

**Kauffman School  
Evaluation Long- Term  
Outcomes Report**

**Year 2**

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Policy Research



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## EXECUTIVE SUMMARY



As part of its ongoing efforts to raise academic achievement of children from low-income families in Kansas City, Missouri, the Ewing Marion Kauffman Foundation founded the 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” (The Ewing Marion Kauffman School 2013).

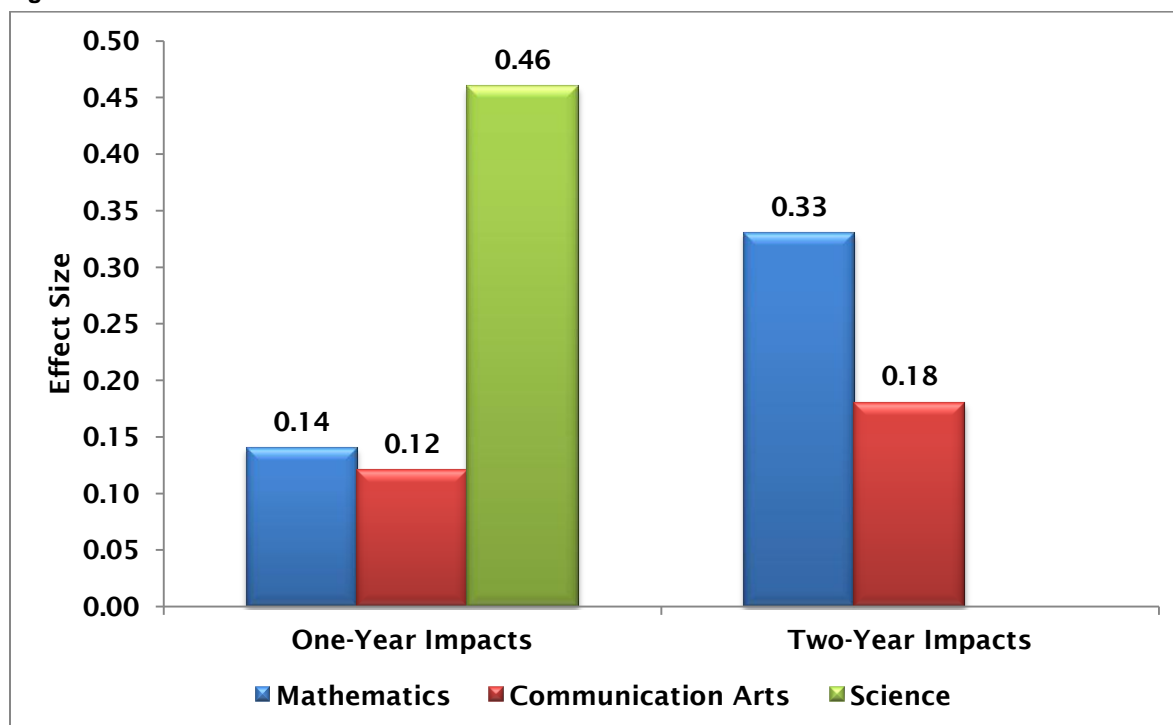
As a public charter school, the Kauffman School is tuition-free and serves students living in Kansas City. The School enrolled its first class of 5th graders in fall 2011 (about 100 students), and added a second class of 5th graders in fall 2012 (about 100 students). In fall 2013, a third class of 5th graders joined the School (about 200 students). Each year, the School will add a new 5th grade class, ultimately resulting in a fully enrolled middle school and high school (grades 5 through 12).

The Kauffman School has ambitious goals for its students. These include 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 behavior during the 2011–2012 and 2012–2013 school years. Mathematica Policy Research obtained data from the Missouri Department of Elementary and Secondary Education that included student achievement on the Missouri Assessment Program (MAP) exams, attendance and suspensions, and demographic characteristics. Using these data, we identified a group of Kansas City students similar to Kauffman students based on demographic characteristics and prior achievement. We used data on outcomes for these students to determine whether the Kauffman School is producing gains in achievement, attendance, and behavior that outpace those of other schools in Kansas City.

**Main findings.** Our findings indicate that in the 2011–2012 and 2012–2013 school years the Kauffman School had positive, statistically significant, and educationally meaningful impacts on student achievement growth in math, communication arts (reading), and science beyond the growth achieved by students in other Kansas City public schools. —In all three subjects the Kauffman School attained its goal of having students grow at least 1.25 years for every year they attend. Our main results compare the achievement growth of Kauffman students to that of similar students in other public schools (including other charter schools) serving 5th- and 6th-grade students within the boundaries of the Kansas City Missouri School District (KCMSD). We report results separately for students one year and two years after entering the Kauffman School in 5th grade.

Our estimates of the impact of the Kauffman School on student achievement growth are measured in effect size units (units of standard deviations of student test scores). These impacts estimate the average effect that attending the Kauffman School has on student test score growth beyond what students would have achieved if they had they attended other Kansas City public schools. We estimate the impact of the Kauffman School after one year of enrollment to be 0.14 standard deviations in math, 0.12 in reading, and 0.46 in science (see Figure ES.1). The estimated impacts of the Kauffman School after two years of enrollment are 0.33 standard deviations in math and 0.18 standard deviations in reading. (There is no two-year estimate for science because the state does not have a science test for 6th graders.)

**Figure ES.1. Kauffman School MAP Effect Size Estimates**



Note: All effect size estimates presented in this figure are statistically significantly different from zero.

The size of the estimated impact of the Kauffman School on student achievement is substantial. The magnitude of the effect size estimates imply that students attending the Kauffman School achieve approximately 0.68 additional years of learning growth in math after two years of enrollment (see Bloom et al. 2008 for conversion tables). Prior to entering the Kauffman School (i.e., in 4th grade), the average Kauffman student is at the 36th percentile in the state distribution of math test scores. The math impact estimate implies that the average student would move to the 49th percentile after two years of enrollment at the School. Moreover, the two-year math effect is equal to approximately 42 percent of the local black-white math test score achievement gap in 6th grade in Kansas City.

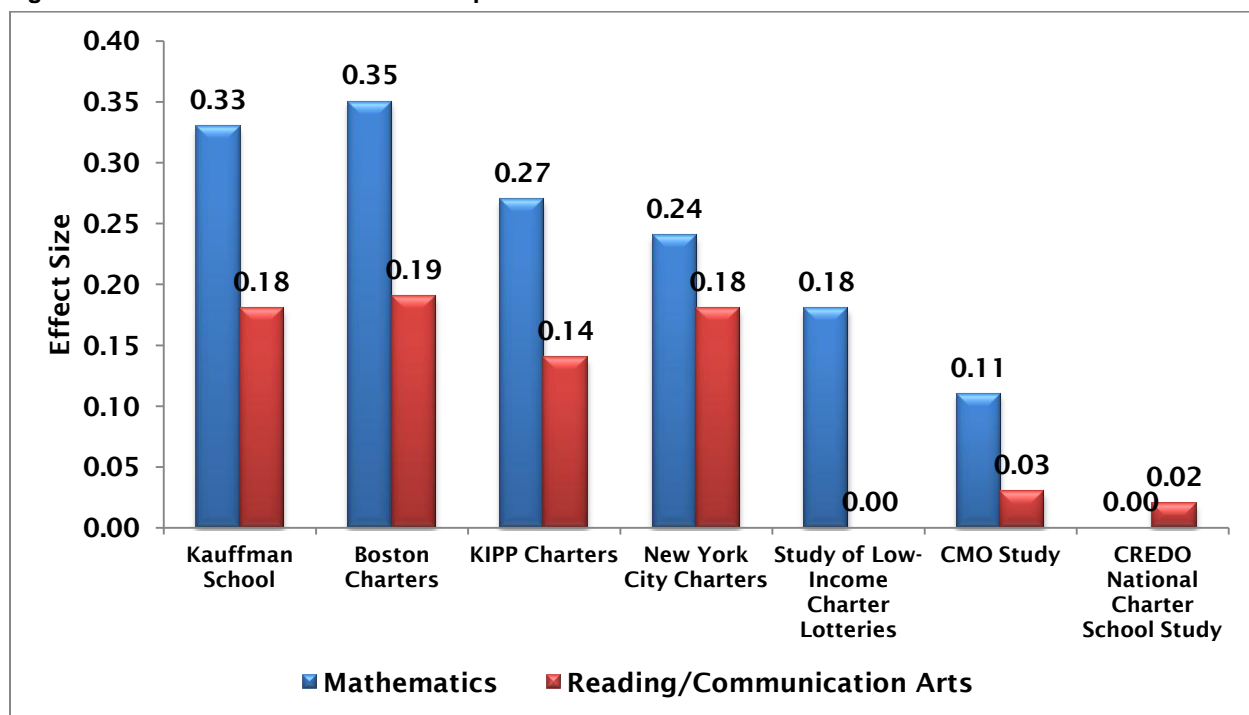
The effect size estimate in reading is substantial as well; the magnitude implies that students attending the Kauffman School achieve approximately 0.50 additional years of learning growth by the end of the second year after enrolling. The average Kauffman student moves from the 39th percentile in the state reading test score distribution prior to entering the school to the 46th

percentile after two years. This effect is approximately equivalent to 24 percent of the local black-white reading test score achievement gap in 6th grade.

The estimated impact of the Kauffman School after one year of enrollment is largest in science. In their first year in the school, Kauffman students appear to be achieving 1.15 additional years of learning in science compared to students at other Kansas City schools. This is equivalent to approximately 40 percent of the local black-white science achievement gap in 5th grade. However, the science impact estimate should be interpreted with caution, because there was no prior year science exam that could be used in the analysis; prior reading and math scores must be used as baselines instead.

**Comparison to other charter schools.** The Kauffman School’s estimated achievement impacts in math and reading after two years of enrollment are similar to those of other highly successful charter school programs (see Figure ES.2). Relative to Boston charter schools, the estimated impacts of the Kauffman School are slightly smaller in math and comparable in reading (Abdulkadiroglu et al. 2009). The Kauffman School’s impacts for math and reading are slightly above the impacts of the average KIPP middle school examined in Tuttle et al. (2013). The average two-year impacts of New York City charter schools analyzed by Hoxby et al. (2009) are slightly lower than those of the Kauffman School in math and comparable in reading.

