Madison Education Partnership

RESEARCH BRIEF

What Happens When Children Miss School? Unpacking Elementary School Absences in MMSD

Authors

Jaymes Pyne
Eric Grodsky
University of Wisconsin – Madison

Elizabeth Vaade
Madison Metropolitan School District

Eric Camburn
Dominique Bradley
University of Wisconsin – Madison

Madison Education Partnership

The Madison Education Partnership (MEP) is a research-practice partnership between the University of Wisconsin – Madison School of Education's Wisconsin Center for Education Research and the Madison Metropolitan School District. MEP provides a context for collaborative problem identification, jointly designed empirical research to address problems of practice, development of educational interventions, and the creation of mutually beneficial lasting relationships across the UW and MMSD. The partnership serves as a conduit to establish new research within the district, enhances research use for the district, and creates mechanisms for the dissemination of new knowledge in Madison and beyond.

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Content Contact
Eric Grodsky
(608) 262-4896
grodsky@wisc.edu

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Executive Summary

In this report, we document inequalities among MMSD students in the number of excused and unexcused absences they experience each year from kindergarten through third grade. We also show the relationship between student attendance and success in school across multiple metrics including test scores and report card grades.

This report addresses the following questions:

1. How prevalent are excused and unexcused absences in early elementary school?
2. How are student and family background characteristics related to the number and type of absences students experience?
3. How are excused and unexcused absences in early elementary school related to academic and socioemotional outcomes?
4. To what extent do differences in school attendance contribute to racial/ethnic and economic inequalities in academic achievement among children in Grade 3 and younger?

We report the following key findings:

1. Almost all students have at least one excused absence in each year between kindergarten and third grade; in contrast, roughly half of students in each grade experience an unexcused absence.

2. The number of excused and unexcused absences varies widely among students, in part as a function of family income and race/ethnicity. Girls, low-income students, and students with disabilities tend to accrue more excused absences than other students, while students from low-income families, African American students, Latinx students, and students with parents whose education stopped at high school are more likely to have any unexcused absences.

3. Adjusting for prior differences among students, attendance (excused or unexcused) has little bearing on student growth in reading and literacy between kindergarten and third grade and a modest association with growth in mathematics. Excused absences have virtually no relationship to socioemotional skills as reflected in report card grades; unexcused absences, however, are negatively associated with growth in socioemotional skills.

4. Unexcused absences appear to be more of a signal of other challenges students may face than a cause of inequalities in academic achievement; as such, we believe increasing attendance would do little to produce equality in achievement.

What Do We Know About School Attendance Generally?

Consistent school attendance is a high priority for MMSD that is regularly reflected in its communications to students, staff, and families. The district's emerging Strategic Framework for the future has named 90% attendance as one of the metrics designed to measure its goal of students, staff and families thriving in MMSD. A student with a 10% absence rate (18 absences for a student enrolled for the full year) is considered by the district as "chronically absent." The district's focus on regular attendance makes sense; teachers, administrators and support staff cannot help students succeed if students do not come to school. The district's focus is also consistent with research on the relationship between attendance and academic success (Ensminger and Slasarcick 1992; Smerillo et al. 2018). As Robert Balfanz (2016) notes, "The evidence couldn't be clearer. Academic achievement from kindergarten on, high school graduation, and postsecondary enrollment are all highly sensitive to absenteeism" (p. 10).

However, recent evidence suggests that absenteeism in elementary school might be as much or more about *how* students miss school as whether they are in school or not. Using data from the Philadelphia School District, Michael Gottfried (2009) demonstrates that, while both excused and unexcused absences are associated with lower levels of achievement on the SAT-9 in Grades 2-4, the magnitude of the relationship for unexcused absences is appreciably stronger. Both excused and unexcused absences are more strongly related to achievement in math than in reading. Likewise, Gershenson, Jacknowitz and Brannegan (2017) find that unexcused absences are twice as harmful to student achievement growth as are excused absences between third and fifth grade in North Carolina. They also demonstrate that good attendance is more predictive of gains in math scores than of gains in reading scores and that each additional absence has about the same additive relationship with achievement.

How much does missing school matter for the academic progress of young students? In this report, we document the associations between early absenteeism and academic and socioemotional outcomes, differentiating between excused and unexcused absences. We also account for a number of student and family characteristics that predict school attendance and might be associated with academic outcomes even if students were to attend all the time. In the pages that follow, we describe our sample and measures, analytic methods and findings. We close by reconsidering the utility of district- and state-level policies that seek to improve short- and long-run school outcomes by reducing early elementary school absenteeism and the desirability of including attendance metrics in an accountability framework for elementary schools.

How Did We Carry Out the Analysis?

What Data Do We Use?

Data for this report come from MMSD administrative records and include all K-3 students who were enrolled in an MMSD elementary school for 175 or more days of the school year (about 90% of students), from 2012-2013 through 2016-2017 school years. Table 1 shows the number of students we observe in each grade and year. We have data for 18,053 students. Because we observe 2/3 of students in at least two years (and 17% in all four years) we have a total of 39,934 observations of students in all years of the data (see Appendix A for details). Sample sizes for analyses differ based on availability of data and methodological considerations, all of which we describe below.

Table 1. Student Observations by Year

Year	K-3	Kindergarten	Grade 1	Grade 2	Grade 3
2013	8,138	2,110	2,051	2,030	1,947
2014	8,020	2,083	2,045	1,955	1,937
2015	8,012	2,103	1,985	2,027	1,897
2016	7,970	1,994	2,045	1,978	1,953
2017	7,794	1,938	1,936	2,007	1,913
Total	39,934	10,228	10,062	9,997	9,647

How Do We Measure Elementary Student Absences?

Elementary school teachers take attendance at the beginning of the day, reporting students as "present," "absent," or "tardy." A school staff member (usually a school secretary) codes as "excused" a student whose parent or guardian has left a message on the attendance line or has spoken directly with school staff excusing the student. A staff member then calls the family of each absent student from whom the school has not heard and assigns a more detailed absent code, falling into two broad categories of "excused" or "unexcused" absences. In addition to absence due to illness (on which there is no limit with a doctor's note), families may schedule 10 pre-approved/pre-planned absence days and an additional 15 days for extracurricular activities (e.g., sporting competitions). Otherwise, a student is typically marked "unexcused" by default. MMSD tallies absences for each period, weighted by the total number of minutes in the period and day, to produce total counts of days absent for each student.[1] Tardies are not counted toward the official count of absences.

We differentiate between excused and unexcused absences throughout this report. We discuss this distinction further below, but in most instances the distinction lies in whether or not a parent called the school to report the absence (or responded to the school's call about the absence). Almost every student is absent at least once, but only around half of the students in our sample each year ever have an unexcused absence. The things that predict failing to contact the school are more likely to be related to challenges parents confront, choices they make or a mixture of the two that may be fundamentally different from the things that lead students to be absent.

[1] The number of minutes in a class period varies by school. Therefore, this weighting scheme gives a more precise estimate of the total number of days each student misses in a semester or year compared to simply counting absences by a third of a day.

While we know the policies that ostensibly govern whether or not an absence is excused, we know much less about how school staff actually make decisions about absences. Is a call from parents sufficient to classify an absence as excused or do school staff cross-check the reasons for absence a parent offers with the list of reasons considered legitimate by the district? Do school staff respond in the same way to all parent or are they more likely to count some children's absences as excused and others as unexcused? We cannot answer these questions but hope that the district will consider them in responding to the findings we present in the following pages of this report.

How Do We Measure Academic and Socioemotional Outcomes?

We begin our analyses by exploring the relationships between attendance and test scores. We evaluate performance on the Phonological Awareness Literacy Screening (PALS) from kindergarten through second grade and on the Measures of Academic Progress (MAP) math and reading tests in third grade, the lowest grade level that MMSD administers that assessment. PALS measures a number of dimensions of student literacy, including letter recognition, concept of word, letter sounds, rhyme awareness, sound awareness, and spelling. MAP measures reading and mathematics skills in the fall and spring of each school year starting in third grade. For both PALS and MAP scores, we consider only the spring assessments as outcomes and standardize students' scores by grade level so the typical student in each grade level has a score of zero and the average distance from a typical score is one. This standardization allows us to assess students' outcome measures relative to other students in the same grade, while providing a consistent metric across grade levels. For third-grade MAP test scores and kindergarten PALS scores, we present results from 2012-2013 through 2016-2017. First-grade PALS scores were available in the district beginning in the 2014-2015 academic year, while second-grade PALS scores were first available during the 2015-2016 academic year. We pool those scores with kindergarten scores, which are available for 2012-2013 through 2016-2017.

In addition to test scores, we measure academic and socioemotional learning grades using fourth-quarter report card items from K-3.[2] Although both scores on standardized tests and report card grades provide information about students' levels of academic success, they tap distinct and unique dimensions of student achievement. Test scores are well-suited for comparing students' levels of knowledge in a domain along a common metric. They are narrowly tailored but relatively reliable indicators of academic performance. Grades, on the other hand, reflect not only subject domain-specific knowledge, but also students' abilities and willingness to present their work in a way teachers find acceptable, teachers' perceptions of effort and other related cognitive and non-cognitive skills. Test scores are summative assessments one-step removed from the day-to-day curriculum and practices of the classroom, while grades reflect student performance on a series of tasks over the course of the grading period and are much more tightly coupled with curricular coverage.

Elementary school teachers in MMSD assess students in math, language arts and socioemotional skills (see Appendix B for individual report card items and their distributions, by grade).[3] Within grades, we take the sum of all math and language arts items, which differ across K-3, and then standardize students' scores so the mean of scores is zero with a standard deviation of one. Thirteen socioemotional learning items in report cards are used across K-3 (Appendix B). Teachers rate students' frequency of prosocial behaviors or classroom effort (e.g., "solves conflicts appropriately"; "completes assignments on time"; "works

[2] We prefer fourth-quarter grades to capture the cumulative association between performance and absences across each year of enrollment.

