Kauffman School enrolled its first class of 5th graders (about 100 students) in fall 2011 and added a second class of 5th-graders (about 100 students) in fall 2012. In fall 2013, a third class of 5th graders joined the Kauffman School (about 200 students). With the opening of its new building, the Kauffman School had sufficient capacity to double the size of the cohort entering in 2013. Each year, the Kauffman School will add a new 5th-grade class of about 200 students, ultimately resulting in a fully enrolled middle school and high school (grades 5 through 12).

The hallmarks of the Kauffman School include: (1) ambitious academic goals, (2) high attendance and behavioral expectations, (3) extended school day and year, (4) increased time for mathematics and reading instruction, (5) intensive data-driven decision making, (6) extensive teacher professional development, and (7) well-established cultural norms. We discuss each of these next.

1. **Ambitious academic goals.** The Kauffman School expects its students to excel academically and achieve at least 1.25 years of growth in mathematics, science, and reading each year. These goals are discussed regularly by school administrators and

⁴ The School also offers bus transportation for students who live more than one mile away, thereby providing access to the School to students of need across the city. During the School's second year of operation, the Foundation identified an additional zip code with a high concentration of low-income students and offered first preference for enrollment to students living in that section of Kansas City as well.

staff, teachers, students, and parents. In addition, daily homework, referred to as “life work,” is mandatory, and students serve detention if they do not turn in their assignments.

2. **High attendance and behavioral expectations.** The Kauffman School has high goals for student attendance (95 percent average daily attendance) and behavior (full observance of school policies and procedures). As a guide for student behavior, teachers implement the SLANT method (Sit up, Listen, Ask and answer questions, Nod your head, Track the speaker) that was developed by the Knowledge Is Power Program (KIPP). Students receive merits for positive behavior and demerits for negative behavior, and may serve detention (in or out of school) depending on the number of demerits they earn. The dean of students oversees the implementation of the Kauffman School’s behavioral policies. Before the start of each school year, the Kauffman School holds an all-parent meeting to orient incoming students and their families to its high behavioral expectations.
3. **Extended school day and year.** With students coming from Kansas City’s low-performing schools, the design team anticipated that many of them would enter school performing below grade level and would need more instructional time to catch up academically and be ready for the Kauffman School’s college preparatory program. Thus, the Kauffman School operates an extended school day and year to provide students with more instructional time.

During the Kauffman School’s first year, students received 37.8 hours of instruction per week (Richardson 2009). In Year 2, the weekly instructional time was shortened to 36.5 hours in response to feedback from students, parents, teachers and staff (Gentile et al. 2013). In Year 3, the time was reduced slightly from Year 2, to 36.2 hours. Weekly instructional time was similar in Year 4: 36.3 hours. With the extended school day and year, Kauffman students receive approximately 5 additional weeks of schooling compared to traditional public school students in Kansas City.

4. **Increased mathematics and reading instructional time.** Every day in Year 1, Kauffman students attended a double period of mathematics (104 minutes), a nonfiction reading class (50 minutes), a writing class (50 minutes), and an extended period of literature (80 minutes). During Year 2, students continued to have a double period of mathematics and their nonfiction reading and writing classes. Their literature class focused on guided reading instruction and was shortened to one period of 50 minutes. During Year 3, students continued to receive a double period of mathematics and 50 minutes of reading instruction. A textual analysis course was added in Year 3. The writing class was absorbed into the textual analysis class, and students received a double period of textual analysis. In Year 4 students continued to have a double period of mathematics (100 minutes) and three periods (150 minutes) of instruction related to English language arts (ELA) and reading. In Years 2, 3, and 4, all students attended a daily instructional support class in which they received tutoring and special instruction. Struggling students received additional instruction and practice in any subjects they needed help with, and high-performing students received advanced instruction.
5. **Intensive data-driven decision making.** With its strong emphasis on results, the Kauffman School utilizes a large assessment portfolio so that teachers and administrators can make data-driven decisions about how to adapt instruction to best

meet students' needs. In addition to teacher-developed "exit tickets,"⁵ quizzes, and tests to measure understanding and academic progress, the Kauffman School's assessment portfolio includes the following:

- Achievement Network (ANet) assessments in mathematics and reading, revised by Kauffman School teachers to be consistent with Missouri State Standards, administered every six weeks⁶
 - Strategic Teaching and Evaluation of Progress (STEP) assessments to measure students' reading growth, administered six times per year
 - Northwest Evaluation Association (NWEA) assessments in mathematics, reading, and science, administered twice a year
 - Missouri Assessment Program (MAP) standardized tests in mathematics, ELA, and science, administered annually by the State of Missouri
6. **Extensive teacher professional development.** The Kauffman School places a significant emphasis on teachers' professional development, with teachers experiencing (1) weekly observations and feedback from administrators; (2) weekly individual coaching sessions; and (3) group-based professional development sessions every Friday afternoon, focused on various topics related to curriculum, instruction, and assessment (Gentile et al. 2014).
7. **Well-established cultural norms.** The Kauffman School takes an intentional approach to establishing a culture of shared values, expectations, and norms, epitomized by its motto: "Creating College Graduates." Continuous efforts are made to communicate explicitly—to all school staff, students, and families—the values, expectations, and norms.

⁵ Exit tickets are short questions or tasks that students complete at the end of the class period. These enable teachers to track the progress of their students' understanding of the course material on a regular basis.

⁶ When the Kauffman School started using the ANet exams, it was the only network participant in the state of Missouri and the exams received by the school were aligned to the state standards of Tennessee. School staff therefore re-wrote a large portion of the questions in Year 1 to better align the exams with Missouri standards, and continued to update the exams in subsequent years.



II. METHODOLOGY AND DATA

A. Methodology

Comparing Kauffman students to students from other Kansas City schools. Because all Kauffman students have chosen to enroll in the Kauffman School, they might differ from other Kansas City students in important ways. Measuring the effect of the Kauffman School on student achievement requires identifying a comparison group of Kansas City students who, as of 4th grade (before the Kauffman School's 5th-grade entry year), are similar to the students about to enter Kauffman School. Otherwise, any difference we find in later student outcomes might not really be due to the effect of the Kauffman School.

To guarantee that the comparison group is similar, the gold standard research design would involve conducting a lottery wherein some of the students who apply to the Kauffman School are randomly selected to attend and others are randomly denied admittance. The achievement of these two randomly established groups could then be fairly compared (based on the assumption that any naturally occurring differences among students would be randomly distributed between the two groups). However, the Kauffman School was not sufficiently oversubscribed during its first four years of operation for this approach to be used. Instead, we employed the next-best approach: using data from students across Kansas City to identify a matched comparison group of students who were similar to Kauffman students at the time they were in the 4th grade.

To construct a comparison group of students, we implemented a propensity-score matching procedure. Students attending other schools in Kansas City were matched to Kauffman students based on characteristics such as prior test scores, prior attendance, prior suspensions, and demographic characteristics. This approach is commonly used as an alternative to random assignment when evaluating the impacts of charter schools and has been shown to produce valid impact estimates that replicate the results of experimental research designs (Tuttle et al. 2013; Gill et al. 2015).⁷

Constituting the Kauffman student group. Throughout our analysis, we classify any student who was enrolled for at least part of a year in the Kauffman School as a Kauffman

⁷ See Appendix A.4 for more details about the implementation of the propensity-score matching procedure. In Appendix B.2, we examine the sensitivity of the results to the use of all students in Kansas City public schools as the comparison group rather than those selected by the propensity-score matching procedure.

student. Classifying students in this manner defuses the potential criticism that the Kauffman School's effects are overestimated because low-achieving students have left the charter school. However, including these students might lead to understating the impact of the Kauffman School on student achievement, because students who left the Kauffman School early in the school year would have received very little influence from it. Similarly, students from the Kauffman School's first cohort who left after 5th grade are nonetheless kept in the treatment group for the 6th-, 7th-, and 8th-grade analysis samples.⁸ Again, this is a conservative analytic approach that eliminates the risk of overestimating the impact, but it means that the full impact on students who continue in the Kauffman School for two, three, or four years is likely to be underestimated.⁹

Data for our analysis were available for four cohorts of Kauffman students. Cohort I students are those who entered the Kauffman School as 5th graders in 2011–12 (the year the Kauffman School opened). Cohort II students are those who entered as 5th graders in 2012–13, cohort III students entered as 5th graders in 2013–14, and cohort IV students entered as 5th graders in 2014–15.

In the next chapter, we present impact estimates by the number of years that have passed since students first enrolled in the Kauffman School. The four-year impacts are based on the outcomes of cohort I students, who were 8th graders in 2014–15.¹⁰ The three-year impacts are the average of the Kauffman School's impact on cohort II students (the 7th graders in 2014–15) and its impact on cohort I (the 7th graders in 2013–14). The two-year impacts are the average of the Kauffman School's estimated impact on first three cohorts of students when they were in 6th graders. Similarly, the one-year impacts are the average of the Kauffman School's estimated impact on all four cohorts in their 5th-grade year.

B. Data and descriptive statistics

In this section, we provide details about the data used in our main analysis of the impact of the Kauffman School on student outcomes. We also present a set of descriptive statistics to show how Kauffman students compare to students in other schools in the city, in terms of prior achievement and demographic characteristics.

1. Data

The data we used in our main analyses were provided by the Missouri Department of Elementary and Secondary Education. They consisted of MAP test scores in mathematics, ELA, and science, along with attendance and suspension data for all students in Missouri who were in

⁸ Only students who entered the Kauffman School in 5th grade are included in the treatment group for this analysis. No new students were admitted in 6th or 7th grade during the Kauffman School's second and third year of operation. In year 4, the Kauffman School admitted 22 new students in 6th through 8th grade. These students are excluded from the analysis because they are not directly comparable to the other Kauffman students.

⁹ In Appendix B.1, we discuss the issue of attrition in more detail and present attrition-adjusted impact estimates that approximate the impact of the Kauffman School for 5th-grade students who remain enrolled.

¹⁰ Students who repeated a grade are also included in the calculations. See Appendix B.3 for details.

the 5th, 6th, 7th, or 8th grade in the 2011–12 through 2014–15 school years.¹¹ We also obtained for these students data on their prior (3rd and 4th grade) test scores, prior attendance, prior suspensions, and demographic characteristics. We limited our potential comparison group to students attending schools in the borders served by the Kansas City Public Schools district (KCPS). (See Appendix A.2 for details about the analysis sample selection process.)

The main results in this report are based on a matched comparison group selected from all students attending schools within the borders of KCPS, including other charter schools. This group is likely the most relevant for our evaluation, because using these students to construct the comparison group provides an impact estimate that can be interpreted in terms of how much more or less a Kansas City student would be expected to achieve if that student were to enroll in the Kauffman School rather than a typical Kansas City school. However, given the large number of charter schools serving students in the Kansas City area, comparing the Kauffman School’s impacts on student achievement to those of other Kansas City charter schools might also be of interest. Thus, we report the results in three ways: using comparison groups of students from (1) all public schools in Kansas City (the primary impact estimates), (2) district-operated (non-charter) KCPS schools only, and (3) other charter schools within Kansas City only.

Data on one or more of the variables used as baseline controls are missing for many students. About 12 percent of the students we could potentially include in our analysis sample in the most recent year of data are missing data on one or more of the baseline control variables. To avoid dropping them from the analysis, we employed a multiple imputation procedure to estimate their missing baseline values.¹² We also analyzed the data without using imputation and found similar results (Appendix B.4).

2. Descriptive statistics: What types of students attend the Kauffman School?

Full descriptive statistics for each cohort of Kauffman students, compared with students in other Kansas City public schools, are presented in Appendix A, tables A.2 through A.5. On average, 4th-grade MAP scores of Kauffman students were below the statewide average in both mathematics and ELA. Students at the Kauffman School were also predominantly from low-income and minority families: across the first four cohorts, at least 80 percent of Kauffman students were eligible for free or reduced-price lunches in 4th grade, and at least 85 percent were black or Hispanic.

Although, on average, the Kauffman students performed below the state average on the 4th-grade MAP, they had higher 4th-grade MAP test scores than other students in Kansas City public schools and were less likely to receive any accommodations on the 4th-grade MAP.¹³ Compared to students in Kansas City public schools, Kauffman students also were more likely to be black, were less likely to be Hispanic, and had slightly higher average 4th-grade attendance rates. In general, differences tended to be larger relative to Kansas City district schools and smaller

¹¹ In previous years, the name of the ELA assessment was Communication Arts. For simplicity, in this report we will use “ELA” to refer to both the 2014–2015 exam and the Communication Arts exam from prior years.

¹² Appendix A.3 contains more details about our imputation procedure.

¹³ Examples of test accommodations include extended test time, individual testing, and oral reading of test questions.

relative to Kansas City charter schools. Kauffman students were generally similar to other Kansas City public school students with respect to 4th-grade free or reduced-price lunch and disability rates, though there were some significant differences across cohorts.