**Figure ES.2. Charter School Two-Year Impact Estimates from Various Studies**



Note: Figure contains two-year 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 school in the charter school management organizations studied by Furgeson et al. (2012), and the average charter school in the 27 states analyzed by the Center for Research on Education Outcomes (CREDO 2013). 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 (a) the average oversubscribed charter school serving a large fraction of low-income students analyzed by Gleason et al. (2010), (b) the average school in the charter school management organizations (CMOs) studied by Furgeson et al. (2012), and (c) the average charter school in the 27 states analyzed by the Center for Research on Education Outcomes (CREDO 2013). Few of the charter schools included in these studies were in their first two years of operation. The performance of charter schools often improves after the first year of operation (Gill et al. 2007; Sass 2006), suggesting that the Kauffman School's effects are especially noteworthy because half of the estimated impacts of the Kauffman School took place during the first year the School was open.

The impact of other charter schools on science achievement is less widely reported because science tests are administered in fewer grades in most states. The available evidence suggests that the Kauffman School, with an estimated one-year effect size of 0.46, is substantially outperforming other successful charter schools with respect to its impact on science achievement. New York City charter schools are estimated to have average annual impacts of 0.23 standard deviations on science achievement in grades 5 through 8 (Hoxby et al. 2009). KIPP middle schools are estimated to have a cumulative average impact of 0.33 standard deviations in science after three to four years of enrollment (Tuttle et al. 2013), implying an average one-year impact of approximately 0.094 standard deviations.

**Alternate comparison groups in Kansas City.** The main findings summarized above are a result of comparing Kauffman School students with a matched comparison group of students from all public schools in Kansas City. We also compared Kauffman School students with two subgroups of children—similar students attending non-charter KCMSD schools and similar students attending other Kansas City charter schools. The estimated effect sizes are higher when the Kauffman School is compared only to non-charter KCMSD schools and are lower when compared only to other charter schools. The effect size estimates for the latter comparison remain positive and significantly different from zero in math and science, indicating that the Kauffman School is outperforming the average charter school in Kansas City in these subjects.

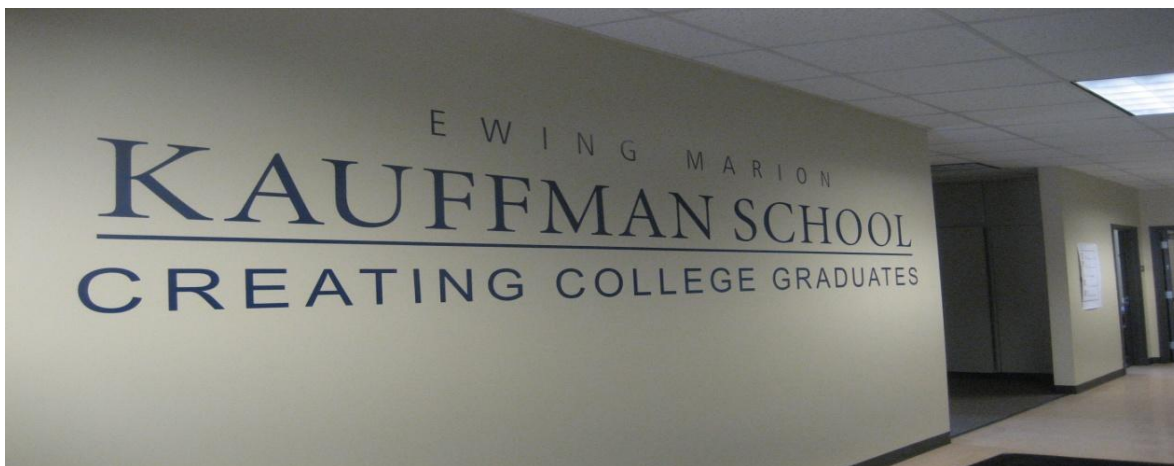
**Changes in effectiveness of the Kauffman School over time.** We analyzed whether the impact of the Kauffman School on student achievement changed during the School's second year of operation by comparing the one-year impact estimates of the Kauffman School on 2011–2012 5th-grade students and on 2012–2013 5th-grade students. In all three subjects, estimated impacts were slightly higher in the school's second year: Math impacts rose from 0.13 to 0.15 standard deviations, CA impacts rose from 0.06 to 0.18 standard deviations, and Science impacts rose from 0.40 to 0.54 standard deviations between year one and year two. These findings provide suggestive evidence that the effectiveness of the Kauffman School may be increasing over time. However, the increases from the first year to the second were not statistically significant.

**Attendance and suspensions.** The results for the estimated impact of the Kauffman School on attendance relative to other Kansas City public schools were mixed. The school had no significant effect on attendance in its first year, but there is some evidence that in 2012–2013 the Kauffman School produced a positive impact on student attendance, equivalent to an increase in the average student attendance rate of 0.9 percentage points. In both years the school achieved its goal of an average daily attendance rate of 95 percent.

The results for the estimated impacts on student suspensions were also mixed. It is important to note that suspension rates are determined by school policy as well as student behavior, and our data

do not allow us to determine which of these elements may be driving differences between Kauffman students and comparison students. Students in the first Kauffman School cohort, who entered the School in 2011–2012, were more likely in both of their first two years in the school to receive suspensions, relative to comparison students. However, students in the second cohort, who entered the School in 2012–2013, were suspended at a rate similar to that of comparison students from other Kansas City public schools. The students who were the first group of 5th graders in the school appeared to struggle more with the School’s behavior norms in both years 1 and 2, than did the second class of 5th graders.

## I. INTRODUCTION



### A. Background about the Kauffman School

For many years, the Kauffman Foundation has focused efforts on improving education for children in Kansas City. Prior to 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, analysis, and decision making prior to 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).<sup>1</sup>

From the Foundation’s perspective, this 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

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<sup>1</sup> Prolonged poor academic performance in the district contributed, in part, to the Kansas City school district losing its accreditation in 2011—the same year the Kauffman School opened. At the time of this writing, the district remains unaccredited.

school, in order to have ample time to prepare struggling students for the School's college preparatory program that begins in ninth grade.

**Step 2. Selecting a location.** The Foundation intended the Kauffman School to serve Kansas City's low-income families. From a review of demographic data on Kansas City, the school design team learned that the majority 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 are located in the western part of the city. In response to this discrepancy, the Foundation selected a location in the eastern part of the city, so that the school would be in proximity to 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 the boundaries of these five zip codes are given first preference for enrollment.<sup>2</sup>

**Step 3. Identifying best practices.** The school 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 conducted a thorough review of research literature on charter schools and visited successful charter schools in New York and Boston to learn more about the variables that contributed to the schools' success.

## B. Key Characteristics of the Kauffman School

The design team identified six attributes that the team considered necessary for success, and that were incorporated into the school's design: (1) ambitious academic goals, (2) high attendance and behavioral expectations, (3) extended school day and year, (4) increased time for math and reading instruction, (5) intensive data-driven decision making, and (6) extensive teacher professional development. These are discussed below.

1. **Ambitious academic goals.** The Kauffman School expects its students to achieve 1.25 years of academic growth in math, science, and reading each year. These goals are regularly communicated to school administrators and 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 these assignments.
2. **High attendance and behavioral expectations.** The School has high goals for student attendance (95 percent average daily attendance) and behavior (full compliance with 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 KIPP. Students receive merits for positive behavior and demerits for non-compliance with School policies and procedures, and may serve detention (in or out of school) depending on the number of demerits they earn. The Dean of Students, who joined the School in the middle of the first year, oversees the implementation of the School's behavioral policies. The School holds an all-parent

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<sup>2</sup> 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 this section of Kansas City as well.

meeting to orient all incoming students and their families to the Kauffman School's high behavioral expectations prior to the start of each school year.

3. **Extended school day and year.** With students coming from Kansas City's low-performing schools, the school design team anticipated that many of the School's students would enter school performing below grade level and would need more instructional time to catch up academically and be ready for the School's college preparatory program. Thus, the School operates an extended school day and year in order to provide students with more instructional time.

During the School's first year, students received 37.8 hours of instruction per week (Richardson 2009). In Year 2, the school day was shortened to 36.5 hours per week in response to feedback from students, parents, teachers and staff (Gentile et al. 2013). Based on the Foundation's estimates, the current schedule now provides Kauffman students with about two extra months of school per year than students in the district's public schools receive.

4. **Increased math and reading instructional time.** In year 1, Kauffman students attended a double period of math each day (104 minutes), a non-fiction reading class (50 minutes), a writing class (50 minutes), and an extended period of literature each day (80 minutes). During year 2, students continued to have a double period of math and their non-fiction reading and writing classes. Students' literature class was focused on guided reading instruction and was shortened to one class period of 50 minutes. In year 2, all students attended an instructional support class each day in which they received tutoring and special instruction. Struggling students received additional instruction and practice in whatever 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 employs 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,"<sup>3</sup> quizzes, and tests to measure understanding and academic progress, the School's assessment portfolio includes:

- Achievement Network (ANet) assessments in math and reading, revised by Kauffman School teachers to be consistent with Missouri State Standards, administered every six weeks<sup>4</sup>
- Strategic Teaching and Evaluation of Progress (STEP) assessments to measure students' reading growth, administered six times per year
- Northwest Evaluation Association (NWEA) assessments in math, reading, and science, administered twice a year

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<sup>3</sup> Exit tickets are short questions or tasks that students complete at the end of the class period. These allow teachers to track the progress of their students' understanding of the course material on a regular basis.

<sup>4</sup> Kauffman School staff revised all of the ANet assessments in Year 1 and some of the ANet assessments in year 2. Kauffman School staff also created a similar set of assessments to measure student learning in science.



- Missouri Assessment Program (MAP) standardized tests in math, reading, and science, administered annually
6. **Extensive teacher professional development.** The School places a significant emphasis on teachers' professional development with an extensive professional development program comprising: (1) frequent observations and feedback from administrators (about once per week); (2) weekly individual coaching sessions from the principal in year 1 and from both the principal and instructional coaches in year 2; and (3) weekly group-based professional development sessions every Friday afternoon, focused on various topics related to curriculum, instruction, and assessment (Gentile et al. 2013).

## 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 School, they might be different from other Kansas City students in important ways. Measuring the effect of the School on student achievement requires identifying a comparison group of Kansas City students who, as of 4th grade, are similar to the students who are about to enter the Kauffman School. Otherwise, any difference we find in later student outcomes might not really be due to the effect of the 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 the School 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 two 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 School students at the time they were in the 4th grade (that is, before students entered the Kauffman School).