[3] Note that "language arts" grades can refer to either English or Spanish language arts, depending both on the school's curriculum (e.g., dual immersion schools), and the language needs of children in other schools (e.g., English language learners). Results are substantively the same when only looking at students who have English language arts grades.

cooperatively with others"; "demonstrates listening skills"). These items use a three-point scale (1-Rarely, 2-Sometimes, 3-Most of the time). Because the content of report cards changed substantially starting in 2016-2017, we only measure academic and socioemotional learning grades from 2012-2013 through 2015-2016.

Details about each analytic sample and distributions of grades and test scores across students in the sample can be found in Appendices A and B, respectively. We are less likely to observe test scores for students who are chronically absent, but the difference is not substantial. For example, we are missing MAP scores for about 14% of students who regularly attend school, but closer to 20% for those who have the most excused absences (the bottom fifth of the attendance distribution). Among those with any unexcused absences, the difference in the likelihood of having a valid test score for those with the least (bottom 20%) and most (top 20%) unexcused absences is similar, at around 5 percentage points.

What Other Characteristics are Potentially Related to Attendance and Academic Success?

We consider several additional characteristics of students and their families that may be associated with both rates of school attendance and academic outcomes. Demographic attributes of students include participation in the free or reduced-price lunch program, highest education achieved by either parent, student's race/ethnicity and gender. We also consider students' English language proficiency and special education status.

In addition to the largely stable characteristics above, we consider the relationship between absences and students' reported health conditions for each year they appear in these data. Students often experience more than one health condition at any given time. MMSD school nurses document a variety of health conditions, including asthma, allergies, autism spectrum, seizures, and many more. Reports of these conditions typically come from a parent or guardian informing a school nurse of the condition(s) at some point during the school year, although guardians can report a new health condition or remove a previous health condition during annual enrollment. If a guardian reports a health condition online during annual enrollment, a school nurse typically calls the guardian for confirmation of the condition. In some cases, school nurses have parental permission to view students' medical records and document the conditions directly from those records. We adjust for the 16 most common health conditions that affect our students, allowing conditions to vary for students over the years that we observe them. We include a list of these health conditions and the average numbers of excused and unexcused absences for students with each condition in Appendix A.

What Methods Do We Use to Analyze the Data?

Question 1: How prevalent are excused and unexcused absences in early elementary school?

To address question one, we document median levels and variation in excused and unexcused absences by grade level and school year. We present descriptive absence information quantitatively for the full sample and by both grade level and school year.

Question 2: How are student and family background characteristics related to the number and types of absences students experience?

We begin our exploration of variation in the incidence of absences by producing box plots to show how the incidence of different types of absences vary by family income, student race/ethnicity and parental education. Next, we distinguish among three dimensions of absence: the median number of excused absences (given that almost all students have at least one excused absence in the course of an academic

year), the probability of having any unexcused absences and, among those with any unexcused absences, the median number of unexcused absences.

We employ conditional median regression to estimate the relationship between student background characteristics and experiences on the one hand and the median number of excused absences students experience in a given year on the other. Conditional median regression is a useful tool for understanding relationships among several predictors and the median value of an outcome (like number of days absent) when the outcome is skewed (see Appendix E for a glossary of terms). This is the case with school absences; a relatively small number of students experience high (more than 36) or very high (more than 50) levels of absenteeism. We use the same technique to predict the median number of unexcused absences, but in the case of unexcused absences, we confine our attention to those students with more than zero unexcused absences.

We estimate the probability of experiencing any unexcused absence using a linear probability model. This model seeks to reflect the contribution of each attribute of the student or her family (race/ethnicity, sex, family income, etc.) to the probability of experiencing at least one unexcused absence in a given year conditional on all other characteristics of the student or family included in the model.

Question 3: How are excused and unexcused absences in early elementary school related to academic and socioemotional outcomes?

Preliminary descriptive work in support of this study, as well as prior research on absenteeism in the early grades, lead us to believe that 1) the association between absences and student success depends on whether absences are excused or not and 2) the strength of the relationship between each additional absence and educational outcomes decreases as the number of absences increases. To test for potential differences in the relationship between excused and unexcused absences, and student outcomes, we include separate measures for each type of absence in our models. To test for changes in the relationship between each additional absence and student outcomes, we allow those relationships to vary across the following levels of student absence: 0 to 1, 1 to 2 and more than two absences. As we show in the results section, the contribution of each additional absence to academic achievement after the second is much smaller than the contributions of the first and second absences.

After constructing these measures separately for excused and unexcused absences, we predict average levels of academic achievement as a function of numbers of excused and unexcused absences based on a statistical model (ordinary least squares regression). For PALS, MAP score and report card math and reading models, we first show descriptive results that account only for each student's grade level, school year, and their number of excused or unexcused absences. These descriptive models are largely consistent with what teachers and administrators know to be true: children who miss more days of school do not perform as well on standardized assessments or report cards as children who regularly attend. However, we show that 1) excused and unexcused absence have substantially different associations with academic success; and 2) the contribution of absences to academic success is much greater for a student's first two absences than for their third and subsequent absences.

The fact that we observe these associations does not necessarily mean that children who miss more school would be as successful as children who regularly attend if only their rates of absence were more comparable. To try to isolate the association between attendance and achievement growth, we statistically adjust for characteristics of students and families that might contribute to both the number of days of school students miss and their academic performance. These characteristics include student race/ethnicity, parental education, family income, disability status, English language learner (ELL) status, health statuses, and prior achievement. In models of test scores, we measure prior achievement using

students' test scores from the previous fall. In models of math and reading grades, we measure prior achievement using students' prior-year fourth-quarter grades. Because kindergarten students do not have prior grades, we model them separately from other grades and use fall PALS scores as a measure of prior achievement.

We present estimates from these models as the percentage of otherwise similar students with perfect attendance that a student with a particular number of excused or unexcused absences would be expected to out-perform on an assessment or average report card grade. As a point of reference, the typical student outperforms about half of her peers. Larger numbers of absences are generally associated with outperforming fewer than half of one's peers who have no absences at all. However, that relationship is largely due to differences in the characteristics of students who attend school more and less frequently, not solely due to missing school.

Finally, to reflect the associations between excused/unexcused absences and teacher evaluations of socioemotional learning (SEL), we estimate the probability that a student earned the highest rating by his or her teacher on SEL items. Across grade levels, almost half of students earned the highest rating ("3-Most of the Time") for all SEL items. As with the previous models, we first describe the relationship between excused/unexcused absences and the probability of having high levels of socioemotional skills, and then estimate the relationship adjusting for differences in student race/ethnicity, parental education, family income, disability status, ELL status, health and prior-year SEL grades.

Question 4: To what extent do differences in school attendance contribute to racial/ethnic and economic inequalities in academic achievement among children in Grade 3 and younger?

Building on the results for Question 3, we compare observed inequalities in MAP test scores in third grade, and report card grades in math and language arts, to the inequalities we would *expect* to see if there were no differences among children in the district in either excused or unexcused absences. We simulate outcomes by setting every student's number of absences to 0 but leaving health measures, prior achievement, family income, race/ethnicity and all other measures included in the model at their observed values. This simulation may overstate the contribution of absences to differences in student achievement to the extent that other factors we do not include in the model are related to both attendance and academic achievement.

Findings

Question 1: How prevalent are excused and unexcused absences in early elementary school?

Almost all students (98%) in kindergarten through third grade have at least one excused absence in a given year, with a median of six days absent with an excuse. Half (50%) of students have at least one unexcused absence in a given year. The median (or typical) student with any unexcused absence records two unexcused absences.

Younger students in the grades we study are slightly more likely to have any excused or unexcused absences than older students and are more likely to have a higher number of excused and unexcused absences. Across grades, about 1 in 100 kindergartners and first graders have no excused absences, while 2 in 100 second and third graders do not have any. The median number of excused absences declines slightly over grade levels, from 7.3 in kindergarten to 6.0 in third grade. Similarly, a little more than half of kindergartners and first graders have any unexcused absences, while half of second graders and less than half of third graders have any. The median kindergartner or first grader has a third of a day's worth of unexcused absences, while the median third grader has none. Among those who have any unexcused absences, the median is 2 for each grade.

Table 2. Absences by Grade Level and School Year

		Excused Absences		Unexcused Absences		
	N	One or more (Percent)	Median	One or more (Percent)	Median	Median given at least one
All	**39,934**	**98%**	**6**	**50%**	**0**	**2**
By Grade						
Kindergarten	10,228	99%	7.33	51%	0.33	2
Grade 1	10,062	99%	6.66	51%	0.33	2
Grade 2	9,997	98%	6.01	50%	0.14	2
Grade 3	9,647	98%	6.00	48%	0.00	2
By School Year						
2012-2013	8,138	98%	6.33	46%	0.00	2
2013-2014	8,020	98%	6.32	46%	0.00	2
2014-2015	8,012	99%	7.00	51%	0.33	2
2015-2016	7,970	98%	6.33	53%	0.33	2
2016-2017	7,794	98%	6.65	55%	0.33	2

Question 2: How are student and family background characteristics related to the number and type of absences students experience?

Girls, low-income students, and students with disabilities tend to accrue more excused absences than other students, while students from low-income families, African American students, Latinx students, and students with parents whose education stopped at high school are more likely to have any unexcused absences and, among those with at least one unexcused absence, typically have more unexcused absences than other students.

We begin by presenting boxplots of the distribution of excused and unexcused absences by family income, student race/ethnicity and parental education (Figures 1-2).[4] In each graph, the box shows the range of absences for the middle 50% of students. The left end of the box marks the number of absences at the 25th percentile and the right end the number of absences at the 75th percentile. For example, the first plot shows that about a quarter of children who are not living in low-income families had four or fewer excused absences and about a quarter had 10 or more excused absences. The median or typical child from a family that is not low-income had about six excused absences, as reflected by the line in the middle of the first box plot.