Because Kauffman students differed from the average student in Kansas City public schools, if we included all Kansas City students in the analysis comparison group, there would have been significant differences in baseline characteristics between Kauffman and comparison students. These differences could lead to concerns about bias in the impact estimates, because students who differ with respect to baseline characteristics may be expected to show different rates of growth. We therefore used a matching procedure to ensure that the comparison students were similar to Kauffman students with respect to baseline characteristics. Appendix A, Table A.8 provides descriptive statistics for the matched comparison groups relative to each cohort of Kauffman students. By design, there are no significant differences in baseline characteristics between the Kauffman and matched comparison groups. Because we were unable to find a match for all students, some Kauffman students are not included in the main analyses. For instance, when creating a comparison group similar to all KCPS students in 2014–15, we were unable to find a match for 9 percent of Kauffman students. Appendix A, Table A.8 shows details on the number of Kauffman students excluded for this reason. Caution should therefore be used when interpreting the impact results, because it is possible that they are not representative of the achievement of all Kauffman students. However, as a robustness check, we performed an analysis that did not use matching but relied exclusively on statistical adjustments to account for baseline differences between Kauffman and comparison students. This analysis included all Kauffman and comparison students with nonmissing data; the results were similar to the main findings. See Appendix B.2 for details.



III. THE IMPACT OF THE KAUFFMAN SCHOOL ON STUDENT ACHIEVEMENT

In this chapter we report the impact of the Kauffman School on student achievement as measured by the MAP exams in mathematics (one to three years after enrollment), ELA (one to four years after enrollment), and science (one year and four years after enrollment). The number of years for which we can measure impacts depends on the state's testing regimen in each subject and grade. We describe various ways of interpreting the impact estimates and place their size in the context of findings for other evaluations of charter school effectiveness. We also evaluate whether the Kauffman School achieved its goal of 75 percent of students enrolled for three consecutive years achieving proficient or advanced scores on the MAP exams.

A. Impacts on state test scores

The impact estimates for the Kauffman School on student achievement in each MAP subject are displayed in Table III.1. The results are based on regression models that include the Kauffman students and matched comparison students and control for small remaining differences in prior achievement and other baseline characteristics.¹⁴ As noted previously, any student who is enrolled in the Kauffman School as a 5th grader for at least part of the school year is included in the Kauffman group for all impact estimates. The impact estimates should therefore be interpreted as the average effect of enrolling in the Kauffman School, accounting for the possibility that students may leave. The results are displayed in effect size units, which can be interpreted as how many student test score standard deviations higher or lower Kauffman students are performing relative to students in the comparison groups (after controlling for baseline achievement).¹⁵ Standard errors are displayed in parentheses below each estimate, and asterisks indicate whether the estimate is significantly different from zero.

¹⁴ The covariates include all the variables summarized in Table A.2. We also include 3rd-grade mathematics and ELA MAP scores, second- and third-order polynomial terms for 4th-grade MAP scores, and indicator variables that equal one if a student has imputed prior test scores or imputed attendance or suspension data.

¹⁵ During the 2014–2015 school year, the statewide standard deviations of 8th-grade MAP scores were 96 in mathematics, 88 in ELA, and 32 in science; of 7th-grade MAP scores, 97 in mathematics and 92 in ELA; of 6th-grade MAP scores, 92 in mathematics and 90 in ELA; and of 5th-grade MAP scores, 82 in mathematics, 84 in ELA, and 32 in science.

Table III.1. Impact of Kauffman School on MAP test scores (citywide comparison group)

	Mathematics	ELA	Science	Sample size
One-year impact estimates (5th grade)	0.22** (0.03)	0.23** (0.03)	0.46** (0.04)	2,956
Two-year impact estimates (6th grade)	0.35** (0.04)	0.18** (0.04)	n.a.	2,205
Three-year impact estimates (7th grade)	0.68** (0.06)	0.52** (0.06)	n.a.	1,114
Four-year impact estimates (8th grade)	0.96** ^a (0.10)	0.53** (0.08)	0.66** (0.10)	748

Notes: This table displays impact estimates in effect size units. The first row presents the average one-year impact estimates for cohort I, II, III, and IV 5th graders. The second row presents the average two-year impact estimates for cohort I, II, and III 6th graders. The third row presents the three-year impact estimates of cohort I and II 7th graders. The fourth row presents the four-year impact estimates of cohort I (the only cohort that has completed four years in the Kauffman School). Standard errors are displayed in parentheses below each impact estimate. The sample size represents the total number of Kauffman and matched comparison students entering each analysis.

**Significantly different from zero at the 1 percent level.

^a The four-year mathematics impact is based in part on imputed outcome data. See text for details.

ELA = English language arts; n.a. = not applicable.

The first row of Table III.1 shows the amount of additional growth realized by Kaufman students relative to matched comparison students in all other Kansas City public schools one year after enrollment. The numbers represent the average effect size estimate for the first four cohorts of 5th graders.¹⁶ The one-year impact estimates for the Kauffman School are positive and statistically significant in mathematics, ELA, and science. Caution should be used when interpreting the science estimate, however, because no prior-year science test score was available to use in the propensity-score matching procedure or as a control variable in the regressions. The statewide science assessment in Missouri is first administered in 5th grade, so the only baseline test score variables available for use in the analysis of 5th-grade science impacts are prior scores in mathematics and ELA.

The remaining rows of Table III.1 report the estimated effect of the Kauffman School on student achievement two, three, and four years after enrollment. With the exception of the four-year ELA impact estimate, all the impacts increase with longer duration. Collectively, these results demonstrate that the impact of the Kauffman School accumulates for students who are enrolled for multiple years.

Approximately 20 percent of 8th-grade students outside the Kauffman School took the Algebra I end-of-course exam in place of the 8th-grade mathematics MAP exam. We imputed the missing 8th-grade mathematics test scores for these students using their other 8th-grade test scores as well as prior mathematics and ELA test scores and demographic characteristics (see Appendix A.3 for details). The four-year mathematics impact estimate should be interpreted with

¹⁶ The effect sizes were estimated separately for each cohort of students. To calculate the impact estimates in Table III.1, we averaged these effect sizes together, weighting by the number of Kauffman students in the analysis sample for each cohort.

caution, because the imputation procedure may not provide an accurate estimate of these students' 8th-grade mathematics scores. This could occur if advanced students who were likely to do well in mathematics chose to take Algebra I instead of 8th-grade mathematics, and this aptitude for mathematics was not fully captured in the student's 7th-grade mathematics or other test scores. Because of this issue, we focus on the three-year impact mathematics estimates when discussing the magnitude of the effect of the Kauffman School on student achievement. To simplify the comparisons of the Kauffman School impacts with results from other studies, we focus on the three-year ELA impact estimates as well. These impact estimates also have the advantage of being based on two cohorts of students rather than one.

In Table III.2, we report the results with two alternative comparison groups. The first half of the table reports the effect size estimates for the Kauffman School compared to district-operated (non-charter) public schools in KCPS. The impact estimates in all subjects are larger when this comparison group is used. The second half of Table III.2 presents the results when the Kauffman School is compared to other charter schools in Kansas City. When compared to this group of schools, the effect size estimates for the Kauffman School are generally lower, but the estimates remain positive and statistically significant for all durations and subjects. Thus, students at the Kauffman School are showing significantly higher growth than students in other Kansas City charter schools.

Table III.2. Alternate estimates of impact of Kauffman School on MAP test scores (district and charter school comparisons)

	Mathematics	ELA	Science	Sample size
Compared to Kansas City district schools				
One-year impact estimates (5th grade)	0.24** (0.04)	0.25** (0.03)	0.51** (0.04)	2,200
Two-year impact estimates (6th grade)	0.35** (0.05)	0.17** (0.04)	n.a.	1,566
Three-year impact estimates (7th grade)	0.77** (0.07)	0.62** (0.07)	n.a.	744
Four-year impact estimates (8th grade)	1.05** (0.13)	0.65** (0.09)	0.84** (0.13)	457
Compared to Kansas City charter schools				
One-year impact estimates (5th grade)	0.20** (0.04)	0.23** (0.04)	0.40** (0.05)	1,366
Two-year impact estimates (6th grade)	0.32** (0.05)	0.20** (0.05)	n.a.	929
Three-year impact estimates (7th grade)	0.57** (0.08)	0.45** (0.08)	n.a.	506
Four-year impact estimates (8th grade)	0.84** (0.14)	0.41** (0.10)	0.51** (0.12)	343

Notes: This table displays impact estimates in effect size units. Standard errors are displayed in parentheses below each impact estimate. The sample size represents the total number of Kauffman and matched comparison students entering each analysis.

**Significantly different from zero at the 1 percent level.

ELA = English language arts; n.a. = not applicable.

B. Interpretation of Kauffman School impact estimates

To assist with the interpretation of the effect size estimates, we converted the effect sizes into three alternative units: (1) years of learning growth, (2) the change in state test score percentile rank for the average Kauffman student, and (3) the effect size as a percentage of local achievement gaps.

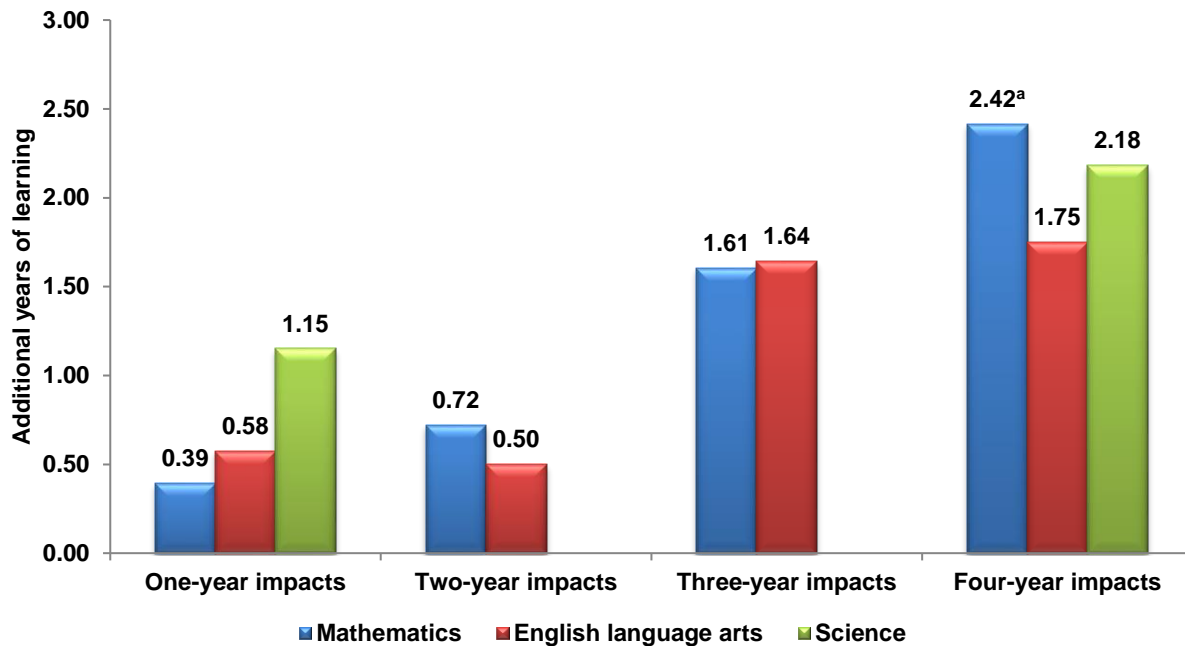
Results as years of learning growth. We can translate the effect sizes presented in the previous section into an approximate measure of the years of additional learning growth experienced by Kauffman students based on results presented in Bloom et al. (2008).¹⁷ Translating the results in this way allows us to evaluate whether the Kauffman School is achieving its goal of producing on average at least 1.25 years of learning growth for students during each year of instruction.

Performing this conversion on the impact estimates for the main comparison group yields the results displayed in Figure III.1. These results show that the Kauffman School is meeting its aim of producing on average at least 1.25 years of learning in each year of instruction, since the average additional growth per year is 0.25 or greater for all impact estimates in each subject. Note that caution is warranted when interpreting the results for Kauffman School effect size in terms of years of learning, because the accuracy of these conversions depends on how similar achievement growth on the MAP exams is to the vertically scaled assessments analyzed in Bloom et al. (2008).¹⁸ It is also worth noting that the results in Figure III.1 provide a conservative estimate of whether the Kauffman School is achieving the 1.25 years of learning growth goal, because students who are no longer enrolled in the school are included in the Kauffman student sample. To obtain a more complete picture of the Kauffman School's progress towards achieving this goal, we also use results from the NWEA exams and STEP literacy assessments that are administered to Kauffman students. See Gentile et al. (2015) for details.

¹⁷ See Gleason et al. (2012), Clark et al. (2013), and Tuttle et al. (2013) for examples of other studies performing conversions between effect size estimates and years of learning growth. Using a set of widely administered vertically scaled assessments, Bloom et al. (2008) estimated that the typical 5th grader grows 0.56 standard deviations in mathematics, 0.40 standard deviations in ELA, and 0.40 standard deviations in science. They also estimated that the typical 6th grader grows 0.41 standard deviations in mathematics 0.32 standard deviations in ELA and 0.27 standard deviations in science, whereas a typical 7th grader grows 0.30 standard deviations in mathematics, 0.23 standard deviations in ELA, and 0.28 standard deviations in science. A typical 8th grader grows 0.32 standard deviations in mathematics, 0.26 standard deviations in ELA, and 0.26 standard deviations in science. To convert the one-year impact estimates of the Kauffman School into units of additional years of learning, we divided the impact estimates by the typical growth of 5th graders in each subject. We used a similar method to convert the two-, three-, and four-year impact estimates into additional years of learning growth. For these results, we divided the impact estimates by the average of the typical growth across all grades included in each analysis.