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 other demographic characteristics. This approach is commonly used as an alternative to the random assignment approach when evaluating the impacts of charter schools and has been shown to

produce valid impact estimates that replicate the results of experimental research designs (Furgeson et al. 2012; Tuttle et al. 2013).<sup>5</sup>

**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 student. Classifying students in this manner defuses the potential criticism that the School's effects are overestimated because low-achieving students have left the charter school. However, this classification may lead to understating the impact of the Kauffman School on student achievement because we are including in the analysis students who may have left the Kauffman School early in the school year and would have received very little influence from the School. Similarly, students from the School's first cohort who left after 5th grade are nonetheless kept in the treatment group for analytic purposes in 6th grade.<sup>6</sup> Again, this is a conservative analytic approach that eliminates the risk of biasing the impact estimate upward, but it means that the full impact on students who continue in the School for two years is likely to be underestimated.<sup>7</sup>

Data for our analysis are available for two cohorts of Kauffman students. Cohort I students are those who entered the Kauffman School as 5th graders in 2011–2012 (the year the School opened). Cohort II students are those who entered the School as 5th graders in 2012–2013. We present both two-year and one-year impact estimates for the Kauffman School. The two-year impacts are based on the outcomes of cohort I 6th grade students in 2012–2013.<sup>8</sup> The one-year impacts are the average of the Kauffman School's estimated impact on cohort I 5th graders in 2011–2012 and its impact on cohort II 5th graders in 2012–2013.

## 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, based on 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. The data consisted of MAP test scores in math, communication arts (CA), and science, along with attendance and suspension data for all students in Missouri who were in the 5th and 6th grade in the 2011–2012 and 2012–2013 school years. We also obtained data on the prior test scores, demographic characteristics, prior attendance, and prior

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<sup>5</sup> 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 KCMSD as the comparison group rather than those selected by the propensity score matching procedure.

<sup>6</sup> The Kauffman School did not admit new 6th grade students to the School. Only students who entered the Kauffman School in 5th grade are included in the treatment group for this analysis.

<sup>7</sup> 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 students who remain enrolled in the School.

<sup>8</sup> Cohort I students who repeated 5th grade in 2012–2013 are also included in the Kauffman student group for the main two-year impact calculations. See Appendix B.3 for details.

suspensions for these students. We limited our potential comparison group to students attending schools in the borders served by the Kansas City Missouri School District (KCMSD). (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 in the borders of KCMSD, including other charter schools. This group of students 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 KCMSD area, comparing the Kauffman School's impacts on student achievement to those of other Kansas City charter schools may also be of interest. Thus, we report the results in three ways—using a comparison group that (1) is drawn from all public schools in KCMSD (the primary impact estimates), (2) consists of students from non-charter KCMSD schools, and (3) consists solely of students from other charter schools in the boundaries of KCMSD.

Data on one or more of the variables used as baseline controls are missing for many students. Approximately 22 percent of the students we could potentially include in our analysis sample are missing data on one or more of the baseline control variables. To avoid dropping these students from the analysis, we employed a multiple imputation procedure to estimate those students' missing baseline values.<sup>9</sup> We also analyzed the data without using imputation and found similar results (see Appendix B.4).

## 2. Descriptive Statistics: What Types of Students Attend the Kauffman School?

Full descriptive statistics for the first two cohorts of Kauffman students as compared to students in other Kansas City public schools are presented in Appendix Tables A.2 and A.3. On average, Kauffman students in both cohorts had 4th grade MAP scores that were below the statewide average in both Math and CA. Students at the Kauffman School were also predominately from low-income and minority families: across both cohorts, 83 percent of Kauffman students were eligible for free or reduced-price lunches and 89 percent were black or Hispanic.

On average, Kauffman students 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. Kauffman students were also more likely to be black, 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 relative to Kansas City charter schools. Kauffman students were similar to other Kansas City public school students with respect to free/reduced-price lunch and disability rates.

Given that the first two cohorts of 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 that differ with respect to baseline characteristics may be expected to show

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<sup>9</sup> See Appendix A.3 for more details about our imputation procedure.

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 Table A.6 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.

### III. THE IMPACT OF THE KAUFFMAN SCHOOL ON STUDENT ACHIEVEMENT



In this chapter, we present the main impact estimates for the Kauffman School on student achievement as measured by the MAP exams in math, reading, and science. We present two-year impact estimates for math and reading and one-year impact estimates for all three subjects. We describe various ways of interpreting the impact estimates and place the size of the estimates in the context of findings for other evaluations of charter school effectiveness.

#### A. Impacts on MAP 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 linear regression models that include the Kauffman students and matched comparison students and control for small remaining differences in prior achievement and other baseline characteristics.<sup>10</sup> These 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).<sup>11</sup> Standard errors are displayed in parentheses below each estimate, along with asterisks indicating whether the estimate is significantly different from zero.

<sup>10</sup> The covariates include all the variables listed in Table II.1. We also include 3rd grade math and CA 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.

<sup>11</sup> The statewide standard deviations of 6th grade MAP scores were 40 in math and 33 in CA. The statewide standard deviations of 5th grade MAP scores were 43 in math, 35 in CA, and 34 in science.

**Table III.1. Impact of Kauffman School on MAP Test Scores (Citywide Comparison Group)**

	Math	Communication Arts	Science	Sample Size
<b>One-Year Impact Estimates</b>	0.14** (0.05)	0.12* (0.05)	0.46** (0.05)	1,294
<b>Two-Year Impact Estimates</b>	0.33** (0.08)	0.18** (0.07)	N/A	596

Note: This table displays impact estimates in effect size units. The first row of this table presents the average one-year impact estimates for cohort I 5th graders and cohort II 5th graders. The second row of this table presents the two-year impact estimates for cohort I 6th graders. 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. One asterisk (\*) indicates significantly different from zero at the 5 percent level. Two asterisks (\*\*) indicate significantly different from zero at the 1 percent level.

The first row of Table III.1 shows the amount of additional growth realized by Kauffman students relative to matched comparison students in all other Kansas City public schools after one year of enrollment in the Kauffman School. These numbers represent the average effect size estimate for cohort I 5th graders and cohort II 5th graders.<sup>12</sup> The one-year impact estimates for the Kauffman School are positive and statistically significant in math, reading, and science. The estimated math effect size is 0.14 standard deviations and the estimated reading effect size is 0.12 standard deviations. The magnitude of the science estimate is 0.46 standard deviations, which is more than three times as large as the one-year impact estimates for math and reading. Caution should be used when interpreting the science effect size 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 impacts are prior scores in math and communication arts.

The second row of Table III.1 reports the estimated effect of the Kauffman School on student achievement after two years of enrollment. The results show that the Kauffman School had a positive and significant two-year impact on student MAP growth of 0.33 standard deviations in math and 0.18 standard deviations in reading.

We report the results when two alternative comparison groups are used in the analysis in Table III.2 below. The first half of the table reports the effect size estimates for the Kauffman School when compared to non-charter public schools in KCMSD. The one- and two-year 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 sizes estimates for the Kauffman School are lower, but the estimates remain positive, and the two-year impact estimate for math and one-year impact estimate for science remain statistically significant. The differences in the results for the different comparison groups suggest that Kansas City's charter schools are outperforming its district schools, on average.

<sup>12</sup> The effect size estimates were estimated separately for cohort I 5th graders and cohort II 5th graders. To calculate the one-year 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 5th grade cohort.

**Table III.2. Alternate Estimates of Impact of Kauffman School on MAP Test Scores (District/Charter Comparisons)**

	Math	Communication Arts	Science	Sample Size
<b>Compared to Kansas City District Schools</b>				
One-Year Impact Estimates	0.18** (0.05)	0.16** (0.06)	0.52** (0.06)	886
Two-Year Impact Estimates	0.44** (0.10)	0.20* (0.08)	N/A	393
<b>Compared to Kansas City Charter Schools</b>				
One-Year Impact Estimates	0.10 (0.06)	0.08 (0.06)	0.42** (0.07)	540
Two-Year Impact Estimates	0.23* (0.11)	0.14 (0.10)	N/A	233

Note: 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. One asterisk (\*) indicates significantly different from Kauffman at the 5 percent level. Two asterisks (\*\*) indicate significantly different from Kauffman at the 1 percent level.

## B. Interpretation of Kauffman School Impact Estimates

To assist with the interpretation of the effect size estimates, we convert 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.** A common approach used to assist with the interpretation of effect size units is to compare them to an educational benchmark such as the growth students typically achieve in relevant grades and subjects. We can estimate the gains in achievement of a typical student (in units of test score standard deviations) and compare that to the additional gains in achievement of Kauffman School students (also measured in units of test score standard deviations). Using this comparison 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. We perform this conversion based on results presented in Bloom et al. (2008).<sup>13</sup> Using a set of widely administered vertically scaled assessments; Bloom et al. (2008) estimated that the typical 5th grade student grows 0.56 standard deviations in math, 0.40 standard deviations in reading, and 0.40 standard deviations in science. Bloom et al. (2008) also estimated that the typical 6th grade student grows 0.41 standard deviations in math and 0.32 standard deviations in reading. To convert the two-year impact estimates of the Kauffman School into units of additional years of learning, we divide the effect size by the average number of standard deviations for 5th and 6th grade students that equate to a year of learning growth in the corresponding subject.