Figure 1. Distribution of Absences by Family Income and Race/Ethnicity

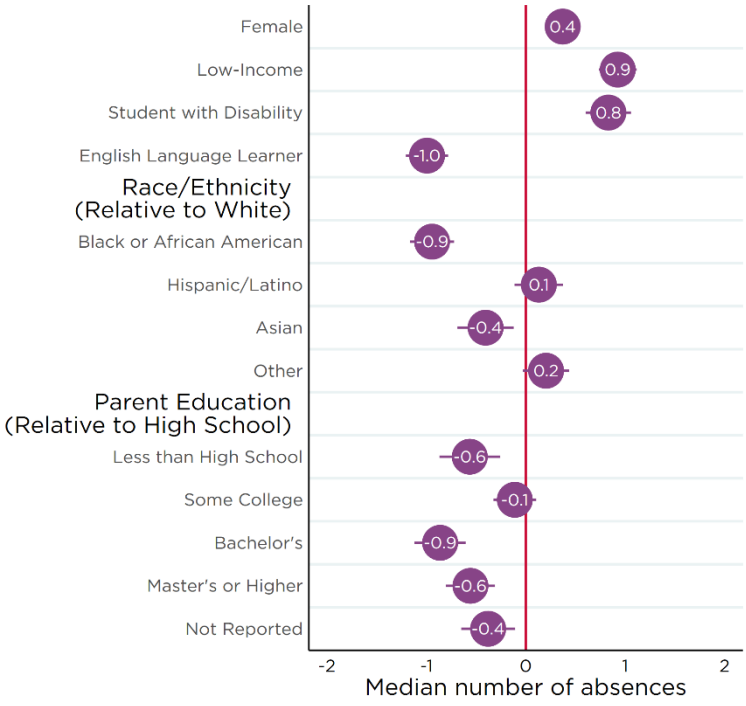
Note: This graph excludes the top 6% (n=2,372) of observations.

The distribution of excused absences is largely consistent across groups, with a median around six and a third quartile (or 75th percentile) near 10. Distributions are skewed to the right, with some students accruing very large numbers of excused absences. Note that we do not show students with more than 25 absences in a year—about 6% of the sample.

Distributions of unexcused absences vary more widely across student background characteristics. The typical low-income student, for example, has about one unexcused absence and the third-quartile low-income student around three. The typical more economically advantaged student at both the median and the third quartile has no unexcused absences. For distributions of absences across parental education see Appendix A.

We next present results from models assessing the independent contribution of different student and family characteristics to school attendance. Figure 2 shows that K-3 girls in MMSD typically have about four-tenths of a day more excused absences than boys, conditional on family income, disability status, English language proficiency, race/ethnicity, parental education, health status, grade level, and school year.

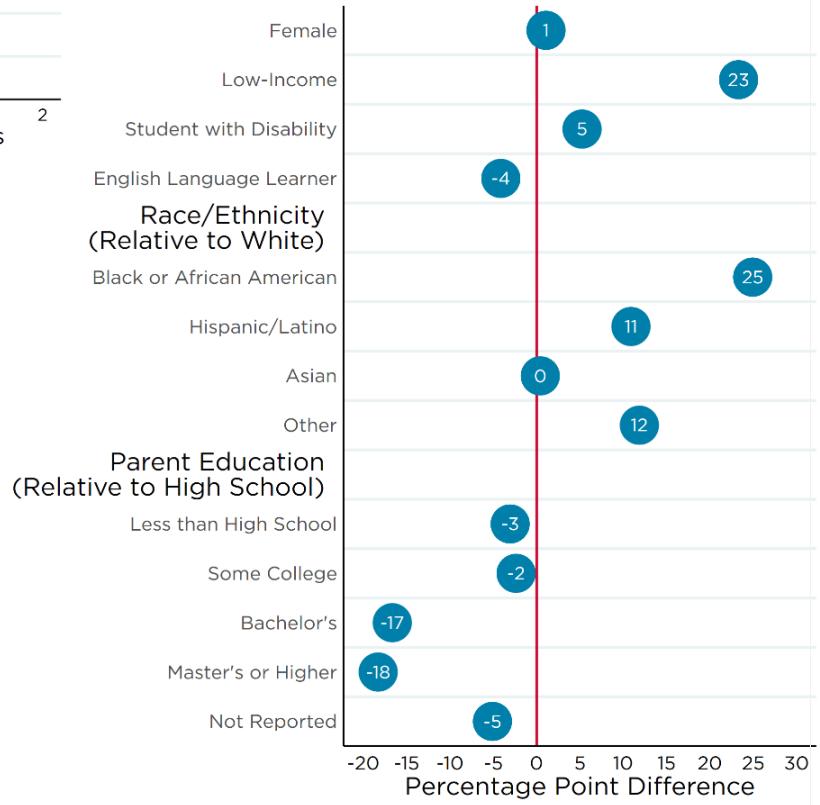
Figure 2. Median Number of Excused Absences by Income, Race/Ethnicity and Parental Education



Although almost everyone has at least one excused absence, unexcused absences are less common in the district and much less evenly distributed (as shown in Figure 1). Looking first at the probability of experiencing any unexcused absences over the course of the school year, Figure 3 shows that low-income students are 23 percentage points more likely to have an unexcused absence than higher-income students, accounting for differences in student gender, disability status, English proficiency, race/ethnicity, parental education, health status, grade level and school year. Students with disabilities are 5 percentage points more likely to have unexcused absences than other students and English language learners are 4 percentage points less likely to have unexcused absences compared to

Students from low-income families have 0.9 additional excused absences at the median compared to similar higher-income students, and students with disabilities have 0.8 days of excused absences more than other students, all else equal. English language learners experience one fewer excused absence than native English speakers. African American students have about nine-tenths of a day and Asian students about four-tenths of a day fewer excused absences than otherwise similar white students at the median. Students whose parents have a high school diploma or some college education have slightly more excused absences than other students.

Figure 3. Chance of Having Any Unexcused Absences

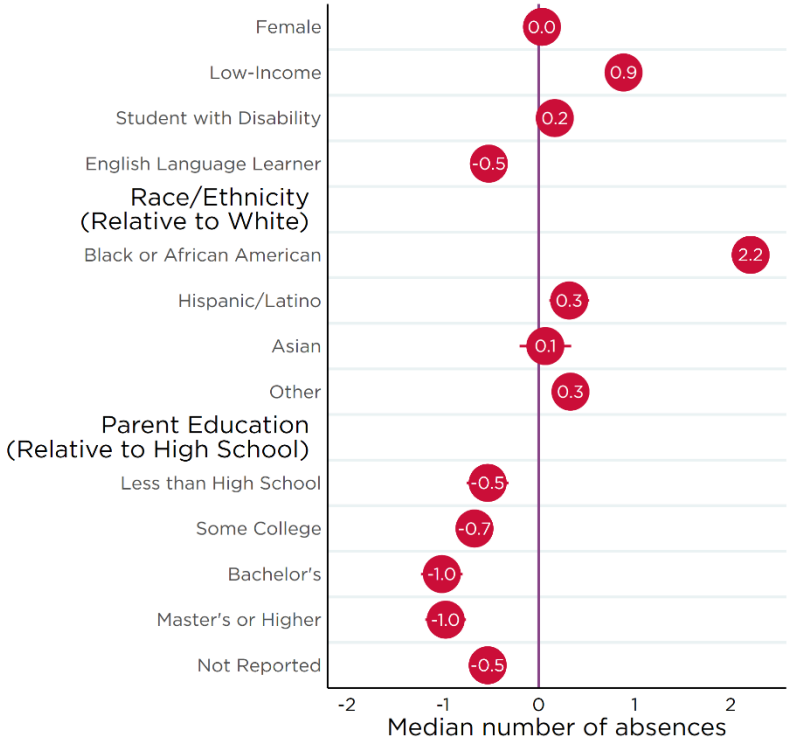


otherwise similar students. Racial/ethnic differences in the likelihood of having an unexcused absence are pronounced.

African American students are 25 percentage points more likely and Latinx students 11 percentage points more likely to have unexcused absences than white students, net of other differences among students. All else equal, students whose parents did not complete high school are slightly less likely to have an unexcused absence (3 percentage points) and students of parents with a least a college education are substantially less likely to have an unexcused absence in any given year (by 17 to 18 percentage points) than students of parents with a high school diploma but no further education.

Finally, we estimate differences in the median number of unexcused absences among students with one or more unexcused absence for the year (Figure 4). The typical low-income student has about one more unexcused absence than the typical higher-income student, conditional on having at least one unexcused absence and accounting for gender, disability status, English language proficiency, race/ethnicity, parental education, health status, grade level, and school year. In contrast, the median English language learner has a half-day's unexcused absence less than English-proficient students, all else equal. African American students at the median have just over two unexcused absences more than otherwise similar white students who also have any unexcused absences during the school year, and Latinx students at the median have about a third of a day more unexcused absences than otherwise similar white students. Finally, students whose parent completed high school but did not go further in their formal education accrue more unexcused absences than others who come from less or more educated families, all else equal.