¹⁸ If typical achievement growth on the MAP is less than growth on the assessments analyzed in Bloom et al. (2008), then this conversion will underestimate the additional years of learning growth achieved by Kauffman students and vice versa. The scale of the MAP assessments is based, in part, on the Terra Nova exams, giving the MAP some of the characteristics of a vertically scaled exam. Thus, in principle, we could use average growth on the MAP in place of the numbers from Bloom et al. (2008). However, there are known issues with the MAP vertical scale when students show no growth on average between grades 5 and 6 (CTB McGraw-Hill 2012). Therefore, we did not attempt to use the vertical scale of the MAP to convert effect sizes into units of years of learning.

Figure III.1. Kauffman School estimates of additional years of learning growth on MAP exams



Note: The additional growth for all impact estimates is significantly different from zero.

^a The four-year mathematics impact is based in part on imputed outcome data. See text for details.

Results as test score percentile ranks. As a second interpretation approach, we report the change in state test score percentile ranks that the average Kauffman student would expect to achieve as a result of attending the Kauffman School rather than an average Kansas City school. In 4th grade, before entering the Kauffman School, the average Kauffman student from the first and second cohorts was at the 39th percentile in both the state mathematics test score distribution and the state ELA test score distribution.¹⁹ Three years after enrollment at the Kauffman School, the average student moved to the 65th percentile in mathematics and the 60th percentile in ELA.²⁰ On average, students enrolled at the Kauffman School moved from substantially below the state average to above average three years after enrollment.

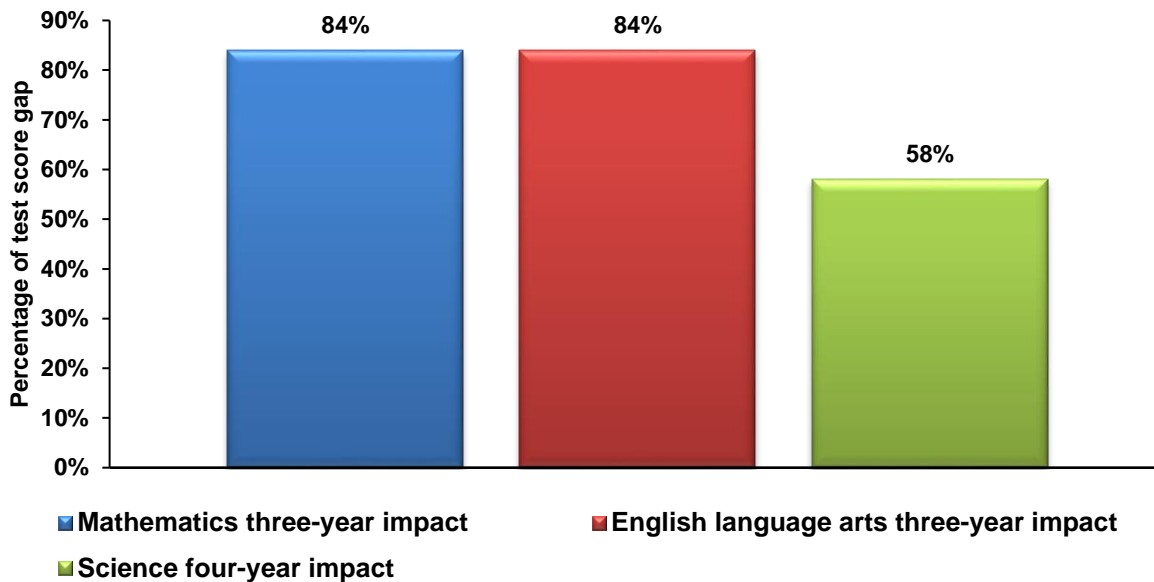
Results as a percentage of local achievement gaps. The Kauffman School effect size estimates can also be reported as a percentage of the local black-white test score gap (Figure III.2). These percentages provide a sense of how much of that achievement gap is being closed three years after enrollment in the Kauffman School. The three-year impact estimates are equivalent to 84 percent of the 7th-grade black-white test score gap in both mathematics and ELA for Kansas

¹⁹ These calculations are based on the current analysis sample of cohort I and II students only, because this is the sample used to calculate the three-year impact estimates.

²⁰ The percentile ranks three years after enrollment at the Kauffman School were calculated by taking the average 4th-grade z-scores of Kauffman students and adding the three-year effect size estimates. These calculations assume that the percentile rank of the average student in Kansas City does not change over time.

City students.²¹ The four-year science impact estimate for the Kauffman School is equivalent to 58 percent of the black-white test score gap.²² These results indicate that the Kauffman School is making significant progress toward reducing achievement gaps for minority students.

Figure III.2. Kauffman School impact estimates as a percentage of the local black-white test score gap



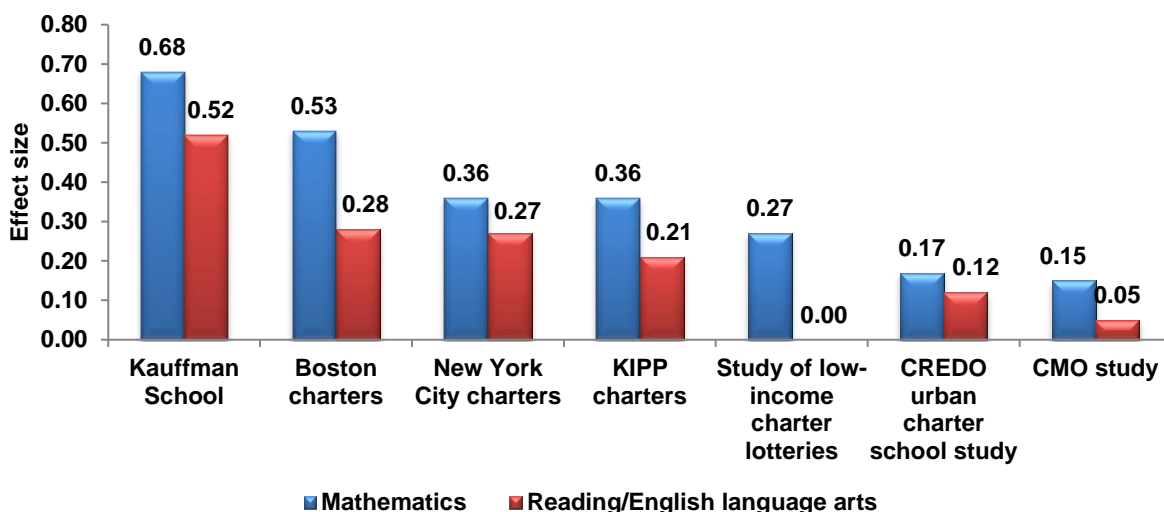
Note: All impact estimates are significantly different from zero.

C. Comparison of Kauffman School estimated impacts to those of charter schools nationwide

The main three-year effect size results (based on the citywide comparison group) are larger than the average impacts estimated for high-performing charter schools in other studies and substantially greater than average impact estimates for charter schools nationwide. Here we discuss studies of three groups of charter schools widely acknowledged as producing substantial achievement growth for students: Boston, KIPP, and New York City charter schools. We also report the results of three nationwide studies of charter schools that focused on (1) charter schools with admission lotteries, (2) the average urban charter school in 41 regions analyzed by the Center for Research on Education Outcomes (CREDO 2015), and (3) charter school management organizations (CMOs). The comparisons are summarized in Figure III.3.

²¹ The average 7th-grade mathematics z -score for non-Kauffman black students in Kansas City in mathematics is -0.772, and the average z -score for white students is 0.039. The corresponding z -scores in ELA are -0.683 for black students and -0.065 for white students. These z -scores are based on test score data from the spring of 2015 to provide an estimate of the current black-white test score gap.

²² The average 8th-grade science z -score for non-Kauffman black students in Kansas City is -1.049; the corresponding average z -score for white students is 0.080. These z -scores are based on data from spring 2015.

Figure III.3. Charter school three-year impact estimates from various studies

Note: Figure III.3 contains three-year effect size estimates for the average Boston charter school reported in Abdulkadiroglu et al. (2009), the average KIPP charter school analyzed by Tuttle et al. (2013), the average New York City charter school in grades 4 through 8 reported in Hoxby, et al. (2009), the average charter school with a lottery admission process serving a large fraction of low-income students analyzed by Gleason et al. (2010), the average urban charter school in the 41 regions analyzed by the Center for Research on Education Outcomes (CREDO 2015), and the average school in the CMOs studied by Furgeson et al. (2012).

CMO = charter school management organization; CREDO = Center for Research on Education Outcomes; KIPP = Knowledge Is Power Program.

The performance of the Kauffman School in mathematics and reading is higher than the average estimated impacts of other successful charter school programs. A study of Boston charter schools (Abdulkadiroglu et al. 2009) showed an estimated average three-year effect size for these schools of 0.53 in mathematics and 0.28 in reading.²³ The results presented by Hoxby et al. (2009) imply average three-year effect sizes of 0.36 in mathematics and 0.27 in reading for New York City charter schools in grades 4 through 8.²⁴ A study of KIPP charter middle schools—widely recognized as high-performing—reported average three-year impact estimates of 0.36 in mathematics and 0.21 in reading (Tuttle et al. 2013). The Kauffman School is estimated, on average, to have larger impacts on student achievement than these high-performing charter school programs. It is important to note that Figure III.3 displays the *average* impacts of the charter schools in these groups. Some individual schools or subsets of these groups have larger estimated impacts than the Kauffman School. For example, the three-year impact estimates for over-subscribed Boston charter middle schools analyzed in Abdulkadiroglu et al.

²³ The three-year impact estimates reported in this section are generally obtained by tripling the average annual impact estimates reported by the authors. The exceptions to this are the KIPP study, the charter lottery study, and the CMO study. In the KIPP and CMO studies, the authors reported three-year impact estimates separately from one-year estimates. The three-year impact estimates for the charter lottery study were obtained by increasing the two-year estimates by 50 percent.

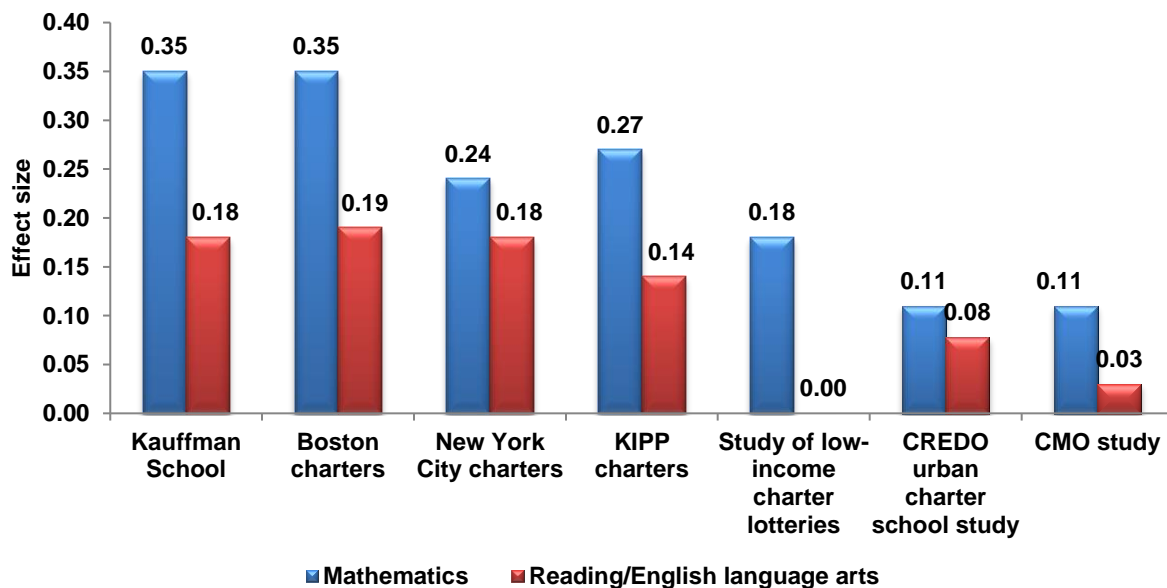
²⁴ The estimated impacts of New York City charter schools on lower elementary school grades are smaller than in grades 4 through 8. When lower elementary school grades are included in the calculations, the average three-year impact estimates for New York City charter schools are 0.27 in mathematics and 0.18 in ELA.

(2009) are equivalent to 0.51 standard deviations in reading and 1.6 standard deviations in mathematics.

The achievement growth of students at the Kauffman School is substantially higher than the average growth of students at broader samples of charter schools nationwide (Figure III.3). Gleason et al. (2010) analyzed a sample of oversubscribed charter middle schools with lottery admission processes. The results indicate an average three-year impact estimate of 0.27 in mathematics and zero in reading for charter schools serving a large fraction of low-income students.²⁵ Across urban charter schools in the 41 regions included in the Center for Research on Education Outcomes (CREDO) analysis, the average impact was 0.17 in mathematics and 0.12 in reading (CREDO 2015). The average charter school in the CMOs analyzed by Furgeson et al. (2012) was estimated to produce three-year effect sizes of 0.15 in mathematics and 0.05 in reading.

The three-year impact estimates for the Kauffman School are approximately double the size of the two-year estimates. When the Kauffman School two-year impact estimates are compared to those reported in other studies of charter schools, the estimates fall within the range of other highly successful charter programs but are still substantially larger than the impact estimates from national charter school studies (Figure III.4).