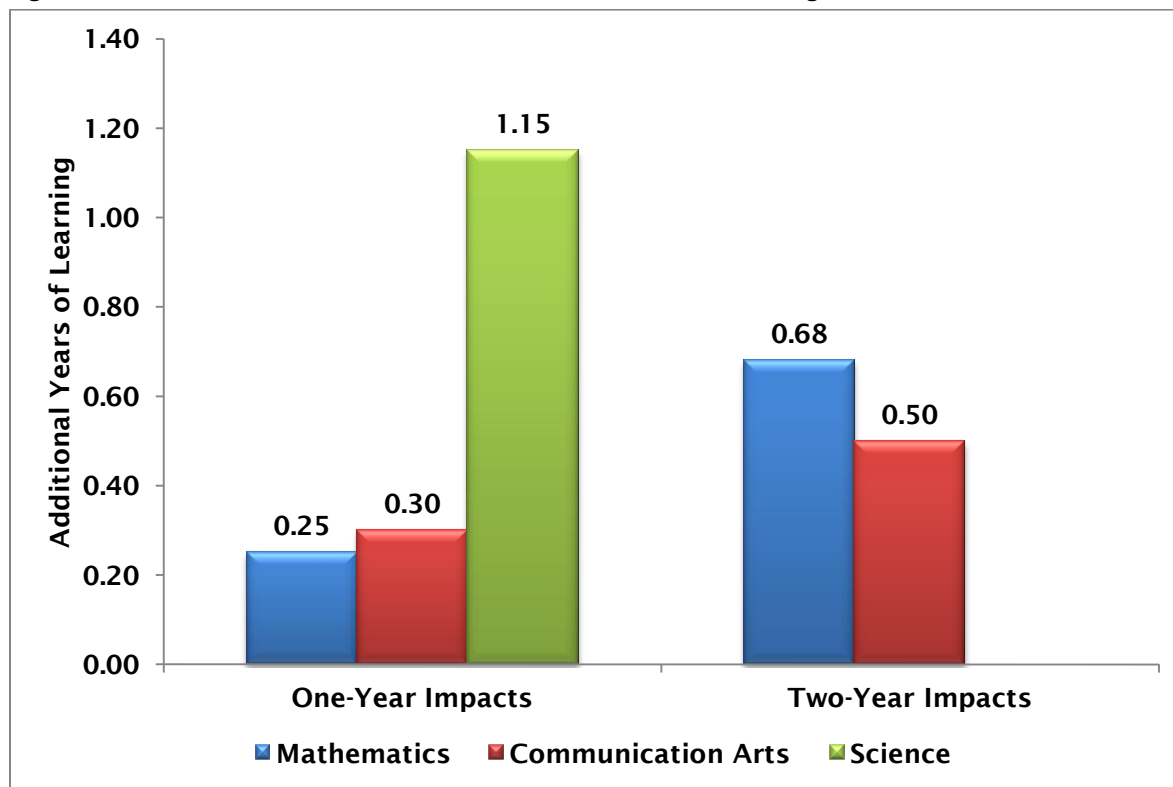
Performing this conversion on the results from the main comparison group yields the results shown in Figure III.1. Kauffman students realized an additional 0.25 years in math, 0.30 years in reading, and 1.15 years in science based on the one-year impact estimates. Applying a similar conversion to our two-year impact estimates indicates that, after two years of enrollment, Kauffman

<sup>13</sup> 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.



students achieved approximately 0.68 years of additional learning growth in math and 0.50 years of additional learning growth in reading. All of these results suggest that the School is meeting its aim of producing 1.25 years of learning in each year of instruction. Note that caution is warranted when interpreting the Kauffman School effect size results in terms of years of learning because the accuracy of these conversions depends on how similar a standard deviation of achievement on the MAP exams is to the vertically scaled assessments analyzed in Bloom et al. (2008).<sup>14</sup>

**Figure III.1. Kauffman School Estimates of Additional Years of Learning Growth on MAP Exams**



Note: This figure displays the additional years of learning growth achieved by Kauffman students relative to similar students in other Kansas City public schools. The additional growth was significantly different from zero all subjects.

**Results as test score percentile ranks.** As a second interpretation, 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 attending an average Kansas City school. In 4th grade, prior to entering the Kauffman School, the average Kauffman student was at the 36th percentile in the state math test score distribution and at the 39th percentile in the state

<sup>14</sup> 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 where students show no growth on average between grades 5 and 6 (CTB McGraw-Hill 2010). Therefore, we did not attempt to use the vertical scale of the MAP to convert effect sizes into units of years of learning.

communication arts test score distribution.<sup>15</sup> After two years of enrollment at the Kauffman School, the average student moved to the 49th percentile in math and the 46th percentile in communication arts.<sup>16</sup> On average, students enrolling at the Kauffman School move from substantially below average in the state distribution to close to the state average after two years of enrollment at the School.

**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 and the test score gap for poor students. These percentages provide a sense of how much of the achievement gap is being closed after one or two years of enrollment in the Kauffman School. The two-year impact estimates for the Kauffman School are approximately equivalent to 42 percent of the 6th grade black-white test score gap in math and 24 percent of the black-white gap in communication arts for Kansas City students.<sup>17</sup> The one-year impact estimate for the Kauffman School in 5th grade science is approximately equivalent to 40 percent of the black-white test score gap in that subject.<sup>18</sup> In terms of the test score achievement gap for students who are eligible for free or reduced-price lunches relative to students who are ineligible: the two-year impact estimates for the Kauffman School are approximately equivalent to 64 percent of this gap in math and 23 percent of this gap in communication arts. The one-year impact estimate in science is approximately equivalent to 56 percent of the test score gap for poor students.<sup>19</sup> These results indicate that the Kauffman School is making progress in reducing achievement gaps by race and income.

### C. Comparison of Kauffman School Estimated Impacts to Charter Schools Nationwide

The main two-year effect size results (based on the citywide comparison group) fall within the range of the impacts estimated for high-performing charter schools in other studies and are higher than impact estimates of charter schools nationwide. Below 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) charter school management organizations (CMOs), and (3) charter schools across 27 states. The comparisons are summarized in Figure III.2 below.

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<sup>15</sup> These calculations are based on cohort I students only, because this sample of students is used to calculate the two-year impact estimates.

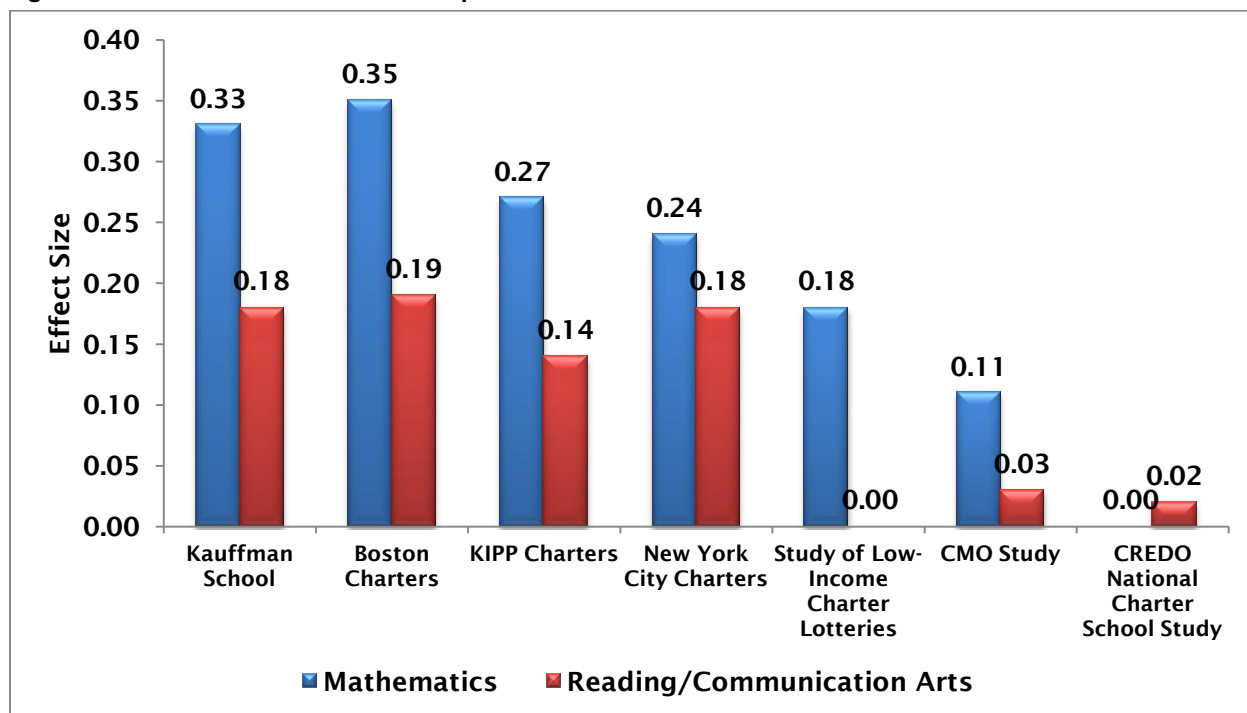
<sup>16</sup> The percentile ranks after two years of enrollment at the Kauffman School were calculated by taking the average 4th grade z-scores of Kauffman students and adding the two-year effect size estimates. These calculations assume that the percentile rank of the average student in Kansas City is not changing over time.

<sup>17</sup> The average 6th grade math z-score for non-Kauffman black students in Kansas City in math is -0.625 and the average z-score for white students is 0.154. The corresponding z-scores in reading are -0.628 for black students and 0.128 for white students.

<sup>18</sup> The average 5th grade science z-score for non-Kauffman black students in Kansas City is -0.980; the corresponding average z-score for white students is 0.167.

<sup>19</sup> The z-scores used in the calculations for the poverty achievement gaps are as follows: 6th grade math for free or reduced-price lunch (FRL) students is -0.525 and non-FRL students is -0.010; 6th grade reading for FRL students is -0.613 and non-FRL students is 0.167; 5th grade science for FRL students is -0.804 and non-FRL students is 0.012.

Figure III.2. Charter School Two-Year Impact Estimates from Various Studies



Note: Figure contains two-year 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 school in the charter school management organizations studied by Furgeson et al. (2012), and the average charter school in the 27 states analyzed by the Center for Research on Education Outcomes (CREDO 2013).

The performance of the Kauffman School in math and reading is on par with the estimated impacts of other successful charter school programs. A study of Boston charter schools (Abdulkadiroglu et al. 2009) showed an estimated average two-year effect size for these schools of 0.35 in math and 0.19 in reading.<sup>20</sup> A study of KIPP charter middle schools—widely recognized as high-performing—reported average impact estimates of 0.27 in math and 0.14 in reading (Tuttle et al. 2013). Hoxby et al. (2009) reported average two-year effect sizes of 0.24 in math and 0.18 in reading for New York City charter schools in grades 4 through 8.<sup>21</sup> The Kauffman School is therefore performing at a level similar to these high-performing charter schools.

The achievement growth experienced by students at the Kauffman School is substantially higher than the average growth experienced by charter school students nationwide. Gleason et al.

<sup>20</sup> The two-year impact estimates reported from other studies in this section are generally obtained by doubling 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 which the authors report two-year impact estimates separately from one-year impact estimates.

<sup>21</sup> 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 two-year impact estimates for New York City charter schools are 0.18 in math and 0.12 in reading.