Figure 4. Median Number of Unexcused Absences among Those with Any Unexcused Absences



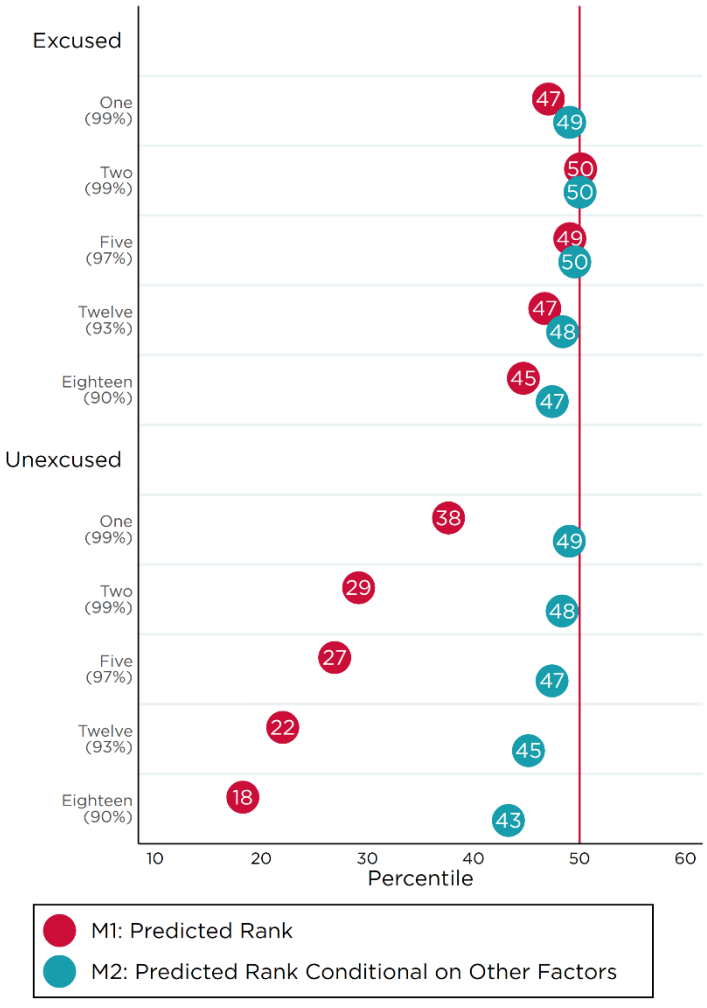
Question 3: How are excused and unexcused absences in early elementary school related to academic and socioemotional outcomes?

Unexcused absences appear to be more detrimental to academic and socioemotional outcomes than excused absences. Having even one unexcused absence is much more predictive of negative academic and socioemotional outcomes than having 18 excused absences. **However, demographics, health and prior achievement explain much of the association between unexcused absences and negative outcomes.** We present key results from this section in Figures 5 through 10, and refer readers to Appendix C for full model results.

How are absences related to test scores?

We consider performance on PALS, MAP reading and MAP mathematics separately. We observe only one grade level of MAP scores for students in our sample (in third grade) but include up to three grade levels of PALS scores (kindergarten, first and second grade). In each case, we rely on spring assessments and consider the independent associations of excused and unexcused absences with each outcome. For each set of results we provide two estimates: one that is conditional only on year and grade level. These estimates reflect what administrators and teachers may perceive as the association between achievement and missing school. In another set of results, we statistically adjust for differences in student' race/ethnicity, sex, parental education, ELL, special education status, health indicators (captured by 16 indicators for various conditions), participation in the free or reduced lunch program and the test score in the prior fall. Estimates based on the latter model come closest to reflecting differences in achievement growth among similar children with varying numbers and types of absences over the school year.

Figure 5. Predicted Percentile Rank on PALS (compared to those with zero absences)



Note: Labels on y-axis refer to the number of each type of absence. Percentages in parentheses refer to the attendance rate associated with each quantity of absences.

How are absences related to PALS Scores?

PALS tests measure basic literacy skills in kindergarten through second grade. Recall that the average student is expected to outscore roughly half of her peers on each assessment. Figure 5 shows estimates for the expected difference in PALS scores for students with different numbers of absences from students with no absences at all. Descriptive estimates, in red, show the association between different numbers of absences and PALS scores holding constant only grade level and school year. Students with a single excused absence outscore roughly 47% of otherwise similar students with no excused absences, holding constant the number of unexcused absences. Students with two excused absences on average score at about the same level on

PALS as students with no excused absences. The negative association we observe for a single absence re-emerges at higher numbers of excused absences, with students who miss 18 days of school with a parental excuse outscoring only 45% of their peers with no excused absences, a 5 percentage point deficit. These very modest associations are further attenuated when we condition on other attributes of students and their families (estimates plotted in teal). Net of other differences among students, those with 18 excused absences — meeting the threshold for chronic absenteeism — outscore 47% of their otherwise similar peers on PALS who were not absent. Most of the small association we estimate between excused absences and PALS scores is accounted for by attributes of students that predict both their absences and their PALS scores.

The relationship between unexcused absences and PALS scores, illustrated in the bottom panel of Figure 5, is strikingly different from the relationship between excused absences and PALS scores. Descriptive results suggest that students with a single unexcused absence on average outscore only 38% of students with no unexcused absences, a deficit of 12 percentage points. A student with a single unexcused absence experiences outcomes far worse than a student with 18 excused absences (the latter being labeled "chronically absent," the former not). The situation is appreciably worse for students with high numbers of unexcused absences. A student with 18 unexcused absences is expected to outperform one of five of her similar peers with no unexcused absences.

Contrary to the results for excused absences, observable differences among students and their families account for a substantial portion of the association between unexcused absences and PALS scores. Holding constant student sex, race/ethnicity, free and reduced-price lunch participation, prior fall PALS score, health detriments, ELL and special education status, students with a single unexcused absence are expected to outperform 49% of otherwise similar students with no unexcused absences. In percentage point terms, these other observed characteristics account for 11 percentage points of the 12 percentage point score deficit we observe for students with one, relative to students with no, unexcused absences (nearly all of the association). Nonetheless, the incremental association between additional unexcused absences and PALS scores are more pronounced. A student with 18 unexcused absence is expected to outscore only 43 percent of her peers on the PALS, all else equal.

How are absences related to MAP scores?

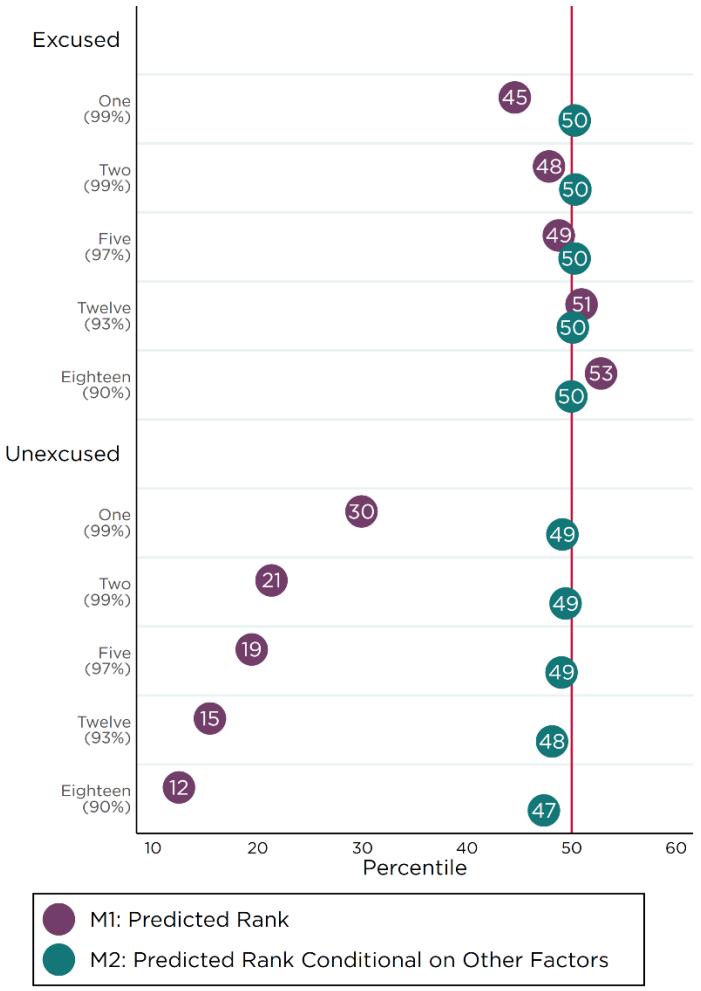
While PALS assessments are designed to measure basic literacy skills, the 'MAP' assessments are designed to measure a broader range of skills and to distinguish between reading and mathematics skills. These assessments are administered beginning in the third grade in MMSD in both fall and spring. We focus on the spring results in this report and use the previous fall's test scores to assess how absences might affect growth in test score performance from fall to spring.

Figure 6 plots expected differences in MAP readings scores in the spring of third grade for different levels and types of absences. Descriptive differences (adjusted only for the year in which the student was in third grade) suggest a possible *increase* in reading test scores for students with higher numbers of excused absences. Where a student with a single excused absence is expected to outscore roughly 45% of his always-present peers on the third-grade MAP reading assessment, a student with 18 excused absences is expected to outscore 53% of his peers with no excused absences. This anomalous pattern is completely accounted for by other observable characteristics of students such as student race/ethnicity, parent education and family income, special education designation, English language proficiency, and students' fall MAP reading scores.

Figure 7. Predicted Percentile Rank on MAP Math Score (compared to those with zero absences)

Note: Labels on y-axis refer to the number of each type of absence. Percentages in parentheses refer to the attendance rate associated with each quantity of absences.

Figure 6. Predicted Percentile Rank on MAP Reading Score (compared to those with zero absences)



Note: Labels on y-axis refer to the number of each type of absence. Percentages in parentheses refer to the attendance rate associated with each quantity of absences.

Adjusting for these other attributes, MAP reading scores are virtually independent of the number of excused absences a student has. The relationship between unexcused absences and third-grade MAP reading scores is slightly different. Descriptive estimates (in dark purple) show that a student with a single unexcused absence outscores only 30% of otherwise similar students with no unexcused absences. The pattern of results is consistent with those for PALS scores discussed above, only the magnitude of the disparities in MAP reading achievement between those with and without unexcused absences is slightly more pronounced. Adjusting for differences in student and family attributes we observe, a student with 18 unexcused absences is expected to outscore 47% of otherwise similar students with no unexcused absences.

The associations between unexcused absences and math performance on MAP (Figure 7) are virtually identical to the associations for reading scores, discussed above. Excused absences, however, appear to have a more detrimental association with math performance than with reading performance. Conditional on observed characteristics of students and their families, students with a single excused absence outscore 47% of otherwise similar students without any excused absences on the math assessment. Students with 18 excused absences on average outscore about 44% of otherwise similar students with no excused absences.