Figure III.4. Charter school two-year impact estimates from various studies



Notes: Figure III.4 contains two-year effect size estimates for the average Boston charter school reported in Abdulkadiroglu et al. (2009), the average KIPP charter school analyzed by Tuttle et al. (2013), the average New York City charter school in grades 4 through 8 reported in Hoxby et al. (2009), the average charter school with a lottery admission process serving a large fraction of low-income students analyzed by Gleason et al. (2010), the average urban charter school in the 41 regions analyzed by the Center for Research on Education Outcomes (CREDO 2015), and the average school in the CMOs studied by Furgeson et al. (2012).

CMO = charter school management organization; CREDO = Center for Research on Education Outcomes; KIPP = Knowledge Is Power Program.

²⁵ Gleason et al. (2010) report negative but statistically insignificant impact estimates based on the full set of charter schools in their sample (not only those serving low-income students).

Because there are fewer available data for science achievement than for mathematics and reading, relatively few studies of charter school effectiveness report impact estimates in science.²⁶ The Kauffman School’s estimated four-year science impact compares favorably to the science impacts of KIPP middle schools, which are estimated to have a cumulative average impact of 0.33 standard deviations in science for students three to four years after enrollment (Tuttle et al. 2013).

D. Goal that 75 percent of students score proficient or advanced on MAP exams

One goal of the Kauffman School is that at least 75 percent of students enrolled for three consecutive years score in the proficient or advanced performance range on “all” subjects of the MAP test. According to school staff, the original intent of the goal is that 75 percent of students would achieve proficiency on each state test administered to its students. The proficiency rates of the first two cohorts of Kauffman students enrolled for three consecutive years are summarized in Table III.3. The first column displays the percentage of these students who scored proficient or advanced on the MAP exams taken in the spring before they entered the Kauffman School (i.e., in 4th grade). This column provides an indication of how ambitious the 75 percent goal is, as only 39 percent of incoming cohort I and II had achieved proficient or advanced in mathematics and 36 percent in ELA on their prior-year MAP exams.

The Kauffman School did not meet the goal of 75 percent of students achieving at the proficient or advanced levels after three years of consecutive enrollment. Among students who were enrolled at the Kauffman School for three consecutive years, 68 percent achieved proficient or advanced on the mathematics, and 67 percent on the ELA MAP exams. To provide additional detail about the progress Kauffman students made toward this goal, we report the results separately for cohort I and cohort II students.

Table III.3. Percentage of Kauffman students scoring proficient or advanced on MAP exams after three years of continuous enrollment

	Proficient/advanced at time of entry	Proficient/advanced after three years of enrollment
Cohort I and II students combined		
Mathematics MAP (%)	39	68
ELA MAP (%)	36	67
Both mathematics and ELA MAP (%)	26	57
Sample size	140	152
Cohort I students		
Mathematics MAP (%)	32	66
ELA MAP (%)	30	55
Both mathematics and ELA MAP (%)	20	51

²⁶ Hoxby et al. (2009) reports average annual impacts of 0.23 standard deviations in science for New York City charter schools in grades 5 through 8. However, that impact is estimated with a large standard error and is not statistically significant (p -value = 0.14). Multiplying this annual impact estimate by four would therefore be unlikely to provide a meaningful comparison with the four-year science impact of the Kauffman School.

Sample size	74	74
Cohort II students		
Mathematics MAP (%)	45	68
ELA MAP (%)	44	78
Both mathematics and ELA MAP (%)	32	62
Sample size	66	78

Notes: The sample includes 152 cohort I and cohort II students who were enrolled at the Kauffman School for three consecutive years. The scores at time of entry are based on 4th-grade MAP scores for 134 students and 3rd-grade MAP scores for 6 students who skipped a grade when entering the Kauffman School. Twelve cohort II students are missing baseline MAP exam scores. The scores after three years of enrollment are based on 7th-grade MAP exams for 146 students and 6th-grade MAP exams for 6 students who repeated a grade while at the Kauffman School.

ELA = English language arts

Table III.4 displays the percentage of Kauffman students scoring proficient or advanced after four years of continuous enrollment. The Kauffman School achieved the goal of 75 percent proficiency on each state test for these students, with 81 percent of scoring proficient or better in mathematics, 76 percent in ELA, and 78 percent in science. Overall, 64 percent of students reached proficiency on all three exams after four years of enrollment.

Table III.4. Percentage of Kauffman students scoring proficient or advanced on MAP exams after four years of continuous enrollment

	Proficient/advanced at time of entry	Proficient/advanced after four years of enrollment
Mathematics MAP (%)	32	81
ELA MAP (%)	27	76
Science MAP (%)	n.a.	78
All available MAP assessments (%)	19	64
Sample size	59	59

Notes: The sample includes 59 cohort I students who were enrolled at the Kauffman School for four consecutive years. The scores at time of entry are based on 4th-grade MAP scores taken in spring 2011 for 55 students and 3rd-grade MAP scores taken in spring 2011 for 4 students who skipped a grade when entering the Kauffman School. The scores after four years of enrollment are based on 8th-grade MAP exams taken in spring 2015 for 54 students, and 7th-grade MAP exams taken in spring 2015 for 5 students who repeated a grade during their time at the Kauffman School. These 5 students are included in the calculation of overall proficiency rates in the first row of the table, with results based only on mathematics and ELA scores, because 8th grade science MAP scores are unavailable for them.

ELA = English language arts; n.a. = not applicable.



IV. CHANGE IN EFFECTIVENESS OF THE KAUFFMAN SCHOOL OVER TIME

The Kauffman School has completed four full years of operation: 2011–12, 2012–13, 2013–14, and 2014–15. We can use data on 5th, 6th, and 7th graders to test whether the estimated impacts of the Kauffman School have changed over time. We might expect to see an increase in the estimated impact over time, because other studies have found that charter schools often show increases in performance after the first year (Gill et al. 2007; Sass 2006).

Table IV.1 compares the estimated one-year (5th grade) Kauffman School impacts for cohorts I, II, III, and IV. Tables IV.2 and IV.3 display the corresponding comparisons of impacts for 6th and 7th graders across years.

Looking across the three tables, a clear pattern emerges: although there is no evidence of any statistically significant changes in impacts over the first three years of the school’s operation, impacts for the fourth year (2014–15) exceed those of preceding years in most of the comparisons. One-year impacts for 5th graders are higher in 2014–15 than in the preceding year in reading and mathematics (but not statistically distinguishable in science). Two-year impacts for 6th graders are higher in mathematics for the most recent cohort relative to the preceding one (but not distinguishable in reading). Three-year impacts for 7th graders are higher in both English and mathematics for the most recent cohort relative to the preceding cohort. In short, even though the Kauffman School was producing significant achievement impacts in earlier years, it appears to have substantially accelerated its achievement impacts in 2014–15.

The significant increase in estimated impacts across grades and subjects in the 2014–15 school year may be related to the change in standards tested on the MAP exams to align with the Common Core State Standards. The Kauffman School had already changed its curricula to align with the Common Core standards prior to 2014–15, which likely positioned students to perform well on the new MAP exams. It is also possible that the larger impacts in year 4 were related to other factors, such as increases in teacher or school effectiveness.

Table IV.1. Comparison of one-year MAP test score impacts: Cohort I, II, III, and IV 5th graders

	Cohort I 5th graders (2011–12)	Cohort II 5th graders (2012–13)	Cohort III 5th graders (2013–14)	Cohort IV 5th graders (2014–15)
5th-grade mathematics effect size	0.13 (0.06)	0.15 (0.07)	0.12 (0.04)	0.42** (0.06)
5th-grade ELA effect size	0.06 (0.07)	0.18 (0.06)	0.13 (0.04)	0.44** (0.06)
5th-grade science effect size	0.40 (0.08)	0.54 (0.07)	0.43 (0.04)	0.52 (0.07)
Sample size	677	617	948	714

Notes: This table displays impact estimates in effect size units. Standard errors are displayed in parentheses below each impact estimate. The sample size represents the total number of Kauffman students and matched comparison students entering each analysis.

**Significantly different from the prior cohort at the 1 percent level.

ELA = English language arts.

Table IV.2. Comparison of two-year MAP test score impacts: Cohort I, II, and III 6th graders

	Cohort I 6th graders (2011–2013)	Cohort II 6th graders (2012–2014)	Cohort III 6th graders (2013–2015)
6th-grade mathematics effect size	0.33 (0.08)	0.20 (0.07)	0.43* (0.06)
6th-grade ELA effect size	0.18 (0.07)	0.20 (0.07)	0.17 (0.06)
Sample size	596	585	1,024

Notes: This table displays impact estimates in effect size units. Standard errors are displayed in parentheses below each impact estimate. The sample size represents the total number of Kauffman students and matched comparison students entering each analysis.

*Significantly different from the prior cohort at the 5 percent level.

ELA = English language arts.

Table IV.3. Comparison of three-year MAP test score impacts: Cohort I and II 7th graders

	Cohort I 7th graders (2011–2014)	Cohort II 7th graders (2012– 2015)
7th-grade mathematics effect size	0.57 (0.07)	0.80* (0.09)
7th-grade ELA effect size	0.41 (0.08)	0.66* (0.09)
Sample size	534	580

Notes: This table displays impact estimates in effect size units. Standard errors are displayed in parentheses below each impact estimate. The sample size represents the total number of Kauffman students and matched comparison students entering each analysis.

*Significantly different from the prior cohort at the 5 percent level.

ELA = English language arts.

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V. THE IMPACT OF THE KAUFFMAN SCHOOL ON STUDENT ATTENDANCE AND SUSPENSIONS

In this chapter, we present the impacts of the Kauffman School on student attendance and suspensions during the 2014–15 school year. Keep in mind that the analysis of suspensions cannot distinguish effects driven by differences in student behavior from effects driven by differences in the enforcement of school policies or reporting practices. If Kauffman students are more likely than students in other schools to be suspended, it could be due to an increased frequency of infractions or because the Kauffman School issues suspensions for different kinds of behavior than do other Kansas City schools.

The set of comparison students used to analyze attendance and suspension outcomes is the same as the set used to analyze MAP achievement in Chapter III. We also used the same set of baseline control variables, including 4th-grade attendance and suspension information. We analyzed the attendance and suspension outcomes separately by cohort and by grade to highlight differences that arise over time and across grades. We used the attendance rate as the outcome in the attendance models and present three sets of results for suspension outcomes. The state of Missouri collects suspension data separately for in-school suspensions and out-of-school suspensions. For the initial suspension analysis, we combined these data into one variable, indicating whether a student received either type of suspension. Our aim in combining these data was to create a variable that would be as comparable as possible across schools, because different schools have different standards for the kinds of disciplinary infractions that warrant in-school and out-of-school suspensions. To provide additional information on the source of the Kauffman School suspension impacts, we also present separate results where indicators for ever receiving an in-school or out-of-school suspension are used as outcome variables. (Appendix A.1 provides further details on the construction of the attendance and suspension variables.)

The distribution of suspensions is skewed, with the majority of students receiving no suspensions. To simplify the analysis for the main suspension impact results, our outcome of interest is whether a student ever received a suspension during the year.²⁷ Before presenting the impact estimates of the Kauffman School, we present descriptive statistics about attendance and

²⁷ Because the suspension outcome is a binary rather than a continuous variable, we use a logit model in place of the linear regression to implement the analysis.

suspensions at the Kauffman School and other schools in the Kansas City school district during the 2014–15 school year. That descriptive information is displayed in Table V.1.

Table V.1. Attendance and suspension rates for Kauffman and all Kansas City students during 2014–15

	Kauffman students	Kansas City students
5th graders		
Attendance rate (%)	96.2 (3.5)	94.5 (4.9)**
Received one or more suspensions (%)	31.0 (46.4)	18.4 (38.7)**
One or more in-school suspensions (%)	20.3 (40.3)	7.3 (26.1)**
One or more out-of-school suspensions (%)	23.5 (42.5)	14.3 (35.0)**
Sample size	187	1,585
6th graders		
Attendance rate (%)	96.0 (3.5)	94.6 (4.9)**
Received one or more suspensions (%)	29.6 (45.8)	24.6 (43.1)
One or more in-school suspensions (%)	17.3 (37.9)	11.9 (32.4)
One or more out-of-school suspensions (%)	19.6 (39.8)	18.2 (38.6)
Sample size	179	1,592
7th graders		
Attendance rate (%)	95.4 (4.7)	93.6 (5.9)**
Received one or more suspensions (%)	33.7 (47.6)	30.3 (46.0)
One or more in-school suspensions (%)	22.9 (42.3)	15.1 (35.9)
One or more out-of-school suspensions (%)	21.7 (41.5)	22.5 (41.8)
Sample size	83	1,472
8th graders		
Attendance rate (%)	94.6 (5.2)	93.2 (6.2)*
Received one or more suspensions (%)	48.9 (50.3)	34.6(47.6)*
One or more in-school suspensions (%)	35.2 (48.0)	21.6 (41.2)*
One or more out-of-school suspensions (%)	29.5 (45.9)	24.2 (42.8)
Sample size	88	1,455
Average across grades		
Attendance rate (%)	95.7 (4.1)	94.2 (5.3)**
Received one or more suspensions (%)	33.9 (47.0)	25.0 (42.9)**
One or more in-school suspensions (%)	22.2 (41.3)	12.4 (32.6)**
One or more out-of-school suspensions (%)	22.9 (42.1)	18.5 (38.7)*
Sample size	537	6,104

Notes: Standard deviations are presented next to means in parentheses. The bottom section of the table displays the average across grade levels, weighted by the number of Kauffman students in each grade.