(2010) analyzed a sample of oversubscribed charter middle schools with lottery admission processes. The authors report an average two-year impact estimate of 0.18 in math and zero in reading for charter schools serving a large fraction of low-income students.<sup>22</sup> The average charter school in the charter school management organizations analyzed in Furgeson et al. (2012) was estimated to produce two-year effect sizes of 0.11 in math and 0.03 in reading. Across the 27 states included in the Center for Research on Education Outcomes analysis, there was no average impact for charter schools in math and a two-year average impact of only 0.02 in reading (CREDO 2013).

Relatively few studies of charter school effectiveness report impact estimates in science because there are fewer available data on science achievement than there are for math and reading. New York City charter schools are estimated to have average annual impacts of 0.23 standard deviations on science achievement in grades 5 through 8 (Hoxby et al. 2009). KIPP charter schools are estimated to have an average impact of 0.33 standard deviations in science after three to four years of enrollment, implying an average one-year impact of approximately 0.094 standard deviations.<sup>23</sup> The Kauffman School's estimated science impact is substantially larger than both of these. As noted previously, caution should be used when interpreting the science impact estimates for the Kauffman School, since no prior year science exam score was available for use in the analysis.

Few of the charter schools included in the studies cited above were in their first two years of operation. Studies have shown that the performance of charter schools often improves after the first year of operation (Gill et al. 2007; Sass 2006). For example, Sass (2006) finds that charter schools in Florida significantly under-perform traditional public schools during their first year of operation. Sass (2006) also finds that the impact estimates of first-year charter schools are on average between 0.05 and 0.07 standard deviations lower than the impact estimates of charter schools in their 5th and higher years of operation.<sup>24</sup> These results suggest that the Kauffman School's estimated effects are especially noteworthy because half of the impacts occurred during the first year the School was open.

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<sup>22</sup> Gleason et al. (2010) report negative but statistically insignificant impact estimates based on the full set of charter schools in their sample.

<sup>23</sup> The KIPP one-year science impact estimate was obtained by dividing the three- to four-year impact estimate by 3.5.

<sup>24</sup> The results in Sass (2006) differ by subject and whether the sample was based on all charter schools or a sample that excludes conversion charter schools. Conversion charter schools began as traditional public schools but later changed to charter schools.

#### IV. CHANGE IN EFFECTIVENESS OF THE KAUFFMAN SCHOOL OVER TIME



The Kauffman School has completed two full years of operation: the 2011–2012 school year and the 2012–2013 school year. We can use data on the two cohorts of 5th grade students to test whether the estimated impact of the Kauffman School has changed over time. We might expect to see an increase in the estimated impact of the Kauffman School during its second year of operation since other studies have found that charter schools often show increases in their performance after the first year (Gill et al. 2007; Sass 2006).

Table IV.1 compares the estimated one-year Kauffman School impacts for cohort I 5th graders in 2011–2012 and cohort II 5th graders in 2012–2013. Both cohorts performed significantly better than their comparison groups in math and science, and cohort II performed better than its comparison group in all three subjects. In all three subjects, the estimates are larger for cohort II than for cohort I, though none of these differences are statistically significant.<sup>25</sup> Thus, there is suggestive evidence that the School’s impacts increased between the first year and the second, but the data are not sufficient to be sure of this.

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<sup>25</sup> Independent two-sample t-tests were used to test for significant differences between the one-year impacts estimates in each subject.

**Table IV.1. Comparison of One-Year MAP Test Score Impacts: Cohort I 5th Graders & Cohort II 5th Graders**

	<b>Cohort I 5th Graders</b>	<b>Cohort II 5th Graders</b>	<b>Difference</b>
5th Grade Math Effect Size	0.13* (0.06)	0.15* (0.07)	0.02
5th Grade CA Effect Size	0.06 (0.07)	0.18** (0.06)	0.13
5th Grade Science Effect Size	0.40** (0.08)	0.54** (0.07)	0.14
Sample Size	677	617	

Note: 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. One asterisk (\*) indicates significantly different from zero at the 5 percent level. Two asterisks (\*\*) indicate significantly different from zero at the 1 percent level.



## **V. THE IMPACT OF THE KAUFFMAN SCHOOL ON STUDENT ATTENDANCE AND BEHAVIOR**



In this chapter, we present the impacts of the Kauffman School on the attendance and behavior outcomes of its students, using suspension data as an indicator of student behavior. It is important to keep in mind, however, that these analyses cannot distinguish effects driven by differences in student behavior from effects driven by differences in school policies or reporting practices. For example, if Kauffman students are more likely to be suspended, this could be due to poor behavior, or it could be because the Kauffman School issues suspensions for different kinds of behavior than 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 use the same set of control variables. We analyze the attendance and suspension outcomes separately by year and by cohort to highlight differences that may arise over time and across grades. We use the attendance rate as the outcome in the attendance models. The state of Missouri collects suspension data separately for in-school suspensions and out-of-school suspensions. For the purposes of our analysis, we combined these data into one variable indicating whether a student received any type of suspension. Our aim in combining these data was to create a variable that would be as comparable as possible across schools, since some schools may have different standards for the kinds of disciplinary infractions that warrant in-school and out-of-school suspensions. (See Appendix A.1 for further details about the construction of the attendance and suspension variables.)

The distribution of suspensions is skewed: small number students receive a large number of suspensions. If we were to use the number of suspensions as the outcome of interest, this



distribution could produce misleading results. To avoid this problem, rather than counting the number of suspensions we instead examine whether a student ever received a suspension during the year.<sup>26</sup> The results are displayed in Table V.1.

**Table V.1. Impact of Kauffman School on Attendance and Suspensions (Citywide Comparison Group)**

	Impact on Attendance Rate	Impact on Probability of Being Suspended	Sample Size
Cohort I 6th Graders	0.009* (0.004)	0.12* (0.05)	596
Cohort II 5th Graders	0.008 (0.005)	0.02 (0.04)	617
Cohort I 5th Graders	-0.008 (0.005)	0.13* (0.05)	676

Note: This table reports the estimated impact of the Kauffman School on attendance and suspensions. The suspension results are marginal effects from logit models where 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. One asterisk (\*) indicates significantly different from zero at the 5 percent level. Two asterisks (\*\*) indicate significantly different from zero at the 1 percent level.

**Impact on attendance.** The results displayed in Table V.1 are mixed. For cohort I 6th grade students, the Kauffman School had a positive and statistically significant estimated impact on the attendance rate. The magnitude of the estimate indicates that Kauffman students' attendance rate is 0.9 percentage points higher than that of similar comparison students. The magnitude of the estimated attendance impacts for cohort II 5th graders is similar, though not significantly different from zero. The estimated impact for cohort I 5th graders is in the opposite direction but again not statistically significant.

Overall, the attendance impact results provide suggestive evidence of a positive impact for the Kauffman School of slightly less than 1 percentage point in the 2012–2013 school year (for cohort I 6th graders and cohort II 5th graders). In 2011–2012, the Kauffman School appeared to have no effect on attendance.

**Impact on suspension.** The suspension impacts for the Kauffman School are also mixed. For cohort I students, the Kauffman School had a positive and significant estimated impact on the likelihood that a student would receive a suspension in both grades.<sup>27</sup> During the 2012–2013 school

<sup>26</sup> Because the suspension outcome is a binary variable rather than a continuous one, we use a logit model in place of the linear regression to implement the analysis.

<sup>27</sup> To check the robustness of our results to different definitions of the ever-suspended variable, we performed a sensitivity analysis examining in-school and out-of-school suspensions as separate outcomes. When we analyzed these variables separately, we found that the significant coefficient on the ever-suspended variable for cohort I students was driven by high levels of out-of-school suspensions at the Kauffman School. For cohort II students, the coefficients on both the in-school and out-of-school suspension variables were small and not significantly different from zero.

year, 6th grade Kauffman students were 12 percentage points more likely to receive a suspension than comparison students. The magnitude of the estimated impact for cohort I students was similar in the preceding year, when they were in 5th grade. For cohort II 5th graders, however, the estimated suspension impact is close to zero and statistically insignificant.

Caution is warranted when interpreting the suspension impact estimates for the Kauffman School. The positive and significant impacts for cohort I students could be due to (1) larger behavior problems for this group of students relative to comparison students, (2) stricter discipline policies at the Kauffman School, which may issue suspensions for less-severe disciplinary infractions relative to other schools, or (3) the longer school day and school year that the Kauffman students experience (since the longer school day and school year present more opportunities for suspensions to be issued). We report the attendance and suspension results when the two alternative comparison groups are used in Appendix Table B.10.

The difference in behavior outcomes between the two classes at the Kauffman School is mirrored in students' responses to behavior-related survey questions in year 2 (Gentile et al. 2013), as follows:

- 64 percent of the 5th graders but only 48 percent of the 6th graders reported often or almost always being able to control their tempers.
- 44 percent of 5th graders but only 34 percent of 6th graders reported often or almost always remaining calm even when upsetting things happen.
- 61 percent of 5th graders but only 40 percent of 6th graders agreed or strongly agreed that the School's rules are fair.
- 83 percent of 5th graders but only 60 percent of 6th graders agreed or strongly agreed that they are treated with respect at the School.
- 82 percent of the 5th graders but only 65 percent of the 6th graders reported being satisfied or very satisfied with the Kauffman School.

These differences in students' attitudes toward the School, its rules, how they are treated, and their ability to self-regulate their behavior could partly result from a more intensive orientation to the School's behavioral expectations experienced by the second cohort of entering 5th graders during the summer prior to entering the school. It could also be due to naturally occurring differences in the two cohorts. These patterns will be explored further, as the School continues to add a new 5th grade cohort each year.

## 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. The School also has ambitious goals for student behavior and data indicate that some students struggle with the School’s high behavioral expectations.

**Achieving academic goals.** An analysis of data from the School’s first two years shows that the School achieved the goal of having students grow at least 1.25 years for every year they attend the Kauffman School, in all three subjects tested by the MAP (mathematics, communication arts, and science). Moreover, in years 1 and 2, attending the Kauffman School led to better performance on the MAP assessments in all three subjects, relative to similar students in other Kansas City public schools. If the school continues to produce positive impacts of the magnitude seen in its first two years, students who persist could overcome typical achievement gaps within a few years.

**Achieving attendance goals.** The Kauffman School achieved its goal of an average daily attendance rate of 95 percent across years 1 and 2 (see Gentile et al. 2013). By the second year of operation (2012–2013), the School had a statistically significant positive impact on its students’ rate of attendance, boosting the rate by about one percentage point.