How are absences related to grades?

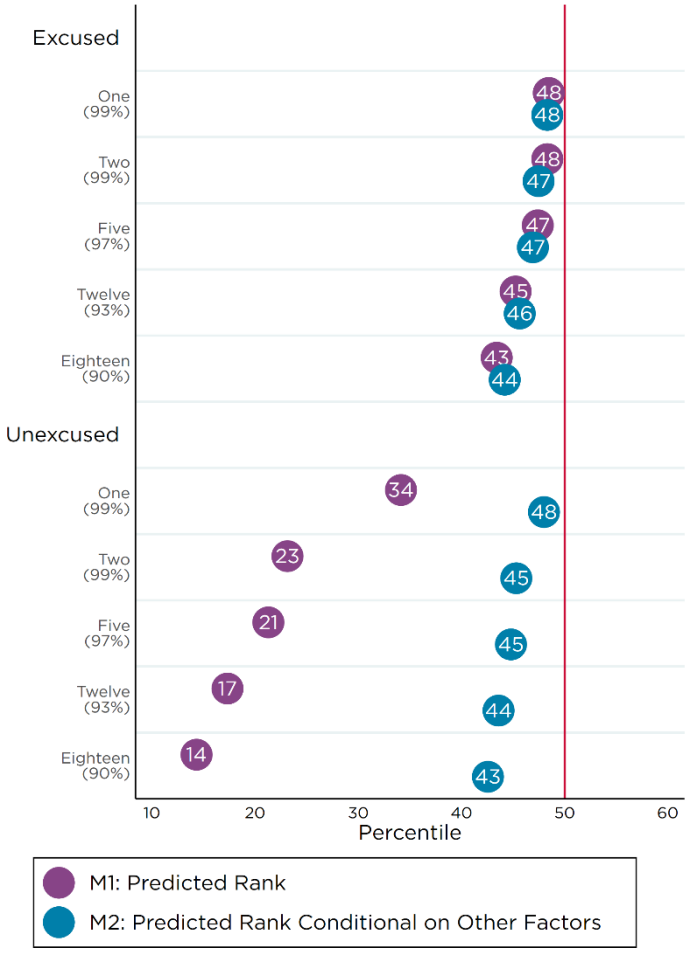
Students' math, language arts, and socioemotional learning grades come from fourth-term report cards completed by classroom teachers. Similar to adjusting for fall test scores, we control for differences in prior year grades in the models that follow. However, in doing so we necessarily omit kindergarten students from the models since many kindergarten students do not attend MMSD 4K schools and have no report card grades prior to kindergarten. In Appendix D, we report kindergarten models that instead account for Fall PALS scores.

Figure 8 displays percentile rankings of language arts grades for first through third grades. Baseline estimates accounting only for student grade level and school year (in purple) suggest that typical students with one to five excused absences earn only slightly lower grades than typical students who have no excused absences. Students with more than five excused absences see a slight decline in language arts grades relative to students with no absences. Accounting for student and family characteristics reduces these associations slightly, with high-excused absence students earning similar grades as those with one excused absence. The baseline associations between unexcused absences and language arts grades in Figure 8 are similar and only slightly stronger than those reported earlier for third-grade reading test scores (Figure 6). Adjusting for other characteristics of students and their families and prior year grades, results are quite similar to test score results.

Figure 8. Predicted Percentile Rank on Language Arts Grades (compared to those with zero absences)

Note: Due to inclusion of prior year langage arts grades, models do not include kindergartners. Labels on y-axis refer to the number of each type of absence. Percentages in parentheses refer to the attendance rate associated with each quantity of absences.

Figure 9. Predicted Percentile Rank on Math Grades (compared to those with zero absences)



Note: Due to inclusion of prior year math grades, models do not include kindergartners. Labels on y-axis refer to the number of each type of absence. Percentages in parentheses refer to the attendance rate associated with each quantity of absences.

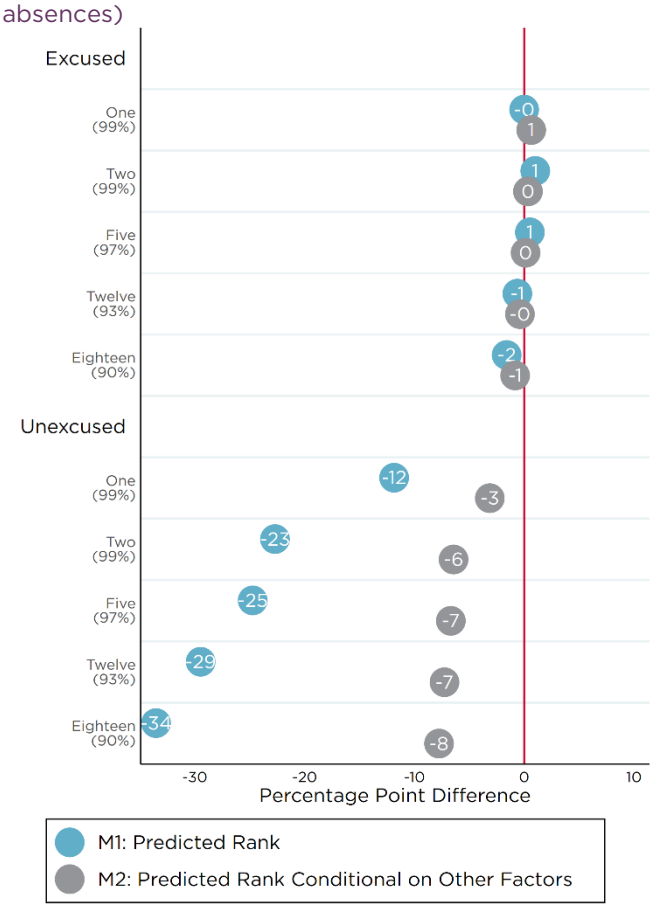
Recall that 45% of students earn a perfect score on this scale. The baseline model, only accounting for student grade level and school year, indicates that students with one excused absence are as likely as those with none to earn the highest socioemotional learning grade. Students with two or five excused absences are 1 percentage point *more* likely than those with none to be reported as expressing high socioemotional skills.

Those with 12 excused absences are about as likely as those with no excused absences, and those with 18 are 2 percentage points *less* likely to be reported as expressing high socioemotional skills than those with none. Adjusting for student and family characteristics changes these estimates only slightly.

Similar to third-grade MAP math scores (Figure 9), we find a stronger association between excused absences and math grades than between excused absences and language arts grades. A typical student with one or two excused absences is expected to perform better than 48% of students with no excused absences. Students with 18 excused absences only perform better than 43% of similar students with no excused absences. Adjusting for student and family characteristics does not alter these results substantially. Results for unexcused absences and math grades are substantively identical to results for unexcused absences and language arts grades discussed above.

Finally, Figure 10 shows estimates for the relationships between different types and numbers of absences and the probability of being reported by teachers as expressing high socioemotional skills across 13 items.

Figure 10. Probability of High Socioemotional Learning Skills (compared to those with zero absences)



Note: Due to inclusion of prior year SEL grades, models do not include kindergartners. Labels on y-axis refer to the number of each type of absence. Percentages in parentheses refer to the attendance rate associated with each quantity of absences.

The descriptive associations between unexcused absences and socioemotional grades indicate that a student with one unexcused absence is 12 percentage points less likely to be reported as expressing high socioemotional skills than those with no unexcused absences. Those with two unexcused absences are 23 percentage points less likely, and those with 18 unexcused absences are 34 percentage points less likely to be reported as expressing high socioemotional skills. However, like the previous grade models, student and family characteristics, including prior socioemotional learning grades, account for much of these associations. Adjusting for these attributes suggests that unexcused absences in and of themselves have little bearing on socioemotional learning grades after two absences.

Question 4: To what extent do differences in school attendance contribute to racial/ethnic and economic inequalities in academic achievement among children in Grade 3 and younger?

We find that equalizing attendance could lead to a very modest effect on test score differences and grades, with minimal potential for a reduction in achievement gaps between racial/ethnic and income groups. Results for question 3 show that excused absences do not have much bearing on achievement and the negative association between unexcused absences and academic achievement is largely due to the association between unexcused absences and other student characteristics, including prior achievement and health conditions. These findings lead us to believe that unexcused absences, in particular, appear to be a signal of other challenges students may face, rather than a cause of inequalities in academic achievement. Given the association between race/ethnicity, family income and unexcused absences, how might eliminating differences across groups in patterns of attendance influence inequalities in student achievement?