*Significantly different from Kauffman students at the 5 percent level.

**Significantly different from Kauffman students at the 1 percent level.

The average attendance rate of Kauffman students across all grades was significantly higher than that of other Kansas City students. The Kauffman School also suspended students at a significantly higher rate during 2014–15, compared with other schools in Kansas City. The descriptive statistics presented in Table V.1 are based on the full sample of Kauffman and Kansas City students in 5th through 8th grades during 2014–15. In Table V.2, we present the

estimated impacts of the Kauffman School on attendance and suspensions, based on the sample of matched comparison students. In Appendix B, Table B.8, we report the attendance and overall suspension impact estimates when the two alternative comparison groups (charter-school and KCPS students) are used.

Table V.2. Impact of Kauffman School on attendance and suspensions during 2014–15

	5th graders	6th graders	7th graders	8th graders	2014–15 average
Attendance rate (%)	1.13** (0.40)	0.91** (0.35)	0.68 (0.71)	0.42 (0.59)	0.87** (0.23)
Probability of being suspended (%)	13.1** (4.4)	3.82 (3.9)	4.0 (6.5)	14.0** (5.3)	8.85** (2.4)
Probability of in-school suspension (%)	14.2** (3.7)	5.69 (3.3)	7.82 (5.6)	14.2** (4.7)	10.5** (2.1)
Probability of out-of-school suspension (%)	9.39* (4.3)	0.84 (3.6)	1.12 (6.2)	4.48 (5.3)	4.51 (2.3)
Sample size	714	1,024	580	748	3,066

Notes: The suspension results are marginal effects from logit models in which the outcome variable is an indicator for receiving a suspension during the year. Standard errors are displayed in parentheses beside each impact estimate. The sample size represents the total number of Kauffman students and matched comparison students entering each analysis. The fifth column represents a weighted average (by the number of Kauffman students) of the impacts across grade levels.

*Significantly different than zero at the 5 percent level.

**Significantly different than zero at the 1 percent level.

Impact on attendance. The results show that during the 2014–15 school year, the Kauffman School overall had a positive and statistically significant impact on the attendance rate of its students. The magnitude of the coefficient indicates that, on average, Kauffman students had an attendance rate 0.90 percentage points higher than that of other similar students in Kansas City. The estimated impact is positive in all grades, but is statistically significant only for 5th and 6th graders (as well as for all grades combined).

Impact on suspensions. The estimated suspension impacts for the Kauffman School are also positive, which indicates that Kauffman students are significantly more likely to be suspended than similar students in Kansas City. Overall, Kauffman students were approximately 9 percentage points more likely to receive at least one suspension during the school year. This significant overall suspension impact estimate appears to be driven by higher in-school suspension rates at the Kauffman School. The school did not have a statistically significant effect on the probability that a student would receive an out-of-school suspension.

To help put the high suspension rates at the Kauffman School into perspective, we present in Table V.3 the average number of days suspended *among students who receive at least one suspension*. The average number of days suspended *among students ever suspended* is not significantly different between Kauffman and matched comparison students in any of the three grades examined. The average number of days suspended among students receiving at least one suspension is between two and three for most grades for both Kauffman and comparison students. The results are similar when median days suspended is examined in place of average

days: the figure for median days ranges from one to two across grades for both groups. Overall, although more students receive suspensions at the Kauffman School, the average number of days missed due to suspensions *among suspended students* is not significantly higher.

Table V.3. Average number of days suspended for students receiving suspensions during 2014–15

	Kauffman students	Kansas City students
5th graders		
Mean days suspended	2.26 (1.85)	2.06 (1.63)
Mean days suspended (in-school)	1.59 (1.13)	1.54 (1.01)
Mean days suspended (out-of-school)	1.64 (0.93)	1.88 (1.43)
Sample size	55	106
6th graders		
Mean days suspended	2.20 (1.73)	2.33 (2.12)
Mean days suspended (in-school)	1.64 (0.95)	1.96 (2.13)
Mean days suspended (out-of-school)	1.82 (1.27)	1.89 (1.25)
Sample size	47	213
7th graders		
Mean days suspended	2.58 (2.06)	2.66 (2.70)
Mean days suspended (in-school)	2.23 (1.91)	2.43 (2.49)
Mean days suspended (out-of-school)	1.64 (0.93)	1.96 (1.61)
Sample size	26	161
8th graders		
Mean days suspended	2.54 (2.36)	3.20 (3.03)
Mean days suspended (in-school)	1.95 (1.82)	2.91 (2.78)*
Mean days suspended (out-of-school)	1.86 (1.67)	2.02 (1.45)
Sample size	42	232
Average across grades		
Mean days suspended	2.36 (1.99)	2.51 (2.34)
Mean days suspended (in-school)	1.80 (1.45)	2.15 (2.12)
Mean days suspended (out-of-school)	1.74 (1.22)	1.93 (1.42)
Sample size	170	712

Notes: Standard deviations are presented next to means in parentheses. The sample size represents the total number of Kauffman students and matched comparison students with at least one suspension (in-school or out-of-school). The bottom section of the table displays the average across grade levels for days missed due to overall, in-school, and out-of-school suspensions, weighted by the number of Kauffman students with at least one suspension in that category.

*Significantly different from Kauffman students at the 5 percent level.

The fact that the average number of days missed among Kauffman students who receive suspensions is less than three helps shed light on how the Kauffman School may be having large positive impacts on student achievement while suspending students at high rates. The additional instructional time at the Kauffman School resulting from the extended school day and year is much longer than three days. Kauffman students receive the equivalent of approximately five weeks of additional schooling per year relative to other public school students in Kansas City.

Since the average number of days missed due to suspensions is small relative to the additional instructional time at the Kauffman School (less than 3 days missed compared to approximately 5 weeks of additional schooling), it is possible that the high suspension rates are not substantially detracting from learning.

Finally, caution is warranted when interpreting the suspension impact estimates for the Kauffman School. The positive and significant impacts could be due to (1) stricter discipline policies at the Kauffman School, which might result in the issuing of suspensions for less-severe infractions than at other schools; (2) the longer school day and school year at the Kauffman School, which provides more opportunities for suspensions to be issued; or (3) an increased frequency of infractions by Kauffman students than comparison students.

Changes in attendance and suspension impacts across years.

Table V.4 compares the schoolwide attendance and suspension impacts for each year of the Kauffman School's operation. The impact on attendance rates was not significantly different in 2014–15 compared to 2013–14. The impacts on suspension rates were significantly lower in 2014–15 for overall, in-school, and out-of-school suspensions compared to 2013–14.

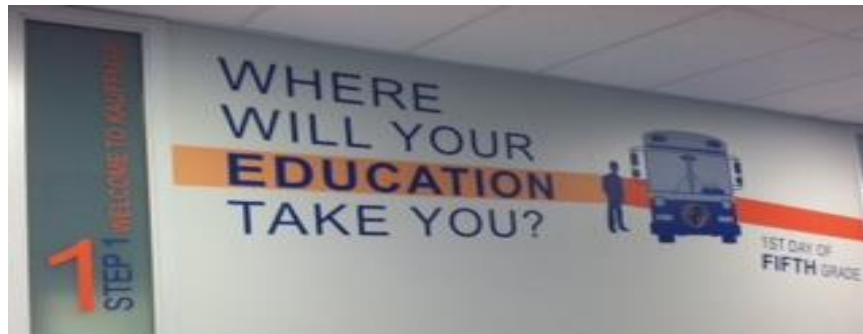
Table V.4. Comparison of impacts of the Kauffman School on attendance and suspensions across years

	2011–12 average	2012–13 average	2013–14 average	2014–15 average
Attendance rate (%)	-0.83 (0.48)	0.87** (0.31)	0.72 (0.27)	0.87 (0.23)
Probability of being suspended (%)	13.4 (5.2)	7.22 (3.5)	24.7** (2.6)	8.85** (2.4)
Probability of in-school suspension (%)	0.27 (3.9)	-1.27 (2.2)	24.8** (2.6)	10.5** (2.1)
Probability of out-of-school suspension (%)	14.2 (4.7)	8.97 (3.4)	16.6 (2.8)	4.51** (2.3)
Sample size	677	1,213	2,067	3,066

Notes: The suspension results are marginal effects from logit models in which the outcome variable is an indicator for receiving a suspension during the year. Standard errors are displayed in parentheses beside each impact estimate. The sample size represents the total number of Kauffman students and matched comparison students entering each analysis.

**Significantly different from the prior school year's outcomes at the 1 percent level.

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VI. CONCLUSIONS

A. Key findings

The Kauffman School has ambitious goals for its students: accelerated learning and high levels of attendance. The results from our analysis of MAP assessments and attendance data show that the Kauffman School is achieving these goals. Though the Kauffman School is suspending its students at a higher rate than similar students at other schools in Kansas City, the suspension rate in 2014–15 was lower than in the previous year, and the out-of-school suspension rate was not distinguishable from the rate for the comparison students. In addition, the days missed due to suspensions is small relative to the additional instructional time received by Kauffman students.

Achieving academic goals. An analysis of data from the Kauffman School’s first four years shows that the Kauffman School achieved its goal of having students grow on average at least 1.25 years for every year of attendance, in all three subjects tested by the MAP (mathematics, ELA, and science). Upon entering, the average student was substantially below the state average in terms of mathematics and ELA scores, but within three years performed above the state average in both subjects.

Comparisons to other charter schools. The Kauffman School’s three-year impacts on test scores are larger than the average effects of groups of other charter schools known for their strong positive impacts on student achievement, such as Boston, KIPP, and New York City charter schools. The Kauffman School’s impacts are similar to those of the highest-performing KIPP middle schools.

Achieving attendance goals. The Kauffman School achieved its goal of an average daily attendance rate of 95 percent each year during Years 1, 2, 3, and 4 (Gentile et al. 2015). During the 2014–15 school year, the Kauffman School had a statistically significant positive impact on its students’ rate of attendance, boosting it by 0.9 percentage points.

Suspension of students. During 2014–15, Kauffman students were 9 percentage points more likely to receive at least one suspension compared with other similar students in Kansas City. This difference appears to have been driven primarily by a higher rate of in-school suspensions; the Kauffman School did not have a significant impact on the rate of out-of-school suspensions. Though the Kauffman School suspended students at a significantly higher rate than other schools in Kansas City, the average number of days missed due to suspensions was small

relative to the additional instructional time received by Kauffman students. The suspension rate at the Kauffman School was also lower in 2014–15 than during the previous year.

B. Next steps for the Kauffman School

Growing and moving. Year 5 is a year of change and expansion for the Kauffman School, which will open the high school for its first group of 9th-grade students. The student body will also continue to grow, with the addition of over 200 new 5th graders, along with backfilling at the other grade levels.

Use of the Common Core State Standards. The State of Missouri discontinued use of the Common Core-aligned Smarter Balanced exam after 2015 and is in the process of developing new content standards. The Kauffman School plans on continuing to use its Common Core–aligned ELA and mathematics curricula in year 5, while Missouri is working on developing the new standards.

Maintaining School culture. As the Kauffman School grows, administrators and teachers are attending to the issue of how to maintain and expand the Kauffman School’s culture. On the new campus, students and staff occupy different buildings based on grade level. This grouping has logistical benefits but poses challenges for instilling a common culture across buildings and grade levels. Administrators and teachers are working on ways to maintain the Kauffman School’s hallmarks: ambitious academic achievement, high attendance rates, and exemplary behavior.

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APPENDIX A

DATA, SAMPLE SELECTION, AND ANALYSIS METHODOLOGY

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1. Data preparation details

The Missouri Department of Elementary and Secondary Education provided data on state assessment results and student characteristics for all students enrolled in Missouri public schools during our analysis period. Mathematica Policy Research requested student data for all 3rd graders in 2010–2014, all 4th graders in 2011–2014, all 5th graders in 2012–2015, all 6th graders in 2013–2015, all 7th graders in 2014–15, and all 8th graders in 2015. The state assessment data contained Missouri Assessment Program (MAP) scaled scores, proficiency levels, and test accommodation information for each student test by year, grade level, and content area. The student characteristics data contained demographic, free or reduced-price lunch status, limited English proficiency, disability, attendance, and disciplinary information for each student by year and school of enrollment, as well as school-level characteristics such as charter school classification and school location.

To link the state assessment and student characteristics data, we reduced both to the unique student level. From the assessment data, we removed records in which students had more than one unique subject-specific MAP scaled score reported in a given year. From the characteristics data, we first removed all records with zero or missing reported attendance and then summed attendance and disciplinary variables across each student’s school-specific records to calculate student-year totals. We then reduced the data to the student level such that all year-specific attendance/disciplinary information was preserved in separate variables, and demographic, free or reduced-price lunch status, limited English proficiency, and disability information was taken from the student’s 4th-grade record if available, 3rd-grade record if the 4th-grade record was unavailable, and 5th-grade record if both 4th- and 3rd-grade records were unavailable. Students not found in both the assessment and the characteristics data were dropped from the analysis.