**Struggling with student behavior goals.** The data concerning student behavior reveal an interesting pattern: the first group of 5th graders in the School appeared to struggle more with the School’s behavior norms in both years 1 and 2 than did the second class of 5th graders. This difference in behavior between the two classes at the Kauffman School is mirrored in their responses to behavior-related survey questions in year 2, with more 5th graders than 6th graders reporting that they are able to control their tempers and remain calm during times of stress, that the School’s rules are fair, and that they are treated with respect at school, as well as overall satisfaction with the School.

**Comparisons to other charter schools.** The impact estimates for the Kauffman School are higher than estimates of charter schools' average impacts nationally, and similar to those of charter schools known for their strong positive impacts on student achievement, such as Boston charter schools, KIPP charter schools, and New York City charter schools. These results are especially notable, considering that the Kauffman results are from its first two years, and most of the results in these studies are based on established charter schools.

## B. Next Steps for the Kauffman School

**Growing and moving.** Year 3 is a year of change and expansion for the Kauffman School. The Kauffman Foundation constructed a new school building, specifically designed for the School, to house grades 5 through 8. The School accepted twice the number of 5th graders as it had previously—200 new students—and hired additional teachers and staff, including more special education teachers and operations staff to support the smooth running of the School.

**Implementing the Common Core State Standards.** During year 3, teachers and school leaders are participating in development activities to ensure that the School's curriculum and instruction are aligned with the Common Core State Standards (CCSS). These efforts include working with Expeditionary Learning to adapt its Common Core language arts curriculum to meet the needs of Kauffman students, and holding in-house curriculum development sessions to update the School's mathematics curriculum to be consistent with the CCSS.

**Maintaining School culture.** As the School grows, administrators and teachers are attending to the issue of how to maintain and expand the School's culture. In the new building, 5th graders are on the second floor, while 6th and 7th graders share the third floor. This grouping has logistical benefits but poses challenges for instilling a common culture across grade levels. Administrators and teachers are working on ways to maintain the School's hallmarks: ambitious academic achievement, high attendance rates, and exemplary behavior.

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## **APPENDIX A**

### **DATA, SAMPLE SELECTION, AND ANALYSIS METHODOLOGY**





## 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. We requested student data for all 3rd graders in 2010–2013, all 4th graders in 2011–2013, all 5th graders in 2012–2013, and all 6th graders in 2013. 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/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.

To link the state assessment and student characteristics data, we reduced both to the unique student level. In the state assessment data, we removed duplicate records when students had more than one unique subject-specific MAP scaled score reported in a given year. In 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/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 not available. Any students not found in both the characteristics and state assessment 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/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.<sup>28</sup> 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 enrolled in the Kauffman School in 5th grade in 2011–2012 or 2012–2013 for at least part of the school year. **The Kansas City District Schools** comparison group is composed of students enrolled in the Kansas City 33 School District in 5th grade in our two 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 just 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

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<sup>28</sup> 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.

on school location as well as background research on charter schools identified as being located in Kansas City (Missouri Department of Elementary and Secondary Education 2012) and enrolling 5th grade students in 2011–2012 or 2012–2013.

In addition to the above restrictions, we excluded any Kauffman students missing all outcome (5th or 6th grade) grade MAP test scores or all 3rd and 4th grade MAP test scores. We also dropped any comparison students missing all 3rd and 4th grade MAP test scores or any outcome scores from the final analysis sample. Six Kauffman students (6 percent) were dropped from the cohort I analysis sample and 15 Kauffman students (15 percent) were dropped from the cohort II analysis sample as a result of these restrictions. With respect to the full comparison group, 16 percent of otherwise eligible students were dropped from the cohort I analysis sample and 9 percent of otherwise eligible students were dropped from the cohort II analysis sample. Finally, we excluded any students who were enrolled for part of any school year at the Kauffman School from the comparison group (and included them in the Kauffman School group). The numbers of students included in the Kauffman School and comparison groups for each grade and cohort in our analysis are provided in Table A.1.<sup>29</sup>

**Table A.1. Number of Students in Each Comparison Group**

<b>Final Study Group</b>	<b>Cohort I 5<sup>th</sup> Graders</b>	<b>Cohort I 6<sup>th</sup> Graders</b>	<b>Cohort II 5<sup>th</sup> Graders</b>
Kauffman Students	101	96	87
All Kansas City Public Schools Comparison Group	1,731	1,610	1,663
Kansas City District Schools Comparison Group	1,009	940	948
Kansas City Charter Schools Comparison Group	728	675	729

We display the baseline average characteristics of all students included in the Kauffman School and comparison groups for cohort I and cohort II students in Tables A.2 and A.3. These tables show that Kauffman students tend to be significantly different from students enrolled in Kansas City public schools with respect to 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 scores that were below the statewide average.<sup>30</sup> 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 relative to students enrolled in Kansas City district schools.<sup>31</sup> The same directional trends exist for Kauffman students relative to other Kansas City charter school students, but the differences are less pronounced and mostly statistically insignificant.

<sup>29</sup> Five Kauffman students included in the cohort I grade 5 analysis in 2011–2012 were no longer in the data in 2012–2013 and were thus excluded from the grade 6 analysis for cohort I students.

<sup>30</sup> The statewide average 4th grade MAP scaled score was 650 in math and 662 in CA. The statewide standard deviation of 4th grade MAP scores was 35 in math and 38 in CA.

<sup>31</sup> Examples of test accommodations include extended test time, individual testing, and oral reading of test questions.

**Table A.2. Baseline 4th-Grade Average Characteristics of Kauffman School Students and Other Kansas City Public School Students: Cohort I**

	<b>Kauffman School</b>	<b>All Kansas City Public Schools</b>	<b>Kansas City District Schools</b>	<b>Kansas City Charter Schools</b>
4th Grade MAP Math Scaled Score	637	629*	628*	630
4th Grade MAP CA Scaled Score	651	639**	636**	644
Free/Reduced-Price Lunch	0.86	0.89	0.91	0.85
Black	0.78	0.63**	0.58**	0.69
Hispanic	0.14	0.25**	0.30**	0.19
Male	0.50	0.49	0.50	0.47
Disabled	0.07	0.09	0.09	0.08
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	0.20	0.17	0.16	0.18
Sample Size	96	1610	940	675

Note: One asterisk (\*) indicates significantly different from Kauffman students at the 5 percent level. Two asterisks (\*\*) indicate significantly different from Kauffman students at the 1 percent level.

**Table A.3. Baseline 4th-Grade Average Characteristics of Kauffman School Students and Other Kansas City Public School Students: Cohort II**

	<b>Kauffman School</b>	<b>All Kansas City Public Schools</b>	<b>Kansas City District Schools</b>	<b>Kansas City Charter Schools</b>
4th Grade Math Scaled Score	642	633**	629**	637
4th Grade CA Scaled Score	650	639**	634**	646
Free/Reduced-Price Lunch	0.80	0.89	0.93**	0.83
Black	0.77	0.61**	0.56**	0.69
Hispanic	0.09	0.25**	0.31**	0.16*
Male	0.53	0.48	0.50	0.47
Disabled	0.11	0.09	0.09	0.09
Any Baseline Test Accommodation	0.15	0.24*	0.32**	0.14
4th Grade Attendance Rate	0.96	0.94**	0.94**	0.95**
4th Grade Ever Suspended	0.05	0.14**	0.13**	0.17**
Sample Size	87	1,663	948	729

Note: One asterisk (\*) indicates significantly different from Kauffman students at the 5 percent level. Two asterisks (\*\*) indicate significantly different from Kauffman students at the 1 percent level.

### 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/comparison status using a chained linear equations model that included all outcome variables as well as 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/4th grade MAP test scores or missing data for all outcome (5th or 6th grade) MAP test scores. Missing values were imputed prior to propensity score matching and regression analyses in each multiple-imputation data set.

After coefficient and standard error estimates were collected 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 coefficient is the average of the beta coefficient values in each imputed data set; the multiple-imputation standard error is the square root of the within-imputation coefficient variance plus the between-imputation coefficient variance inflated by a finite imputation correction multiplier:

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

### 4. Propensity Score Matching Methodology

We estimated a propensity score (p-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.4 for a list of the variables.)

**Table A.4. List of Potential Covariates Used for Propensity Score Matching**

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4th Grade Math and Communication Arts MAP Z-Scores
Second- and Third-Order Polynomials of 4th Grade Math and Communication Arts MAP Z-Scores
3rd Grade Math and Communication Arts MAP Z-Scores
4th Grade Attendance Rate and Ever-Suspended Variables
Gender, Race, Individualized Education Plan, English Language Learner, Free/Reduced-Price Lunch, Any Baseline Test Accommodation
Interactions of 4th Grade Math and Communication Arts MAP Z-Scores with Gender, Race, Individualized Education Plan, English Language Learner, Free/Reduced-Price Lunch, Any Baseline Test Accommodation
Interactions of Race with Gender and Free/Reduced-Price Lunch
Indicators for Imputed 3rd/4th Grade Math and CA MAP Z-Score Variables
Indicator for Imputed 4th Grade Attendance Rate or Ever-Suspended Variables

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Once p-scores were generated for each Kauffman student and eligible comparison student, we selected a matched comparison group by finding comparison students with p-score values within a given threshold, or radius, from each Kauffman student's p-score. Comparison students were sampled with replacement, meaning 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. The matching radius was larger for the district comparison group to prevent the sample sizes of Kauffman and matched comparison students from being too small due to the fact that district students differed more from Kauffman students on baseline characteristics relative to the other two groups. The matching radius was also larger for cohort II Kauffman students relative to cohort I students, since cohort II students differed more relative to comparison students on baseline characteristics compared to cohort I students (see Table A.2 and Table A.3.) If there were no comparison students within the matching radius for a given treatment student, he or she 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 treatment students matched to him or her. Table A.5 gives summary matching information for each comparison group.