Figure 11. Achievement gaps in grades (left) and MAP test scores (right) by race/ethnicity and family income

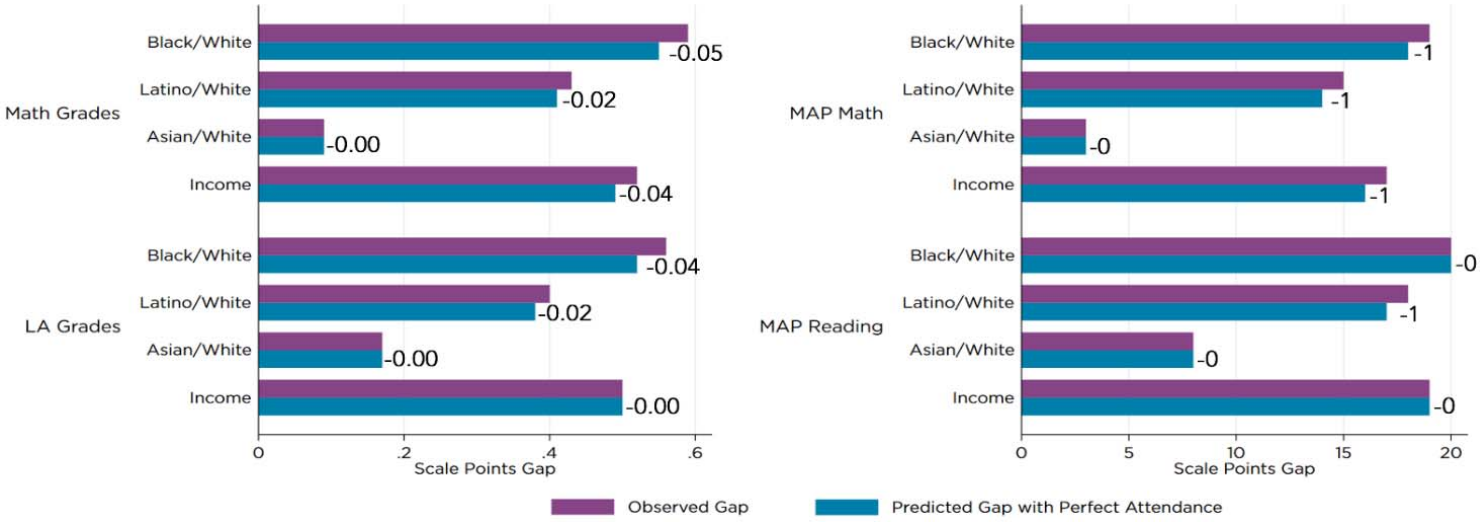


Figure 11 shows racial/ethnic and economic inequalities in academic achievement among children in MMSD. The left side of Figure 11 shows differences in the grades students earn in math and language arts, while the right side shows differences in MAP scores. Estimates are based on the models discussed above in question 3. The observed differences are illustrated in purple and differences expected if students exhibited perfect attendance are illustrated in blue. The numbers to the right of each bar illustrate the impact of equalizing attendance on achievement gaps.

For example, our analysis shows that white students in MMSD score about six-tenths of a grade higher than African American students in math and about four-tenths of a grade higher than Latinx students, taking into account excused/unexcused absences. If all children had the same patterns of attendance, the difference in math grades between African American and white students would be expected to decline by only 0.05 points (from 0.60 to 0.55), and the difference in math grades between Latinx and white students would be expected to decline by 0.02 points (from 0.43 to 0.41). Results are similar for language arts grades, except that equalizing attendance would have no measurable impact on economic disparities in grades.

Equalizing attendance shows a similarly modest expected effect on test score differences. Doing so could reduce disparities in the math test scores of African American, Latinx and white students, as well as between economically advantaged and disadvantaged students by about one scale point. Equalizing attendance could also reduce Latinx/white disparities in MAP reading scores by one point, but would have no discernible effect on other reading test score gaps. These effects are marginal, and, in general, equalizing attendance appears to be a very ineffective way of equalizing achievement in the district.

Conclusion

The logic of focusing on attendance seems straightforward and compelling. Students need to be in school to learn; if students do not come to school, teachers, administrators and support staff cannot do their jobs. Improving attendance rates should increase academic achievement and, to the extent that less advantaged students are more likely to miss school, reduce inequalities.

We present evidence in this report that, for the most part, contradicts this logic. First, if exposure to and engagement in classroom learning underlie the relationship between attendance and achievement, we would expect excused and unexcused absences to have similar associations with grades and test scores. Second, the impact of absences on achievement ought to be approximately additive, as the amount of instruction missed on the first day a child is absent should on average be about the same as the amount of instruction missed on the 10th or 20th day a child is absent. We find neither of these to be the case.

Key Findings

- Almost all students have at least one excused absence in each year between kindergarten and third grade; in contrast, roughly half of students in each grade experience an unexcused absence.
- The number of excused and unexcused absences varies widely among students, in part as a function of family income and race/ethnicity.
- Excused absences have little association with student performance in grades or test scores; unexcused absences, however, are negatively associated with achievement, *but* most of the association can be accounted for by demographics, health conditions, and prior student achievement.
- Unexcused absences appear to be more of a signal of other challenges students may face than a cause of inequalities in academic achievement; as such, we believe increasing attendance would do little to produce equality.

Instead, we show that **language arts scores on the MAP test, literacy scores on PALS and grades in language arts are relatively unresponsive to excused absences among otherwise similar students**. To the extent that excused absences come closer than unexcused absences to exclusively reflecting the impact of time missed on academic progress, we conclude that missing school has little impact on the development of skills in literacy and language arts. Excused absences have a somewhat stronger, but still modest, negative association with achievement in mathematics. This is particularly true as absences build. Although additional excused absences *after* the first two have a smaller association with mathematics achievement than the first two absences, the reduction in achievement can add up over many subsequent absences. For the most part, even the descriptive associations between excused absences and academic outcomes are pretty modest.

The unadjusted association between *unexcused* absences and academic success, however, is much more pronounced. Students who accrue unexcused absences fare much worse in school than those who have only excused absences, and the performance disparity increases with additional unexcused absences. For test scores, almost all of the substantial negative association between unexcused absences and academic success can be accounted for by family income, parental education, student race/ethnicity, disability, Individualized Education Program (IEP) and ELL status, and prior academic achievement. This is the case for language arts, math, and socioemotional learning grades too, although, compared to test score results, associations between unexcused absences and report card grades are slightly stronger even when conditioning on background characteristics and prior grades. Unexcused absences drive the observed association between missing school and learning. But **it's not the fact the students miss school that**

accounts for this association; it's other things about students' and families' lives that affect both attendance and achievement. What might be some of these 'other things' differentiating students with unexcused absences from those without unexcused absences? Without knowing more about the process school staff follow in classifying absences, we can only speculate. To some extent, it seems likely that unexcused absences reflect a lapse in communication; for whatever reason, parents did not initiate contact with the school or respond to the school's call home about a child's absence. However, unexcused absences may also reflect the judgment of school staff about the acceptability of the reason a parent offers for her child's absence. Without further information from those working in the schools, we cannot know.

Less advantaged families are appreciably more likely to have an unexcused absence than are more advantaged families. But this only tells us where to look for answers; it doesn't tell us why calling the school to report an absence or offering an acceptable reason for the absence matters. What share of these parents are so constrained for time that they do not call? To what extent does attachment to or engagement with their child's school influence parents' decisions to report an absence? What, if anything, can or should schools do to persuade more parents to call? These are questions we think are worth pursuing.

Overall, we conclude that the descriptive associations between student attendance and academic achievement are driven by the 20% of total absences in the district that are unexcused, not the 80% that are excused. These associations have more to do with the constraints parents face and the choices they make than with material that teachers cover in classrooms. Unexcused absences are more a signal than a cause; they may tell us something about a child's home life but much less about what happens to the child in school. Alternatively, it is possible that teachers respond differently to excused and unexcused absences in ways that could impact student outcomes.

Based on this report, some might argue that the district should focus its efforts on reducing unexcused absences, reasoning that reducing such absences would increase average achievement and reduce disparities in academic success among students. However, if our interpretation is correct, efforts to reduce unexcused absences would do more to obscure the signal such absences send than to actually improve academic outcomes for students. We believe investments in reducing absences, regardless of how they are categorized, may yield little in the way of improvements. The district has recently added student attendance as part of its accountability metrics, but results of this report suggest that tying accountability to attendance may be counterproductive. Even with district-wide perfect attendance in K–3, our results suggest average academic achievement and racial and economic achievement gaps among these students would improve very little. Attendance is only weakly related to academic outcomes conditional on student attributes and prior achievement but more strongly related to student background attributes like family income, race/ethnicity and parental education. We fear that incorporating attendance into an accountability framework amounts to holding schools accountable for inequality among students and their families as much or more than it holds schools accountable for students showing up for school.

Instead, we see greater value in listening to the signal unexcused absences send. To do so, and to more fully explore the issues raised by this brief, we offer the following recommendations to the district:

1. We encourage MMSD to dig into the practices undertaken by school staff around the recording of absences, including exploring how administrative and instructional staff classify and respond to different types of absences. In addition, we suggest that the district invest in understanding what distinguishes families that call when a child is absent from families that do not. Understanding that decision—coupled with the practices of school staff—will help further unpack what is playing out in these data.
2. We recommend the district explore how to use unexcused absences as an early warning sign for schools to identify students and/or families they may need to work more closely with. This report shows that an absence being "unexcused" alone does not cause negative outcomes, but does help identify students or families who may face additional challenges or who may not feel connected to the school. It would serve the district well to dig into this issue further—perhaps using qualitative methods, which can uncover the "Why?" of parent-school relationships in more nuanced ways.

In addition, we would encourage further exploration of these issues in education research and across other district contexts. Attendance is not a conversation isolated to MMSD; many districts nationwide include attendance metrics in their accountability systems, and all districts are likely grappling with similar issues about the impact of missing school on student outcomes. More studies that focus on attendance patterns, outcomes, and causes could help advance our understanding of this issue, learn more about the signals that unexcused absences may send, and push district thinking on the use of attendance measures for accountability.