We created several new variables to facilitate the analyses. We transformed student MAP scaled scores into z -scores based on statewide year-, grade-, and subject-specific means and standard deviations. We also used enrollment and absence information to create an attendance rate measure that we bottom-coded at the year-specific first percentile to remove extreme outliers. We used disciplinary information to create yearly indicators of whether students received a suspension that year.¹ We then collapsed subject-specific 3rd- and 4th-grade MAP z -scores into grade-specific variables by taking each student’s most recent score (by year) within grade level for those students repeating grades. We created a single binary test accommodation indicator to represent having test accommodations on any 3rd- or 4th-grade MAP test.

2. Sample Selection

The Kauffman School group is composed of students who were enrolled in the Kauffman School in 5th grade in 2011–12, 2012–13, 2013–14, or 2014–15 for at least part of the school year.² The *Kansas City district schools* comparison group is composed of students enrolled in the

¹ All analyses use 4th-grade attendance and suspensions as control variables. If 4th-grade information on these variables was missing, then 3rd-grade values were used instead.

² For the first time in 2014–2015, the Kauffman School backfilled enrollment by accepting new students in 6th, 7th, and 8th grade who were not previously enrolled in the school in 5th grade. These students were excluded from our analysis because the amount of time they spent at the Kauffman School is not comparable to other students

Kansas City 33 School District in 5th grade in our analysis years during at least part of the school year who were not included in the Kauffman School group. The *Kansas City charter schools* comparison group includes only those students who were enrolled in 5th grade for all or part of the school year in a Kansas City charter school. The *all Kansas City public schools* comparison group contained all students in either of the other two comparison groups. We developed a list of charter schools using information on school location and background research on charter schools identified as being located in Kansas City (Missouri Department of Elementary and Secondary Education 2015) and enrolling 5th-grade students in our analysis years.

In addition to these restrictions, we excluded any Kauffman students missing any outcome MAP test scores or all 3rd- and 4th-grade MAP test scores.³ We also dropped any comparison students missing all 3rd- and 4th-grade MAP test scores or any outcome scores from the final analysis sample. As a result of these restrictions, for analyses based on data from 2014–15, we dropped 14 Kauffman students (14 percent) from the cohort I analysis sample, 19 (19 percent) from the cohort II analysis sample, 24 (12 percent) from the cohort III analysis sample, and 23 (11 percent) from the cohort IV analysis sample. With respect to the full comparison group, we dropped 24 percent of otherwise eligible students from the cohort I main analysis sample, 20 percent from the cohort II analysis sample, 15 percent from the cohort III analysis sample, and 12 percent from the cohort IV analysis sample. Johnson et al. (2016) provides details about the percentage of students dropped from the analyses based on data from 2013–14. Finally, we excluded from the comparison group any students who were enrolled for part of any school year at the Kauffman School (and included them in the Kauffman School group). Table A.1 provides the numbers of students included in the Kauffman School and comparison groups for each grade and cohort in our analysis.

Table A.1. Number of students in each comparison group in 2014–15

Final study group	Cohort I 8th graders	Cohort II 7th graders	Cohort III 6th graders	Cohort IV 5th graders
Kauffman students	88	83	179	187
All Kansas City public schools comparison group	1,455	1,472	1,592	1,585
Kansas City district schools comparison group	832	820	965	915
Kansas City charter schools comparison group	629	665	645	691

We display the baseline average characteristics of all students included in the Kauffman School and comparison groups for cohort I students in Table A.2, cohort II students in Table A.3, cohort III students in Table A.4, and cohort IV students in Table A.5. These tables show that Kauffman students tend to differ significantly from students enrolled in Kansas City public schools on several key baseline measures. Kauffman students had significantly higher average 4th-grade MAP test scores than students in other Kansas City schools, though all groups had test

in the same grade. Some 5th-grade students were also enrolled in the school mid-year during 2014–2015. These students are included in the analysis because they spent part of their 5th-grade year enrolled at the Kauffman School.

³ Students who transfer to different school districts in Missouri will generally remain in our sample, but students who leave the state will be excluded due to missing outcome test scores.

scores below the statewide average.⁴ Kauffman students are also more likely to be black and less likely to be Hispanic, are less likely to receive baseline test accommodations, and had higher 4th-grade attendance rates than students enrolled in Kansas City district schools. The same directional trends exist for Kauffman students relative to other Kansas City charter school students, but the differences are less pronounced and less likely to be statistically significant. Kauffman students were generally similar to other Kansas City students with respect to free or reduced-price lunch status and disability status, though there were some significant differences across cohorts.

Table A.2. Baseline 4th-grade average characteristics of Kauffman students and other Kansas City public school students: Cohort I 8th graders

	Kauffman School	All Kansas City public schools	Kansas City district schools	Kansas City charter schools
4th-grade MAP mathematics scaled score	637	629*	628*	630
4th-grade MAP ELA scaled score	651	639**	635**	645
Free or reduced-price lunch	0.86	0.89	0.92	0.85
Black	0.81	0.63**	0.58**	0.69*
Hispanic	0.13	0.25**	0.30**	0.18
Male	0.49	0.48	0.51	0.45
Disabled	0.07	0.09	0.09	0.09
Any baseline test accommodation	0.08	0.21**	0.28**	0.12
4th-grade attendance rate	0.95	0.94**	0.93**	0.95
4th-grade ever suspended	0.18	0.17	0.15	0.19
Sample size	88	1,455	832	629

*Significantly different from Kauffman students at the 5 percent level.

**Significantly different from Kauffman students at the 1 percent level.

ELA = English language arts.

⁴ The statewide average 4th-grade MAP scaled score was 648 in mathematics and 661 in ELA. The statewide standard deviation of 4th-grade MAP scores was 34 in mathematics and 38 in ELA. These numbers are calculated by averaging the year-specific means and standard deviations from 2010–2011 through 2013–2014.

Table A.3. Baseline 4th-grade average characteristics of Kauffman students and other Kansas City public school students: Cohort II 7th graders

	Kauffman School	All Kansas City public schools	Kansas City district schools	Kansas City charter schools
4th-grade mathematics scaled score	643	633**	630**	636*
4th-grade ELA scaled score	651	640**	636**	646
Free or reduced-price lunch	0.80	0.89*	0.94**	0.84
Black	0.77	0.62**	0.56**	0.69
Hispanic	0.08	0.25**	0.32**	0.16*
Male	0.52	0.47	0.50	0.46
Disabled	0.12	0.08	0.08	0.09
Any baseline test accommodation	0.14	0.24*	0.32**	0.14
4th-grade attendance rate	0.97	0.95**	0.95**	0.95**
4th-grade ever suspended	0.11	0.19*	0.19*	0.20*
Sample size	83	1,472	820	665

*Significantly different from Kauffman students at the 5 percent level.

**Significantly different from Kauffman students at the 1 percent level.

ELA = English language arts.

Table A.4. Baseline 4th-grade average characteristics of Kauffman students and other Kansas City public school students: Cohort III 6th graders

	Kauffman School	All Kansas City public schools	Kansas City district schools	Kansas City charter schools
4th-grade mathematics scaled score	635	632	628**	638
4th-grade ELA scaled score	653	640**	633**	650
Free or reduced-price lunch	0.89	0.90	0.94	0.86
Black	0.80	0.58**	0.53**	0.64**
Hispanic	0.11	0.27**	0.32**	0.22**
Male	0.44	0.50	0.53*	0.46
Disabled	0.06	0.10	0.11*	0.09
Any baseline test accommodation	0.12	0.29**	0.38**	0.17
4th-grade attendance rate	0.96	0.95**	0.95**	0.95
4th-grade ever suspended	0.15	0.15	0.16	0.12
Sample size	179	1,592	965	645

*Significantly different from Kauffman students at the 5 percent level.

**Significantly different from Kauffman students at the 1 percent level.

ELA = English language arts.

Table A.5. Baseline 4th-grade average characteristics of Kauffman students and other Kansas City public school students: Cohort IV 5th graders

	Kauffman School	All Kansas City public schools	Kansas City district schools	Kansas City charter schools
4th-grade mathematics scaled score	636	627**	624**	632
4th-grade ELA scaled score	650	638**	631**	647
Free or reduced-price lunch	0.94	0.88**	0.92	0.82**
Black	0.87	0.54**	0.50**	0.59**
Hispanic	0.07	0.30**	0.35**	0.23**
Male	0.45	0.49	0.51	0.45
Disabled	0.08	0.13*	0.14**	0.10
Any baseline test accommodation	0.07	0.35**	0.46**	0.20**
4th-grade attendance rate	0.96	0.95*	0.95**	0.95
4th-grade ever suspended	0.17	0.16	0.15	0.17
Sample size	187	1,585	915	691

*Significantly different from Kauffman students at the 5 percent level.

**Significantly different from Kauffman students at the 1 percent level.

ELA = English language arts.

3. Multiple imputation methodology

We calculated impact estimates using a multiple imputation procedure with $M = 10$ imputed data sets. We imputed missing baseline outcome variable values separately by treatment or comparison status using a chained linear equations model that included all outcome variables and all student characteristic variables included in the final impact regressions.

Students were excluded from the imputation model if they had missing data for all 3rd- or 4th-grade MAP test scores or missing data for all outcome (5th-, 6th-, 7th-, or 8th-grade) MAP test scores. Missing values were imputed before propensity-score matching and regression analyses in each multiple imputation data set.

In addition to imputing baseline test scores, we imputed mathematics scores for students who took the 8th-grade Algebra I end-of-course exam in place of the 8th-grade mathematics MAP exam. In the 8th-grade mathematics imputation we included 8th-grade ELA and science MAP test scores, 7th-grade ELA and mathematics test MAP scores, 8th-grade attendance and suspension data, and the same set of student baseline characteristic variables included in the other imputations.

After collecting coefficient and standard error estimates from each of the 10 imputed data sets, we computed multiple imputation coefficients and standard errors using Rubin's combination method (Rubin 1987). The multiple imputation beta (β_M) coefficient is the average of the beta coefficient values in each imputed data set (β_m); the multiple imputation standard error is the square root of the within-imputation coefficient variance (Var_W) plus the between-imputation coefficient variance (Var_B) inflated by a finite imputation correction multiplier:

$$(1) SE_M = \sqrt{Var_W + \left(1 + \frac{1}{M}\right) Var_B} = \sqrt{\left(\frac{\sum_{m=1}^M Var_m}{M}\right) + \left(1 + \frac{1}{M}\right) \left(\frac{\sum_{m=1}^M (\beta_m - \beta_M)^2}{M - 1}\right)}$$

4. Propensity-score matching methodology

We estimated a propensity score for each eligible treatment and comparison student in each multiple imputation data set using a stepwise logistic regression model. We used an entry criterion of ($p < .20$) to determine whether each variable would enter the final logistic regression model. (See Table A.6 for a list of the variables.)

Table A.6. List of potential covariates used for propensity-score matching

4th-grade mathematics and English language arts MAP z-scores
Second- and third-order polynomials of 4th-grade mathematics and English language arts MAP z-scores
3rd-grade mathematics and English language arts MAP z-scores
4th-grade attendance rate and ever-suspended variables
Gender, race, individualized education plan, English language learner, free or reduced-price lunch, any baseline test accommodation
Interactions of 4th-grade mathematics and English language arts MAP z-scores with gender, race, individualized education plan, English language learner, free or reduced-price lunch, any baseline test accommodation
Interactions of race with gender and free or reduced-price lunch
Indicators for imputed 3rd- and 4th-grade mathematics and English language arts MAP z-score variables
Indicator for imputed 4th-grade attendance rate or ever-suspended variables

After generating propensity scores for each Kauffman student and eligible comparison student, we selected a matched comparison group by finding comparison students with propensity scores within a given threshold, or radius, from each Kauffman student's propensity score. Comparison students were sampled with replacement, which means that each comparison student could be matched to multiple Kauffman students. To limit the number of possible comparison students, we specified a minimum matching radius and maximum number of potential matched neighbors. Because district students differed more from Kauffman students on baseline characteristics relative to the other two groups, we made the matching radius larger for the district comparison group to prevent the sample sizes of Kauffman and matched comparison students from being too small. If there were no comparison students within the matching radius for a given treatment student, that student was excluded from the matched comparison impact analyses. Because each comparison student could be matched to multiple treatment students, we used a weighting scheme in which each treatment student had a weight of one and each comparison student had a weight representing the number of matching treatment students. Table A.7 gives summary matching information for each comparison group.⁵

⁵ Johnson et al. (2016) contains the matching information for other grade/cohort combinations.