**Table A.5. Matching Information Summary**

	<b>All Kansas City Public Schools</b>	<b>Kansas City District Schools</b>	<b>Kansas City Charter Schools</b>
<b>Cohort I 6th Graders</b>			
Minimum Matching Radius	0.0003	0.0008	0.0003
Maximum Number of Matches	20	20	20
Number of Kauffman Students	96	96	96
Mean Number of Kauffman Students Matched	90	79	75
Mean Number of Comparison Students	506	314	158
Mean Matches per Kauffman Student	7.2	5.0	2.4
<b>Cohort I 5th Graders</b>			
Minimum Matching Radius	0.0003	0.0008	0.0003
Maximum Number of Matches	20	20	20
Number of Kauffman Students	101	101	101
Mean Number of Kauffman Students Matched	96	87	85
Mean Number of Comparison Students	580	377	194
Mean Matches per Kauffman Student	7.6	5.6	2.8
<b>Cohort II 5th Graders</b>			
Minimum Matching Radius	0.0005	0.0014	0.0005
Maximum Number of Matches	20	20	20
Number of Kauffman Students	87	87	87
Mean Number of Kauffman Students Matched	77	66	71
Mean Number of Comparison Students	540	355	189
Mean Matches per Kauffman Student	9.1	7.7	3.2

Next we present summary statistics to show how well Kauffman students were matched to comparison students on baseline characteristics. The results are displayed in Table A.6. 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.6 are smaller for both Kauffman and comparison students relative to those in Tables A.2 and A.3. This is because some Kauffman students were different enough from all comparison students such that no good match for these students could be found.<sup>32</sup> These Kauffman students are excluded from the matched comparison analysis. (See Appendix B.2 for a sensitivity analysis where these students are included.)

<sup>32</sup>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.6, we report averages for Kauffman students included in the main analysis where the comparison group includes all Kansas City public schools.

**Table A.6. Baseline 4th Grade Average Characteristics of Matched Comparison Samples**

	<b>Kauffman School</b>	<b>All Kansas City Public Schools</b>	<b>Kansas City District Schools</b>	<b>Kansas City Charter Schools</b>
<b>Cohort I 6th Graders</b>				
4th Grade Math Scaled Score	635 (31)	635 (34)	635 (33)	635 (32)
4th Grade CA Scaled Score	649 (33)	648 (34)	647 (32)	649 (33)
Free/Reduced-Price Lunch	0.87 (0.33)	0.87 (0.34)	0.89 (0.31)	0.86 (0.34)
Black	0.77 (0.42)	0.78 (0.41)	0.74 (0.44)	0.77 (0.42)
Hispanic	0.14 (0.25)	0.12 (0.33)	0.16 (0.36)	0.12 (0.33)
Male	0.49 (0.49)	0.46 (0.50)	0.44 (0.50)	0.42 (0.49)
Disabled	0.08 (0.27)	0.08 (0.27)	0.08 (0.28)	0.07 (0.25)
Any Prior Test Accommodation	0.09 (0.29)	0.10 (0.30)	0.11 (0.32)	0.07 (0.26)
4th Grade Attendance Rate	0.95 (0.04)	0.95 (0.04)	0.95 (0.04)	0.95 (0.04)
4th Grade Ever Suspended	0.20 (0.41)	0.17 (0.37)	0.18 (0.37)	0.17 (0.38)
Sample Size	90	506	314	158
<b>Cohort I 5th Graders</b>				
4th Grade Math Scaled Score	635 (32)	635 (35)	633 (35)	635 (31)
4th Grade CA Scaled Score	648 (34)	649 (35)	646 (34)	648 (34)
Free/Reduced-Price Lunch	0.86 (0.35)	0.86 (0.34)	0.88 (0.33)	0.85 (0.36)
Black	0.79 (0.41)	0.78 (0.41)	0.76 (0.43)	0.77 (0.42)
Hispanic	0.12 (0.33)	0.12 (0.32)	0.12 (0.33)	0.12 (0.32)
Male	0.50 (0.50)	0.46 (0.50)	0.47 (0.50)	0.48 (0.50)
Disabled	0.07 (0.26)	0.08 (0.27)	0.09 (0.29)	0.06 (0.23)
Any Prior Test Accommodation	0.08 (0.28)	0.09 (0.29)	0.12 (0.33)	0.07 (0.25)
4th Grade Attendance Rate	0.95 (0.05)	0.95 (0.04)	0.95 (0.04)	0.95 (0.04)
4th Grade Ever Suspended	0.21 (0.41)	0.17 (0.38)	0.18 (0.38)	0.20 (0.40)
Sample Size	96	580	377	194
<b>Cohort II 5th Graders</b>				
4th Grade Math Scaled Score	642 (28)	642 (28)	641 (29)	643 (29)
4th Grade CA Scaled Score	650 (31)	650 (31)	647 (32)	652 (31)
Free/Reduced-Price Lunch	0.85 (0.36)	0.86 (0.35)	0.90 (0.29)	0.79 (0.41)
Black	0.78 (0.42)	0.74 (0.44)	0.72 (0.45)	0.73 (0.44)
Hispanic	0.10 (0.31)	0.11 (0.32)	0.14 (0.35)	0.11 (0.31)
Male	0.53 (0.50)	0.51 (0.50)	0.51 (0.50)	0.46 (0.50)
Disabled	0.11 (0.31)	0.08 (0.27)	0.09 (0.28)	0.06 (0.23)
Any Prior Test Accommodation	0.13 (0.34)	0.15 (0.35)	0.20 (0.40)	0.09 (0.28)
4th Grade Attendance Rate	0.96 (0.03)	0.96 (0.03)	0.96 (0.04)	0.96 (0.03)
4th Grade Ever Suspended	0.06 (0.24)	0.07 (0.24)	0.11 (0.30)	0.07 (0.24)
Sample Size	77	540	355	189

Note: Standard deviations are displayed in parentheses next to the averages in this table. No differences between averages for Kauffman School students and comparison group students are significantly different from 0.

**APPENDIX B**  
**SENSITIVITY ANALYSES**





## 1. Attrition-Adjusted Results

Approximately 9 percent of 5th grade Kauffman students who were enrolled in the School at the beginning of the school year left the School before taking the 5th grade MAP exams. Most of the students who left the Kauffman School enrolled in other schools in Missouri and took the relevant 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 may drop out of the School during the school year. While this is an informative number to calculate that is comparable to estimates reported in other charter school evaluations, it may also be of interest to estimate the effect of the Kauffman School on students who remain enrolled in the School.

An estimate of the impact of the Kauffman School on the achievement of students who remained enrolled in the School can be calculated by applying an adjustment for attrition known as a Bloom adjustment (Bloom 1984). The adjustment is made by dividing the impact estimates by the fraction of students who remained enrolled in the Kauffman School for the entire school 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 School. This assumption is unlikely to be true for students who withdrew later in the year, which means the attrition-adjusted effect sizes are likely to be biased upwards. The attrition-adjusted one-year effect size estimates are displayed in Table B.1. We do not present attrition-adjusted results for the two-year impact estimates, since many of the students in that analysis spent their entire 5th grade year enrolled in the Kauffman School before dropping out in 6th 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
<b>One-Year Impacts</b>		
5th Grade Math Effect Size	0.15** (0.05)	0.14** (0.05)
5th Grade CA Effect Size	0.13* (0.05)	0.12* (0.05)
5th Grade Science Effect Size	0.51** (0.06)	0.46** (0.05)
Sample Size	1,294	1,294

Note: 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. One asterisk (\*) indicates significantly different from zero at the 5 percent level. Two asterisks (\*\*) indicate significantly different from zero at the 1 percent level.

As can be seen from Table B.1, the one-year impact estimates are generally larger but overall very similar in all three subjects when adjusted for attrition: 0.15 in math, 0.13 in reading, and 0.51 in

science. The significance level for all effect size estimates from the attrition-adjusted results remains unchanged from the main results.<sup>33</sup> 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
<b>Cohort II 5th Graders</b>		
Impact on Attendance Rate	0.009 (0.005)	0.008 (0.005)
Impact on Probability of Being Suspended	0.02 (0.05)	0.02 (0.04)
Sample Size	617	617
<b>Cohort I 5th Graders</b>		
Impact on Attendance Rate	-0.009 (0.005)	-0.008 (0.005)
Impact on Probability of Being Suspended	0.15** (0.06)	0.13** (0.05)
Sample Size	677	677

Note: 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 where 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. One asterisk (\*) indicates significantly different from zero at the 5 percent level. Two asterisks (\*\*) indicate significantly different from zero at the 1 percent level.

## 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 that included all students, even those whose baseline characteristics differed from the Kauffman students' characteristics. Rather than matching students based 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 close 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 were different 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).

<sup>33</sup> The statistical significance of the results will not change after the attrition adjustment, since the standard errors are adjusted along with the impact estimates.

**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
<b>One-Year Impacts</b>		
5th Grade Math Effect Size	0.15** (0.04)	0.14** (0.05)
5th Grade CA Effect Size	0.13** (0.04)	0.12* (0.05)
5th Grade Science Effect Size	0.47** (0.04)	0.46** (0.05)
Sample Size	3,582	1,294
<b>Two-Year Impacts</b>		
6th Grade Math Effect Size	0.34** (0.07)	0.33** (0.08)
6th Grade CA Effect Size	0.18** (0.06)	0.18** (0.07)
Sample Size	1,706	596

Note: 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 5th graders and cohort II 5th graders. The second section of this table presents the two-year impact estimates for cohort I 6th 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. One asterisk (\*) indicates significantly different from zero at the 5 percent level. Two asterisks (\*\*) indicate significantly different from zero at the 1 percent level.

The attendance and suspension impact estimates based on all Kansas City students are displayed in Table B.4. These results are also similar to the main results in terms of the effect size estimates. The estimates are more likely to be statistically significant due to the larger number of students included in the sample.

**Table B.4. Impact of Kauffman School on Attendance and Suspensions Using Full Kansas City Comparison Group**

	Full Kansas City Comparison Results	Benchmark Matched Comparison Results
<b>Cohort I 6th Graders</b>		
Impact on Attendance Rate	0.009* (0.004)	0.009* (0.004)
Impact on Probability of Being Suspended	0.10* (0.04)	0.12* (0.05)
Sample Size	1,706	596
<b>Cohort II 5th Graders</b>		
Impact on Attendance Rate	0.011** (0.004)	0.008* (0.005)
Impact on Probability of Being Suspended	0.10* (0.04)	0.12* (0.04)
Sample Size	1,750	617
<b>Cohort I 5th Graders</b>		
Impact on Attendance Rate	-0.008 (0.004)	-0.008 (0.005)
Impact on Probability of Being Suspended	0.11** (0.03)	0.13* (0.05)
Sample Size	1,832	676

Note: This table reports the estimated impact of the Kauffman School on attendance and suspensions using the full Kansas City comparison sample alongside the benchmark matched comparison results. The suspension results are marginal effects from logit models where 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 comparison students entering each analysis. One asterisk (\*) indicates significantly different from zero at the 5 percent level. Two asterisks (\*\*) indicate significantly different from zero at the 1 percent level.