Appendix A: Details of Data Measurement

Table A1. Number of Years Each Student is Observed

Years	Observations
1	6,264
2	4,807
3	3,924
4	3,058
Total	**18,053**

Table A2. Health Condition Categories and Distribution

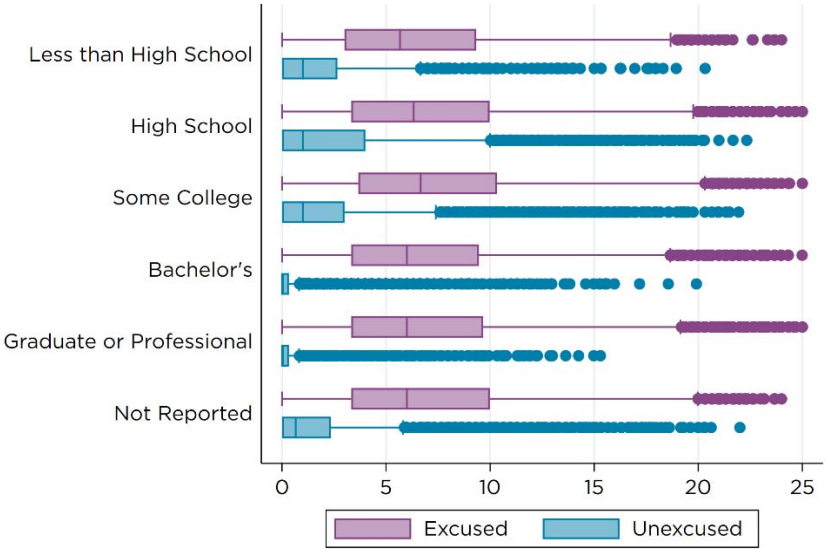
	Mean Excused Absences	Mean Unexcused Absences
Has no condition reported	6.7	1.9
Asthma	9.6*	3.3*
Environmental Allergy	8.6*	2.1
ADD/ADHD	9.1*	3.4*
Food Allergy	8.8*	2.3
Mental Health	10.6*	2.6*
Gastrointestinal	10.2*	2
Headache	9.9*	2.5*
Temporary Condition	9.2*	2.5*
Autism	11.1*	2.3
Dermatology	9.0*	2.8*
Other Allergy	8.8*	1.9
Neurological	13.5*	2.4
Musculoskeletal	12.2*	1.8
Seizure	12.5*	3.6*
Cardiovascular	10.5*	2.9
Other Condition	10.6*	2.5*

** = Statistically significant and higher difference in absences ($p<.05$) compared to students without the condition*
Note: Students can have more than one of the health conditions above simultaneously. T-tests only compare students with or without one condition at a time.
Grades K-3 pooled in the model above

Table A3. Analytic Sample Sizes and Inclusion Criteria for Outcome Models

		School Year					Grade Level			
Grades	N	2012-13	2013-14	2014-15	2015-16	2016-17	KG	G1	G2	G3
Math Grades (no prior year grades)	31,964	Y	Y	Y	Y	N	Y	Y	Y	Y
Math Grades (including prior year grades)	22,474	Y	Y	Y	Y	N	N	Y	Y	Y
Language Arts Grades (no prior year grades)	31,923	Y	Y	Y	Y	N	Y	Y	Y	Y
Language Arts Grades (including prior year grades)	22,449	Y	Y	Y	Y	N	N	Y	Y	Y
Socioemotional Learning Grades (no prior year grades)	30,831	Y	Y	Y	Y	N	Y	Y	Y	Y
Socioemotional Learning Grades (including prior year grades)	21,107	Y	Y	Y	Y	N	N	Y	Y	Y
Test Scores										
Kindergarten PALS	9,635	Y	Y	Y	Y	Y	-	-	-	-
Grade 1 PALS	7,453	N	Y	Y	Y	Y	-	-	-	-
Grade 2 PALS	5,065	N	N	Y	Y	Y	-	-	-	-
Grade 3 MAP Math	8,031	Y	Y	Y	Y	Y	-	-	-	-
Grade 3 MAP Reading	7,980	Y	Y	Y	Y	Y	-	-	-	-

Figure A1. Distribution of Absences by Parental Education



Note: This graph excludes the top 6% (n=2,372) of observations.

Appendix B: Report Card Items and Score Distributions

Table B1. Report Card Items: Grade 1 Language Arts and Mathematics Items

Language Arts	Mathematics
Applies comprehension strategies to books read aloud	Counts, reads, writes and orders numbers within 120
Generates and organizes ideas in writing	Geometry
Reads at level	Knows grade-level math facts
Reads familiar material with fluency and expression	Measurement and Data
Reads for enjoyment and information at independent level	Solves story problems
Revises writing (adds and deletes words/ideas)	
Uses letter sounds (phonics) and spelling knowledge to write	
Uses reading cues (meaning, sentence structure, phonics) to decode text	
Uses reading strategies (rereads, self-corrects, checks word parts)	
Uses writing conventions (spacing, punctuation, capitalization)	

Table B2. Report Card Items: Grade 2 Language Arts and Mathematics Items

Language Arts	Mathematics
Applies comprehension strategies to books read aloud	Counts, reads, writes and orders numbers within 1,000
Applies comprehension strategies to independent reading	Geometry
Edits writing for conventions (capitalization, punctuation, spelling)	Knows grade-level math facts
Generates and organizes ideas in writing	Measurement and Data
Reads aloud with fluency and expression	Represents and solves story problems
Reads at level	
Reads for enjoyment and information at independent level	
Revises writing (adds, deletes and substitutes words/ideas)	
Uses reading cues (meaning, sentence structure, phonics) to decode text	
Uses reading strategies (rereads, reads on, self-corrects)	
Writes for a variety of purposes (story, poem, report, letter)	

Table B3. Report Card Items: Grade 3 Language Arts and Mathematics

Language Arts	Mathematics
Applies comprehension strategies to independent reading	Counts, reads, writes and orders numbers within 10,000
Edits own writing (grammar, punctuation, capitalization, spelling)	Geometry
Reads aloud with fluency and expression	Knows grade-level math facts
Reads at level	Measurement and data
Reads for enjoyment and information at independent level	Solves story and number problems
Revises writing	Understands and compares fractions
Uses effective strategies for spelling words	
Uses reading strategies (rereads, reads on, self-corrects)	
Writes for a variety of purposes and audiences	

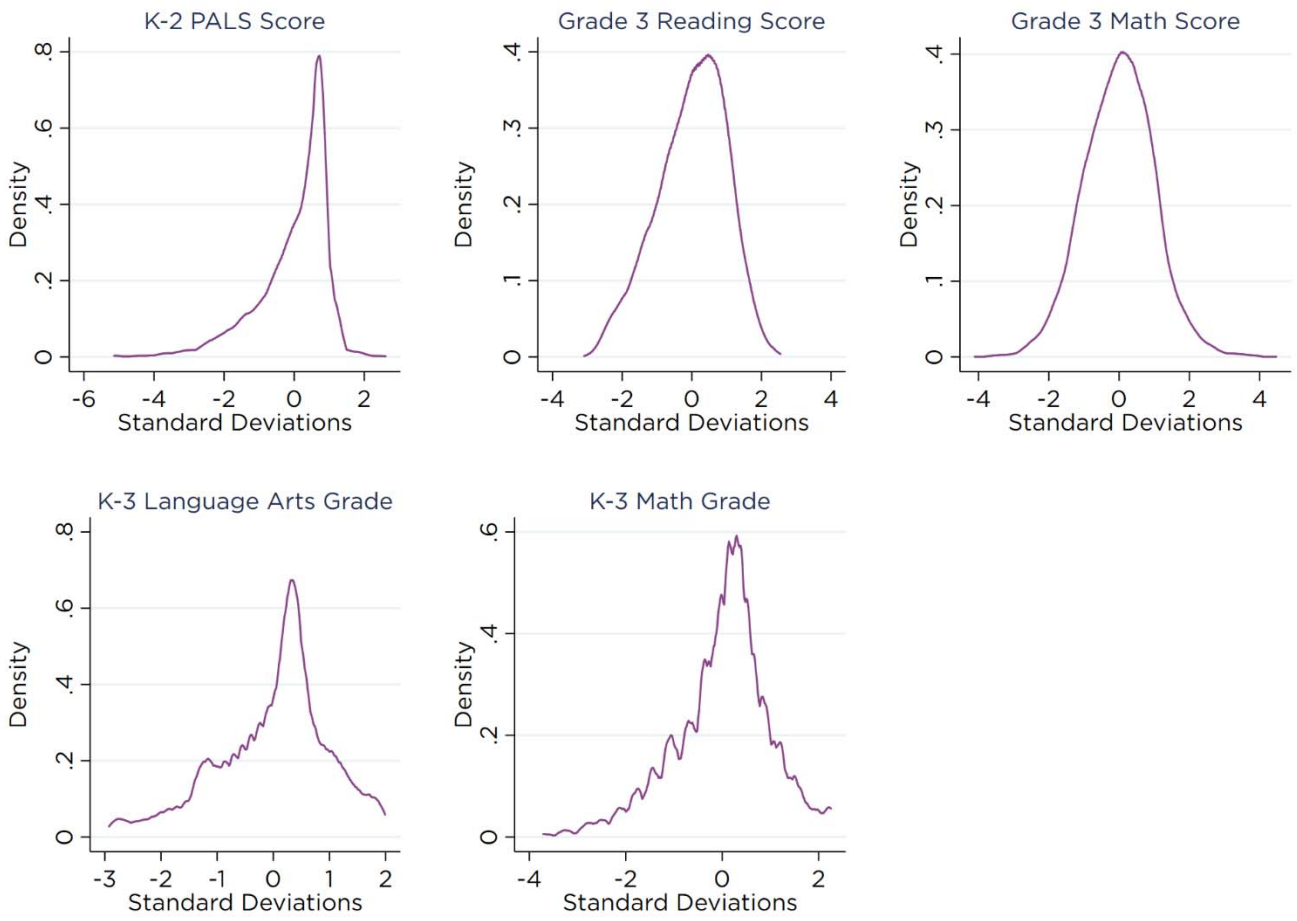
Table B4. Distributions of Test Scores and Report Card Grades

Kindergarten Report Card Items and their Distributions			Grade Received			
English Language Arts	Mean	SD	1	2	3	4
Applies comprehension strategies to books read aloud	2.93	0.66	0.03	0.17	0.65	0.15
Generates and organizes ideas in writing	2.75	0.74	0.07	0.22	0.60	0.11
Knows letter sounds	3.33	0.71	0.02	0.07	0.45	0.45
Knows letters: lower case	2.99	0.55	0.02	0.11	0.75	0.13
Reads at level	2.87	1.05	0.14	0.21	0.30	0.35
Uses reading cues (meaning, sentence structure, phonics) to decode text	2.73	0.86	0.09	0.26	0.47	0.17
Uses reading strategies (rereads, self-corrects, uses initial/final sounds)	2.73	0.85	0.10	0.24	0.49	0.17
Uses writing conventions (word spacing, punctuation, capitalization)	2.5	0.8	0.12	0.32	0.49	0.07
Writes simple sentences using invented and conventional spelling	2.69	0.82	0.11	0.22	0.55	0.12