Table A.7. Matching information summary

	All Kansas City public schools	Kansas City district schools	Kansas City charter schools
Cohort I 8th graders			
Minimum matching radius	0.0006	0.0016	0.0008
Maximum number of matches	20	20	20
Number of Kauffman students	88	88	88
Mean number of Kauffman students matched	85	76	80
Mean number of comparison students	663	381	262
Mean matches per Kauffman student	11.2	7.4	4.8
Cohort II 7th graders			
Minimum matching radius	0.0006	0.0016	0.0008
Maximum number of matches	20	20	20
Number of Kauffman students	83	83	83
Mean number of Kauffman students matched	73	65	68
Mean number of comparison students	507	343	223
Mean matches per Kauffman student	9.1	7.3	4.1
Cohort III 6th graders			
Minimum matching radius	0.0006	0.0016	0.0008
Maximum number of matches	20	20	20
Number of Kauffman students	179	179	179
Mean number of Kauffman students matched	160	153	144
Mean number of comparison students	864	602	313
Mean matches per Kauffman student	7.9	6.9	3.4
Cohort IV 5th graders			
Minimum matching radius	0.0006	0.0016	0.0008
Maximum number of matches	20	20	20
Number of Kauffman students	187	187	187
Mean number of Kauffman students matched	171	158	156
Mean number of comparison students	543	361	288
Mean matches per Kauffman student	4.6	3.6	3.9

In Table A.8, we present summary statistics to show how well Kauffman students were matched to comparison students on baseline characteristics. On average, comparison students from each matched group were not significantly different from Kauffman students on any baseline characteristics used in the analysis. Note that the sample sizes in Table A.8 are smaller for both Kauffman and comparison students relative to those in tables A.2–A.5. This is because some Kauffman students differed enough from all comparison students such that no good match

for these students could be found.⁶ The matched comparison analysis excludes these Kauffman students. (Appendix B.2 contains a sensitivity analysis in which these students are included.)

Table A.8. Baseline 4th-grade average characteristics of matched comparison samples

	Kauffman School	All Kansas City public schools	Kansas City district schools	Kansas City charter schools
Cohort I 8th graders				
4th-grade mathematics scaled score	635 (32)	636 (35)	635 (36)	636 (32)
4th-grade ELA scaled score	649 (34)	650 (35)	646 (33)	651 (35)
Free or reduced-price lunch	0.86 (0.35)	0.85 (0.36)	0.88 (0.33)	0.87 (0.34)
Black	0.81 (0.40)	0.79 (0.40)	0.78 (0.42)	0.80 (0.40)
Hispanic	0.12 (0.33)	0.12 (0.33)	0.13 (0.34)	0.11 (0.31)
Male	0.47 (0.50)	0.45 (0.50)	0.45 (0.50)	0.43 (0.50)
Disabled	0.07 (0.26)	0.07 (0.25)	0.07 (0.26)	0.07 (0.25)
Any prior test accommodation	0.08 (0.28)	0.07 (0.26)	0.10 (0.29)	0.07 (0.25)
4th-grade attendance rate	0.95 (0.04)	0.95 (0.04)	0.95 (0.04)	0.95 (0.04)
4th-grade ever suspended	0.18 (0.39)	0.17 (0.37)	0.18 (0.38)	0.18 (0.39)
Sample size	85	663	381	262
Cohort II 7th graders				
4th-grade mathematics scaled score	643 (28)	643 (28)	641 (28)	643 (28)
4th-grade ELA scaled score	652 (31)	651 (32)	648 (32)	651 (32)
Free or reduced-price lunch	0.85 (0.36)	0.86 (0.35)	0.90 (0.29)	0.81 (0.39)
Black	0.77 (0.43)	0.74 (0.44)	0.71 (0.46)	0.76 (0.43)
Hispanic	0.10 (0.30)	0.10 (0.30)	0.11 (0.31)	0.08 (0.27)
Male	0.51 (0.50)	0.48 (0.50)	0.50 (0.50)	0.47 (0.50)
Disabled	0.10 (0.31)	0.09 (0.28)	0.12 (0.32)	0.07 (0.26)
Any prior test accommodation	0.12 (0.33)	0.14 (0.35)	0.19 (0.39)	0.10 (0.29)
4th-grade attendance rate	0.96 (0.03)	0.96 (0.04)	0.96 (0.04)	0.96 (0.04)
4th-grade ever suspended	0.12 (0.33)	0.13 (0.33)	0.16 (0.37)	0.13 (0.33)
Sample size	73	507	343	223

⁶ The composition of Kaufman students included in each matched comparison group analysis differs slightly among the separate analyses based on each comparison group. In Table A.8, we report averages for Kauffman students included in the main analysis in which the comparison group includes all Kansas City public schools.

	Kauffman School	All Kansas City public schools	Kansas City district schools	Kansas City charter schools
Cohort III 6th graders				
4th-grade mathematics scaled score	634 (32)	635 (31)	633 (33)	634 (31)
4th-grade ELA scaled score	648 (33)	649 (34)	647 (36)	647 (32)
Free or reduced-price lunch	0.88 (0.32)	0.90 (0.30)	0.90 (0.29)	0.92 (0.27)
Black	0.78 (0.42)	0.77 (0.42)	0.76 (0.43)	0.78 (0.42)
Hispanic	0.12 (0.33)	0.14 (0.35)	0.15 (0.36)	0.14 (0.35)
Male	0.45 (0.50)	0.46 (0.50)	0.46 (0.50)	0.42 (0.49)
Disabled	0.07 (0.25)	0.06 (0.23)	0.07 (0.26)	0.08 (0.27)
Any prior test accommodation	0.13 (0.34)	0.14 (0.35)	0.14 (0.35)	0.13 (0.34)
4th-grade attendance rate	0.95 (0.04)	0.95 (0.04)	0.95 (0.04)	0.95 (0.04)
4th-grade ever suspended	0.15 (0.36)	0.14 (0.35)	0.14 (0.35)	0.14 (0.35)
Sample size	160	864	602	313
Cohort IV 5th graders				
4th-grade mathematics scaled score	634 (27)	633 (28)	634 (28)	633 (26)
4th-grade ELA scaled score	647 (32)	646 (31)	646 (31)	649 (31)
Free or reduced-price lunch	0.94 (0.25)	0.94 (0.23)	0.92 (0.27)	0.95 (0.22)
Black	0.88 (0.33)	0.88 (0.33)	0.86 (0.35)	0.87 (0.33)
Hispanic	0.08 (0.26)	0.07 (0.26)	0.08 (0.26)	0.08 (0.27)
Male	0.43 (0.50)	0.40 (0.49)	0.43 (0.50)	0.38 (0.49)
Disabled	0.07 (0.25)	0.07 (0.25)	0.06 (0.24)	0.07 (0.24)
Any prior test accommodation	0.08 (0.27)	0.07 (0.26)	0.08 (0.27)	0.08 (0.27)
4th-grade attendance rate	0.95 (0.04)	0.95 (0.04)	0.95 (0.04)	0.95 (0.04)
4th-grade ever suspended	0.18 (0.38)	0.18 (0.39)	0.13 (0.33)	0.15 (0.36)
Sample size	171	543	361	288

Notes: The Kauffman characteristics and sample size represent the total number of Kauffman students matched to the full comparison group of students from all Kansas City public schools. Standard deviations are displayed in parentheses next to the averages in this table. No differences between averages for Kauffman students and comparison group students are significantly different from zero.

ELA = English language arts.

APPENDIX B

SENSITIVITY ANALYSES

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1. Attrition-adjusted results

Between 7 and 10 percent of cohort I through IV 5th graders who were enrolled in the Kauffman School at the beginning of the year left the Kauffman School before taking the 5th-grade Missouri Assessment Program (MAP) exams. Most of them enrolled in other schools in Missouri and took the MAP exams at the end of the year, so we are able to track their achievement and include them in the analyses. Including these students means that the estimated effect sizes are interpretable as the additional achievement growth a student enrolling in the Kauffman School is expected to attain, accounting for the chance that this student might drop out during the school year. Although this is an informative number to calculate and is comparable to estimates reported in other charter school evaluations, it could also be of interest to estimate the effect of the Kauffman School on students who remain enrolled in the Kauffman School.

An estimate of the impact of the Kauffman School on the achievement of students who remained enrolled can be calculated by applying an adjustment for attrition known as a Bloom adjustment (Bloom 1984), which is calculated by dividing the impact estimates by the fraction of students who remained enrolled in the Kauffman School for the entire year. This adjustment is made under the assumption that the end-of-year outcomes for students who withdrew from the Kauffman School are unaffected by their enrollment in the Kauffman School. This assumption is unlikely to be true for students who withdrew later in the year, which means that the attrition-adjusted effect sizes are likely to be biased upward. The attrition-adjusted one-year effect size estimates are displayed in Table B.1. We do not present attrition-adjusted results for the two-, three-, or four-year impact estimates, because many of the students in that analysis spent their entire 5th-grade year enrolled in the Kauffman School before dropping out in 6th, 7th, or 8th grade. For these students, the assumption of zero impact of the Kauffman School made when calculating the attrition-adjusted results would clearly not hold.

Table B.1. Attrition-adjusted impact of Kauffman School on MAP test scores (citywide comparison group)

	Attrition-adjusted results	Benchmark results
One-year impact estimates		
5th-grade mathematics effect size	0.24** (0.03)	0.22** (0.03)
5th-grade ELA effect size	0.25** (0.03)	0.23** (0.03)
5th-grade science effect size	0.49** (0.04)	0.46** (0.04)
Sample size	2,956	2,956

Notes: This table presents the attrition-adjusted average one-year impact estimates in effect size units. Standard errors are displayed in parentheses below each impact estimate. The sample size represents the total number of Kauffman students and matched comparison students entering each analysis.

**Significantly different from zero at the 1 percent level.

ELA = English language arts.

As shown in Table B.1, the one-year impact estimates are larger but overall very similar in all three subjects when adjusted for attrition: 0.25 in mathematics, 0.24 in ELA, and 0.49 in

science. The significance level for all effect size estimates from the attrition-adjusted results remains unchanged from the main results.¹ The attrition-adjusted attendance and suspension impact estimates are displayed in Table B.2. They are also slightly larger in absolute value, but broadly similar to the main results.

Table B.2. Attrition-adjusted impact of Kauffman School on attendance and suspensions (citywide comparison group)

	Attrition-adjusted results	Benchmark results
Cohort IV 5th graders		
Impact on attendance rate (%)	1.28** (0.43)	1.13** (0.40)
Impact on probability of being suspended (%)	14.8** (4.8)	13.1** (4.4)
Sample size	714	714
Cohort III 5th graders		
Impact on attendance rate (%)	0.64 (0.43)	0.57 (0.39)
Impact on probability of being suspended (%)	31.3** (4.0)	27.9** (3.6)
Sample size	948	948
Cohort II 5th graders		
Impact on attendance rate (%)	0.91 (0.49)	0.84 (0.45)
Impact on probability of being suspended (%)	1.6 (4.9)	1.5 (4.5)
Sample size	617	617
Cohort I 5th graders		
Impact on attendance rate (%)	-0.93 (0.53)	-0.83 (0.48)
Impact on probability of being suspended (%)	14.9* (5.8)	13.4* (5.2)
Sample size	677	677

Notes: This table reports the attrition-adjusted estimated impact of the Kauffman School on attendance and suspensions. The suspension results are marginal effects from logit models in which the outcome variable is an indicator for receiving a suspension during the year. Standard errors are displayed in parentheses below each impact estimate. The sample size represents the total number of Kauffman students and matched comparison students entering each analysis.

*Significantly different from zero at the 5 percent level.

**Significantly different from zero at the 1 percent level.

¹ Because the standard errors are adjusted along with the impact estimates, the statistical significance of the results will not change after the attrition adjustment.

2. Sensitivity of results to comparison group students

To examine the sensitivity of the results to the choice of comparison group, we re-estimated the models including all students in Kansas City in relevant grade levels in the comparison group, even those whose baseline characteristics differed from those of Kauffman students. Rather than match students on baseline characteristics, this method relies exclusively on statistical controls for baseline characteristics. The results are displayed in Table B.3. The results using all Kauffman and comparison students are nearly identical to the results based on the matched comparison group. This indicates that including the baseline control variables in a regression framework performed well in reducing bias that might result from the inclusion of comparison students who differed from Kauffman students in terms of baseline characteristics. In other charter school evaluations, regression results based on all comparison students have been shown to closely approximate results based on matched comparison groups (Tuttle et al. 2013).

Table B.3. Impact of Kauffman School on MAP test scores using full Kansas City comparison group

	Full Kansas City comparison results	Benchmark matched comparison results
One-year impacts		
5th-grade mathematics effect size	0.19** (0.03)	0.22** (0.03)
5th-grade ELA effect size	0.22** (0.03)	0.23** (0.03)
5th-grade science effect size	0.45** (0.03)	0.46** (0.04)
Sample size	7,211	2,956
Two-year impacts		
6th-grade mathematics effect size	0.35** (0.03)	0.35** (0.04)
6th-grade ELA effect size	0.19** (0.03)	0.18** (0.04)
Sample size	5,100	2,205
Three-year impacts		
7th-grade mathematics effect size	0.67** (0.04)	0.68** (0.05)
7th-grade ELA effect size	0.52** (0.05)	0.52** (0.06)
Sample size	3,155	1,115

	Full Kansas City comparison results	Benchmark matched comparison results
Four-year impacts		
8th-grade mathematics effect size	0.95** (0.10)	0.96** (0.10)
8th-grade ELA effect size	0.51** (0.07)	0.53** (0.08)
8th-grade science effect size	0.65** (0.09)	0.66** (0.10)
Sample size	1,543	748

Notes: This table displays impact estimates in effect size units for the full Kansas City comparison sample alongside the benchmark estimates from the matched comparison sample. The first section of this table presents the average one-year impact estimates for cohort I, II, III, and IV 5th graders. The second section presents the average two-year impact estimates for cohort I, II, and III 6th graders. The third section presents three-year impact estimates for cohort I and II 7th graders. The fourth section presents four-year impact estimates for cohort I 8th graders. Standard errors are displayed in parentheses below each impact estimate. The sample size represents the total number of Kauffman students and comparison students entering each analysis.