### 3. Sensitivity of Results to Exclusion of 5th Grade Repeaters

A small percentage of cohort I students (3.9 percent) repeated 5th grade in 2012–2013. This is slightly higher than the percentage of 5th grade repeaters in Kansas City, which is 1.4 percent. When a student repeats 5th 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. If 5th grade repeaters were excluded from the analysis, this might introduce an upward bias in the two-year impact estimates for the Kauffman School, since repeater students are likely to struggle in terms of achievement growth. We therefore included 5th grade repeaters in our main analysis to avoid introducing this sort of bias in the estimates. 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 5th grade. Students who repeat 5th grade are therefore included along with the 6th graders from the same cohort in all our main analyses. Since we have shown that the Kauffman School has positive impacts on student achievement, the assumption about the test scores of 5th grade repeaters will likely bias the two-year impact estimates downward, because we are assuming that the Kauffman School has no effect on repeaters during their second year enrolled in the School.

In Table B.5, we present the results from our two-year impact estimates when 5th 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, given that the School retains students at a higher rate compared to other Kansas City schools. The math effect size estimate is similar to the main results,

whereas the reading effect size estimate is 0.04 standard deviations higher when repeaters are excluded.

**Table B.5. Impact of Kauffman School on MAP Test Scores (Citywide Comparison Group) Excluding 5th Grade Repeaters**

	<b>Results Excluding Repeaters</b>	<b>Benchmark Results Including Repeaters</b>
6th Grade Math Effect	0.33**	0.33**
Size	(0.09)	(0.08)
6th Grade CA Effect	0.22**	0.18**
Size	(0.08)	(0.07)
Sample Size	517	596

Note: This table displays impact estimates in effect size units. The first column displays the two-year impact estimates for cohort 1 6th graders when students who repeat 5th 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. One asterisk (\*) indicates significantly different from zero at the 5 percent level. Two asterisks (\*\*) indicate significantly different from zero at the 1 percent level.

#### 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. We also excluded 5th grade repeaters 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.6. We used the same matching radius and maximum number of matches per Kauffman student as in the main results (see Table A.5). The main difference in the match statistics in Table B.6 compared to Table A.5 is that there are fewer Kauffman Students and fewer comparison students since students with imputed data are excluded from the sample.

**Table B.6. Matching Information Summary for Results Using No Imputed Data**

	No Imputed Values	Including Imputed Values
<b>Cohort I 6th Graders</b>		
Minimum Matching Radius	0.0003	0.0003
Maximum Number of Matches	20	20
Number of Kauffman Students	86	96
Number of Kauffman Students Matched	79	90
Number of Comparison Students	391	506
Mean Matches per Kauffman Student	5.9	7.2
<b>Cohort I 5th Graders</b>		
Minimum Matching Radius	0.0003	0.0003
Maximum Number of Matches	20	20
Number of Kauffman Students	93	101
Number of Kauffman Students Matched	83	96
Number of Comparison Students	445	580
Mean Matches per Kauffman Student	6.6	7.6
<b>Cohort II 5th Graders</b>		
Minimum Matching Radius	0.0005	0.0005
Maximum Number of Matches	20	20
Number of Kauffman Students	79	87
Number of Kauffman Students Matched	68	77
Number of Comparison Students	484	540
Mean Matches per Kauffman Student	8.5	9.1

The average baseline characteristics of Kauffman and comparison students when no imputed data are included are displayed in Table B.7. As with the baseline statistics displayed for the main analysis results (Table A.6), there are no statistically significant differences between the averages for Kauffman and comparison students on any of the baseline characteristics we examined.

**Table B.7. Baseline 4th Grade Average Characteristics of Matched Comparison Sample: Results Using No Imputed Data**

	Kauffman School	All Kansas City Public Schools
<b>Cohort I 6th Graders</b>		
4th Grade Math Scaled Score	639 (31)	639 (35)
4th Grade CA Scaled Score	654 (34)	653 (30)
Free/Reduced-Price Lunch	0.85 (0.36)	0.86 (0.35)
Black	0.78 (0.41)	0.81 (0.40)
Hispanic	0.14 (0.35)	0.11 (0.32)
Male	0.52 (0.50)	0.48 (0.50)
Disabled	0.05 (0.22)	0.07 (0.25)
Any Prior Test Accommodation	0.08 (0.27)	0.12 (0.32)
4th Grade Attendance Rate	0.95 (0.04)	0.95 (0.04)
4th Grade Ever Suspended	0.22 (0.41)	0.14 (0.35)
Sample Size	79	391
<b>Cohort I 5th Graders</b>		
4th Grade Math Scaled Score	636 (32)	636 (35)
4th Grade CA Scaled Score	650 (34)	649 (34)
Free/Reduced-Price Lunch	0.84 (0.37)	0.86 (0.35)
Black	0.78 (0.41)	0.77 (0.42)
Hispanic	0.13 (0.34)	0.11 (0.31)
Male	0.49 (0.50)	0.49 (0.50)
Disabled	0.07 (0.26)	0.08 (0.28)
Any Prior Test Accommodation	0.08 (0.28)	0.08 (0.28)
4th Grade Attendance Rate	0.95 (0.05)	0.95 (0.04)
4th Grade Ever Suspended	0.19 (0.40)	0.22 (0.42)
Sample Size	83	445
<b>Cohort II 5th Graders</b>		
4th Grade Math Scaled Score	643 (27)	641 (29)
4th Grade CA Scaled Score	649 (32)	649 (30)
Free/Reduced-Price Lunch	0.85 (0.36)	0.87 (0.34)
Black	0.76 (0.43)	0.74 (0.44)
Hispanic	0.12 (0.32)	0.14 (0.34)
Male	0.51 (0.50)	0.51 (0.50)
Disabled	0.07 (0.26)	0.06 (0.25)
Any Prior Test Accommodation	0.12 (0.32)	0.16 (0.37)
4th Grade Attendance Rate	0.96 (0.04)	0.96 (0.04)
4th Grade Ever Suspended	0.06 (0.24)	0.06 (0.24)
Sample Size	68	484

Note: Standard deviations are displayed in parentheses next to the averages in this table. No differences between averages for Kauffman School students and comparison group students are significantly different from 0.

The test score impact estimates based on students with non-missing data are displayed in Table B.8. The results are broadly similar to the main results displayed 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.8. Impact of Kauffman School on MAP Test Scores (Citywide Comparison Group) Using No Imputed Data**

	<b>Results Using No Imputed Data</b>	<b>Benchmark Results Using Imputed Data</b>
<b>One-Year Impact Estimates</b>		
5th Grade Math Effect	0.10*	0.14**
Size	(0.05)	(0.05)
5th Grade CA Effect	0.13**	0.12*
Size	(0.05)	(0.05)
5th Grade Science Effect	0.43**	0.46**
Size	(0.05)	(0.05)
Sample Size	1,080	1,294
<b>Two-Year Impact Estimates</b>		
6th Grade Math Effect	0.32**	0.33**
Size	(0.09)	(0.08)
6th Grade CA Effect	0.17**	0.18**
Size	(0.07)	(0.07)
Sample Size	470	596

Note: 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 5th graders and cohort II 5th graders. The second section of this table presents the two-year impact estimates for cohort I 6th graders. In the first data column, only students with non-missing data are included 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. One asterisk (\*) indicates significantly different from zero at the 5 percent level. Two asterisks (\*\*) indicate significantly different from zero at the 1 percent level.

The attendance and suspension impact estimates based on students with non-missing data are displayed in Table B.9. The results are broadly similar to the main results displayed in Table V.1.

**Table B.9. Impact of Kauffman School on Attendance and Suspensions (Citywide Comparison Group) Using No Imputed Data**

	Results Using No Imputed Data	Benchmark Results Using Imputed Data
<b>Cohort I 6th Graders</b>		
Impact on Attendance Rate	0.007 (0.004)	0.009* (0.004)
Impact on Probability of Being Suspended	0.13** (0.05)	0.12* (0.05)
Sample Size	470	596
<b>Cohort II 5th Graders</b>		
Impact on Attendance Rate	0.008 (0.005)	0.008 (0.005)
Impact on Probability of Being Suspended	0.01 (0.05)	0.02 (0.04)
Sample Size	552	617
<b>Cohort I 5th Graders</b>		
Impact on Attendance Rate	-0.007 (0.005)	-0.008 (0.005)
Impact on Probability of Being Suspended	0.10 (0.05)	0.13* (0.05)
Sample Size	528	676

Note: This table reports the estimated impact of the Kauffman School on attendance and suspensions. The first column presents results using only students with non-missing data in the analysis sample. The attendance rate is used as the outcome variable in the attendance regressions. The suspension results are marginal effects from logit models where 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. One asterisk (\*) indicates significantly different from zero at the 5 percent level. Two asterisks (\*\*) indicate significantly different from zero at the 1 percent level.

## 5. Alternative Comparison Groups for Attendance and Suspension Impact Estimates

We report the attendance and suspension results when the two alternative comparison groups are used in Table B.10 below. When the district or charter school reference groups are used, the magnitude of the estimated impacts is similar, though the statistical significance of the estimates varies somewhat relative to the results in Table V.1. The attendance impact estimates for students in 2012–2013 (cohort I 6th graders and cohort II 5th graders) are positive but no longer statistically significant. The attendance impact estimate for cohort I students when they were in 5th grade is negative and statistically significant when the comparison group consists of non-charter Kansas City students.

**Table B.10. 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
<b>Kansas City District Schools</b>			
Cohort I 6th Graders	0.007 (0.006)	0.14* (0.06)	393
Cohort II 5th Graders	0.010 (0.006)	-0.01 (0.06)	421
Cohort I 5th Graders	-0.012* (0.006)	0.16** (0.06)	465
<b>Kansas City Charter Schools</b>			
Cohort I 6th Graders	0.012 (0.006)	0.13 (0.07)	233
Cohort II 5th Graders	0.010 (0.006)	0.05 (0.06)	260
Cohort I 5th Graders	-0.004 (0.006)	0.13 (0.06)	280

Note: This table reports the estimated impact of the Kauffman School on attendance and suspensions. The suspension results are marginal effects from logit models where 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. One asterisk (\*) indicates significantly different from zero at the 5 percent level. Two asterisks (\*\*) indicate significantly different from zero at the 1 percent level.



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