**Significantly different from zero at the 1 percent level.

ELA = English language arts.

3. Sensitivity of results to exclusion of grade repeaters

A small percentage of Kauffman’s cohort I, II, and III students (3.4 percent) repeated 5th grade in 2012–13, 2013–14, or 2014–15. This is slightly higher than the percentage of 5th-grade repeaters in Kansas City (1.1 percent). No cohort I or II students repeated 6th grade in 2013–14 or 2014–15, though 1.4 percent of other Kansas City students did. In 2014–15, 2.9 percent of Kauffman’s cohort I repeated the 7th grade as did 2.6 percent of other Kansas City students. When a student repeats a grade, it creates a missing-data problem for the analysis because that student no longer takes the same outcome assessment as the rest of the students in his or her original cohort. Excluding repeaters from the analyses might introduce bias in the two- or three-year impact estimates for the Kauffman School, because repeater students are likely to struggle in terms of achievement growth. We therefore included repeaters in our main analyses. We follow the method used in Tuttle et al. (2013) for dealing with missing outcome scores for repeaters, which involves assuming that the relative rank in the district test score distribution does not change after the first time the repeater completed his or her previous grade. For example, students who repeat 5th grade are included along with other students from their same cohort in the two-, three-, and four-year impact estimates, with the z -scores of the repeater students fixed at their end-of-5th-grade values.² Cohort I students who repeated any grade were missing 8th-grade science scores, so we used their 5th-grade science z -scores for our main analysis. Because we have shown that the Kauffman School has positive impacts on student

² In previous reports we performed this step of substituting of prior outcome z -scores for repeaters before imputing missing baseline test scores. To improve the accuracy of the imputation procedure for the year 4 impact estimates, we performed this substitution step after the imputation of missing baseline scores. This update had little effect on the impact estimates; the majority remained the same and those that changed moved by only 0.01 standard deviations. Because the results were very similar with and without this change, we did not re-calculate the impact estimates from previous years.

achievement, the assumption about the test scores of repeaters will likely bias the two-, three-, and four-year impact estimates downward, because we are assuming that the Kauffman School has no effect on repeaters during their subsequent years enrolled.

In Table B.4, we present the results from our two- through four-year impact estimates when grade repeaters are excluded from the analysis. These effect sizes will likely provide an upper bound on the estimated effect size for the Kauffman School, because it retains students at a higher rate in 5th grade compared with other Kansas City schools. Nonetheless, the results do not differ substantially from our benchmark results.

Table B.4. Impact of Kauffman School on MAP test scores (citywide comparison group), excluding grade repeaters

	Results excluding repeaters	Benchmark results including repeaters
Two-year impact estimates		
Mathematics effect size	0.35** (0.04)	0.35** (0.04)
ELA effect size	0.19** (0.04)	0.18** (0.04)
Sample size	2,083	2,205
Three-year impact estimates		
Mathematics effect size	0.70** (0.06)	0.68** (0.05)
ELA effect size	0.55** (0.06)	0.52** (0.06)
Sample size	1,049	1,115
Four-year impact estimates		
Mathematics effect size	1.03** (0.11)	0.96** (0.10)
ELA effect size	0.56** (0.08)	0.53** (0.08)
Science effect size	0.70** (0.11)	0.66** (0.10)
Sample size	676	748

Notes: This table displays impact estimates in effect size units. The first column presents the two-year impact estimate for 6th graders, the three-year impact estimate for 7th graders, and the four-year impact estimate for 8th graders when students who repeat 5th, 6th, or 7th grade are excluded from the analysis. Standard errors are displayed in parentheses below each impact estimate. The sample size represents the total number of Kauffman students and matched comparison students entering each analysis.

**Significantly different from zero at the 1 percent level.

ELA = English language arts.

4. Sensitivity of results to imputation procedure

The use of 10 imputed data sets in our multiple imputation procedure should be sufficient to prevent randomness in the imputed values from influencing the results. However, to test the sensitivity of the results to the use of imputed data, we re-estimated the regression models excluding observations that had any imputed baseline values. For the four-year impact analysis,

we also excluded observations with imputed 8th grade mathematics MAP test scores. Grade repeaters were excluded from this sensitivity analysis, so that all impact estimates are based only on observed data. In this section, we report detailed matching information, baseline equivalence results, and MAP impact estimates when no imputed data are used.

The matching information for each cohort and comparison group is displayed in Table B.5. We used the same matching radius and maximum number of matches per Kauffman student as in the main results (Table A.7). The primary difference in the match statistics in Table B.5 compared with Table A.7 is that because students with imputed data are excluded from the sample, there are fewer Kauffman students and fewer comparison students.

Table B.5. Matching information summary for results using no imputed data

	No imputed values	Including imputed values
Cohort I 8th graders		
Minimum matching radius	0.0006	0.0006
Maximum number of matches	20	20
Number of Kauffman students	75	88
Number of Kauffman students matched	73	85
Number of comparison students	485	663
Mean matches per Kauffman student	9.7	11.2
Cohort II 7th graders		
Minimum matching radius	0.0006	0.0006
Maximum number of matches	20	20
Number of Kauffman students	77	83
Number of Kauffman students matched	69	73
Number of comparison students	478	507
Mean matches per Kauffman student	8.8	9.1
Cohort III 6th graders		
Minimum matching radius	0.0006	0.0006
Maximum number of matches	20	20
Number of Kauffman students	161	179
Number of Kauffman students matched	140	160
Number of comparison students	703	864
Mean matches per Kauffman student	7.0	7.9
Cohort IV 5th graders		
Minimum matching radius	0.0006	0.0006
Maximum number of matches	20	20
Number of Kauffman students	179	187
Number of Kauffman students matched	159	171
Number of comparison students	478	543
Mean matches per Kauffman student	4.4	4.6

The average baseline characteristics of Kauffman and comparison students when no imputed data are included are displayed in Table B.6. As with the baseline statistics displayed for the

main analysis results (Table A.8), there are no statistically significant differences between the averages for Kauffman and comparison students on any of the baseline characteristics we examined. Appendix B of Johnson et al. (2016) provides the matching information and a comparison of the baseline characteristics for other cohort and grade combinations.³

Table B.6. Baseline 4th-grade average characteristics of matched comparison sample: Results using no imputed data

	Kauffman School	All Kansas City public schools
Cohort I 8th graders		
4th-grade mathematics scaled score	637 (32)	638 (35)
4th-grade ELA scaled score	654 (33)	656 (33)
Free or reduced-price lunch	0.85 (0.36)	0.84 (0.37)
Black	0.81 (0.40)	0.81 (0.39)
Hispanic	0.12 (0.33)	0.12 (0.32)
Male	0.47 (0.50)	0.42 (0.49)
Disabled	0.07 (0.25)	0.09 (0.29)
Any prior test accommodation	0.10 (0.30)	0.13 (0.33)
4th-grade attendance rate	0.95 (0.04)	0.95 (0.04)
4th-grade ever suspended	0.19 (0.40)	0.17 (0.37)
Sample size	73	485
Cohort II 7th graders		
4th-grade mathematics scaled score	642 (27)	645 (26)
4th-grade ELA scaled score	652 (32)	656 (32)
Free or reduced-price lunch	0.83 (0.38)	0.87 (0.33)
Black	0.77 (0.43)	0.76 (0.43)
Hispanic	0.10 (0.30)	0.10 (0.30)
Male	0.49 (0.50)	0.47 (0.50)
Disabled	0.12 (0.32)	0.07 (0.25)
Any prior test accommodation	0.13 (0.34)	0.13 (0.34)
4th-grade attendance rate	0.96 (0.03)	0.96 (0.04)
4th-grade ever suspended	0.13 (0.34)	0.12 (0.33)
Sample size	69	478

³ Students who repeated a grade were inadvertently included in this robustness check in Johnson et al. (2016). For results presented in this section, which average 2014–2015 effect size estimates with those from previous years, we updated the 2013–2014 results to correctly exclude repeaters from the analysis. Revised results for this robustness check from Johnson et al. (2016) are available upon request.

	Kauffman School	All Kansas City public schools
Cohort III 6th graders		
4th-grade mathematics scaled score	634 (29)	637 (30)
4th-grade ELA scaled score	648 (32)	652 (32)
Free or reduced-price lunch	0.88 (0.33)	0.88 (0.33)
Black	0.77 (0.42)	0.75 (0.43)
Hispanic	0.13 (0.34)	0.15 (0.36)
Male	0.43 (0.50)	0.44 (0.50)
Disabled	0.07 (0.26)	0.06 (0.23)
Any prior test accommodation	0.14 (0.34)	0.14 (0.35)
4th-grade attendance rate	0.95 (0.04)	0.95 (0.04)
4th-grade ever suspended	0.15 (0.36)	0.13 (0.34)
Sample size	140	703
Cohort IV 5th graders		
4th-grade mathematics scaled score	633 (27)	634 (28)
4th-grade ELA scaled score	646 (33)	647 (29)
Free or reduced-price lunch	0.94 (0.23)	0.94 (0.23)
Black	0.89 (0.31)	0.88 (0.32)
Hispanic	0.08 (0.26)	0.06 (0.24)
Male	0.46 (0.50)	0.47 (0.50)
Disabled	0.07 (0.25)	0.08 (0.27)
Any prior test accommodation	0.08 (0.27)	0.08 (0.26)
4th-grade attendance rate	0.95 (0.04)	0.96 (0.04)
4th-grade ever suspended	0.18 (0.39)	0.17 (0.38)
Sample size	159	478

Notes: Standard deviations are displayed in parentheses next to the averages in this table. No differences between averages for Kauffman students and comparison group students are significantly different from zero.

ELA = English language arts.

The test score impact estimates based on students with nonmissing data are displayed in Table B.7. The results are broadly similar to the main results shown in Table III.1. The impact estimates are similar in magnitude, and the statistical significance is the same as for the main results.

Table B.7. Impact of Kauffman School on MAP test scores (citywide comparison group) using no imputed data

	Results using no imputed data	Benchmark results using imputed data
One-year impact estimates		
5th-grade mathematics effect size	0.20** (0.03)	0.22** (0.03)
5th-grade ELA effect size	0.24** (0.03)	0.23** (0.03)
5th-grade science effect size	0.46** (0.03)	0.46** (0.04)
Sample size	2,568	2,956
Two-year impact estimates		
6th-grade mathematics effect size	0.37** (0.04)	0.35** (0.04)
6th-grade ELA effect size	0.24** (0.04)	0.18** (0.04)
Sample size	1,816	2,205
Three-year impact estimates		
7th-grade mathematics effect size	0.69** (0.05)	0.68** (0.05)
7th-grade ELA effect size	0.52** (0.06)	0.52** (0.06)
Sample size	967	1,115
Four-year impact estimates		
8th-grade mathematics effect size	1.16** (0.10)	0.96** (0.10)
8th-grade ELA effect size	0.58** (0.08)	0.53** (0.08)
8th-grade science effect size	0.73** (0.11)	0.66** (0.10)
Sample size	558	748

Notes: This table displays impact estimates in effect size units. The first section of this table presents the average one-year impact estimates for cohort I, II, III, and IV 5th graders. The second section presents the average two-year impact estimates for cohort I, II, and III 6th graders. The third section presents the three-year impact estimates for cohort I and II 7th graders. The fourth section presents the four-year impact estimates for cohort I 8th graders. The first data column includes only students with nonmissing data in the analysis sample. Standard errors are displayed in parentheses below each impact estimate. The sample size represents the total number of Kauffman and matched comparison students entering each analysis.

**Significantly different from zero at the 1 percent level.

ELA = English language arts.

5. Alternative comparison groups for attendance and suspension impact estimates

We report in Table B.8 the attendance and suspension results when the two alternative comparison groups are used. The magnitude of the impact on suspensions is smaller when the charter school comparison group is used relative to the district school comparison group.

Table B.8. Alternate estimates of impact of Kauffman School on attendance and suspensions (district/charter comparisons)

	Impact on attendance rate (%)	Impact on probability of being suspended (%)	Sample size
Kansas City district schools			
Cohort I 8th graders	0.55 (0.77)	14.8 (6.1)	457
Cohort II 7th graders	1.35 (0.90)	5.33 (6.7)	408
Cohort III 6th graders	1.12* (0.45)	6.76 (4.4)	755
Cohort IV 5th graders	1.07* (0.46)	16.9** (4.1)	519
Average across grades	1.04** (0.29)	11.4** (2.5)	2,138
Kansas City charter schools			
Cohort I 8th graders	0.08 (0.72)	11.9 (6.9)	343
Cohort II 7th graders	0.17 (0.78)	4.83 (7.4)	291
Cohort III 6th graders	0.82 (0.46)	-1.03 (5.0)	457
Cohort IV 5th graders	1.69** (0.45)	8.95 (4.7)	443
Average across grades	0.89** (0.28)	5.64* (2.8)	1,534

Notes: This table reports the estimated impact of the Kauffman School on attendance and suspensions. The suspension results are marginal effects from logit models in which the outcome variable is an indicator for receiving a suspension during the year. Standard errors are displayed in parentheses below each impact estimate. The sample size represents the total number of Kauffman students and matched comparison students entering each analysis. The bottom row in each section displays the average across grades, weighted by the number of Kauffman students in each grade.

*Significantly different from zero at the 5 percent level.

**Significantly different from zero at the 1 percent level.

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