Table B4 Cont. Distributions of Test Scores and Report Card Grades

Kindergarten Report Card Items and their Distributions			Grade Received			
Mathematics	**Mean**	**SD**	**1**	**2**	**3**	**4**
Geometry	2.91	0.44	0.02	0.10	0.84	0.04
Knows grade-level math facts	2.53	0.73	0.06	0.42	0.44	0.08
Measurement and data	2.90	0.46	0.02	0.11	0.83	0.04
Reads, writes, compares and orders numbers	3.04	0.69	0.03	0.14	0.60	0.23
Solves simple story problems	2.87	0.63	0.04	0.15	0.71	0.10
Verbally counts forward and backward (by 1s)	2.82	0.82	0.05	0.30	0.44	0.21
			Grade Received			
Socioemotional Learning	**Mean**	**SD**	**1**	**2**	**3**	**4**
Accepts responsibility for own behavior	2.79	0.48	0.03	0.14	0.82	-
Completes assignments on time	2.57	0.50	0.03	0.17	0.79	-
Demonstrates listening skills	2.71	0.50	0.02	0.24	0.73	-
Demonstrates self-control	2.69	0.54	0.04	0.23	0.72	-
Follows oral directions	2.77	0.47	0.02	0.19	0.79	-
Organizes materials and time	2.73	0.51	0.04	0.19	0.77	-
Participates in classroom activities	2.88	0.35	0.01	0.10	0.89	-
Persists in tasks until completion	2.80	0.46	0.03	0.15	0.83	-
Respects the rights, diversity, and feelings of others	2.84	0.40	0.01	0.13	0.85	-
Solves conflicts appropriately	2.74	0.50	0.03	0.19	0.78	-
Takes positive risks in learning and social situations	2.83	0.41	0.02	0.13	0.85	-
Works cooperatively with others	2.81	0.43	0.02	0.16	0.83	-
Works independently	2.74	0.53	0.04	0.18	0.78	-

Figure B1. Distributions of Grades and Test Scores



Appendix C. Full Models

Table C1. Grades K-3 Pooled Models Predicting Absences

	(1) Median Excused	(2) Pr(Unx)>0	(3) Median unx | unx>0
Female	0.37***	0.01**	0.03
	(0.07)	(0.00)	(0.06)
Low-income	0.92***	0.23***	0.88***
	(0.10)	(0.01)	(0.08)
Student with disability	0.83***	0.05***	0.17
	(0.12)	(0.01)	(0.09)
English language learner	-0.99***	-0.04***	-0.52***
	(0.11)	(0.01)	(0.09)
Race/Ethnicity (Relative to white)			
Black or African American	-0.94***	0.25***	2.21***
	(0.11)	(0.01)	(0.09)
Hispanic/Latino	0.13	0.11***	0.32**
	(0.12)	(0.01)	(0.11)
Asian	-0.41**	0.00	0.07
	(0.14)	(0.01)	(0.14)
Other	0.20	0.12***	0.33***
	(0.12)	(0.01)	(0.10)
Parent Education (Relative to High School)			
Less than high school	-0.56***	-0.03**	-0.53***
	(0.16)	(0.01)	(0.11)
Some college	-0.11	-0.02***	-0.67***
	(0.11)	(0.01)	(0.08)
Bachelor's	-0.86***	-0.17***	-1.01***
	(0.13)	(0.01)	(0.11)
Master's or higher	-0.56***	-0.18***	-0.97***
	(0.13)	(0.01)	(0.11)
Not reported	-0.38**	-0.05***	-0.53***
	(0.14)	(0.01)	(0.10)
Asthma	1.45***	0.03***	0.31***
	(0.12)	(0.01)	(0.09)
Environmental allergy	0.61***	-0.02**	-0.13
	(0.11)	(0.01)	(0.10)
Food allergy	0.31	-0.03**	-0.01
	(0.17)	(0.01)	(0.15)
Other allergy	0.15	-0.04	0.04
	(0.31)	(0.02)	(0.27)
ADD/ADHD	0.34*	0.02*	-0.01
	(0.16)	(0.01)	(0.12)
Mental health condition	2.39***	0.03	0.02
	(0.29)	(0.02)	(0.22)

	Median Excused	Pr(Unx)>0	Median unx | unx>0
Gastrointestinal condition	1.20***	-0.01	-0.22
	(0.22)	(0.01)	(0.19)
Headache	1.14***	0.05*	0.16
	(0.32)	(0.02)	(0.25)
Temporary condition	1.47***	0.03	-0.13
	(0.35)	(0.02)	(0.28)
Autism	0.94***	0.00	-0.07
	(0.28)	(0.02)	(0.23)
Dermatology condition	-0.04	-0.00	0.10
	(0.27)	(0.02)	(0.22)
Neurological condition	0.69	-0.05*	-0.25
	(0.38)	(0.02)	(0.31)
Musculoskeletal condition	1.61***	0.00	-0.19
	(0.43)	(0.03)	(0.36)
Seizure	2.22***	0.00	0.22
	(0.37)	(0.02)	(0.30)
Cardiovascular condition	1.63***	0.02	-0.01
	(0.39)	(0.02)	(0.32)
Other condition	1.39***	0.00	-0.07
	(0.16)	(0.01)	(0.13)
Grade level (Relative to Kindergarten)			
1st grade	-0.78***	-0.01	-0.09
	(0.09)	(0.01)	(0.08)
2nd grade	-1.30***	-0.02***	-0.15
	(0.09)	(0.01)	(0.08)
3rd grade	-1.62***	-0.04***	-0.22**
	(0.09)	(0.01)	(0.08)
School year (Relative to 2012-2013)			
2013-2014	-0.18	-0.01	0.01
	(0.10)	(0.01)	(0.09)
2014-2015	0.45***	0.04***	0.01
	(0.10)	(0.01)	(0.09)
2015-2016	-0.16	0.05***	0.02
	(0.10)	(0.01)	(0.09)
2016-2017	0.05	0.08***	0.11
	(0.10)	(0.01)	(0.09)
Constant	7.13***	0.33***	1.96***
	(0.15)	(0.01)	(0.13)
Observations	39,934	39,934	19,915
R-squared		0.262	

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05

Table C2. Grades K-3 Pooled Models Predicting Test Scores

	K-2 PALS Score (z-score)		3rd Grade MAP Math (z-score)		3rd Grade MAP Reading (z-score)	
Absences						
Excused (0 to 1)	-0.074	-0.023	-0.167*	-0.086*	-0.137	0.007
	(0.060)	(0.040)	(0.082)	(0.043)	(0.082)	(0.041)
Excused (1 to 2)	0.076*	0.024	0.033	0.020	0.082	0.002
	(0.034)	(0.023)	(0.052)	(0.027)	(0.052)	(0.026)
Excused (2 or more)	-0.008***	-0.004***	0.000	-0.005***	0.008***	-0.001
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
Unexcused (0 to 1)	-0.315***	-0.024	-0.496***	-0.016	-0.527***	-0.022
	(0.021)	(0.014)	(0.033)	(0.018)	(0.033)	(0.017)
Unexcused (1 to 2)	-0.234***	-0.017	-0.328***	-0.037	-0.269***	0.008
	(0.024)	(0.016)	(0.040)	(0.021)	(0.040)	(0.020)
Unexcused (2 or more)	-0.022***	-0.008***	-0.022***	-0.004*	-0.022***	-0.003*
	(0.001)	(0.001)	(0.003)	(0.002)	(0.003)	(0.002)
Female		-0.005		-0.068***		0.004
		(0.009)		(0.011)		(0.010)
Low-income		-0.016		-0.064***		-0.068***
		(0.013)		(0.017)		(0.016)
Student with disability		-0.401***		-0.078***		-0.163***
		(0.016)		(0.019)		(0.018)
English language learner		0.041**		-0.052**		-0.053**
		(0.014)		(0.019)		(0.018)
Race/Ethnicity (Relative to white)						
Black or African American		-0.049**		-0.139***		-0.132***
		(0.015)		(0.020)		(0.019)
Hispanic/Latino		-0.043**		-0.022		-0.018
		(0.016)		(0.021)		(0.020)
Asian		-0.021		0.033		-0.065**
		(0.019)		(0.023)		(0.022)
Other		0.009		-0.055**		-0.046*
		(0.015)		(0.020)		(0.019)
Parent Education (Relative to High School)						
Less than high school		-0.057**		-0.021		-0.045
		(0.021)		(0.025)		(0.024)
Some college		0.060***		0.023		0.021
		(0.014)		(0.018)		(0.017)
Bachelor's		0.049**		0.107***		0.089***
		(0.017)		(0.022)		(0.021)
Master's or higher		0.052**		0.161***		0.146***
		(0.017)		(0.021)		(0.020)
Not reported		0.011		0.038		0.012
		(0.018)		(0.024)		(0.023)

	K-2 PALS Score (z-score)		3rd Grade MAP Math (z-score)		3rd Grade MAP Reading (z-score)	
Asthma		0.013		0.012		-0.010
		(0.016)		(0.018)		(0.017)
Environmental allergy		-0.018		-0.004		0.013
		(0.015)		(0.017)		(0.016)
Food allergy		-0.017		0.019		0.025
		(0.023)		(0.026)		(0.025)
Other allergy		-0.001		-0.018		-0.013
		(0.041)		(0.042)		(0.040)
ADD/ADHD		-0.158***		-0.058**		-0.041
		(0.024)		(0.022)		(0.021)
Mental health condition		0.031		0.056		0.065
		(0.043)		(0.040)		(0.038)
Gastrointestinal condition		0.006		0.063		-0.016
		(0.029)		(0.034)		(0.032)
Headache		0.110*		0.009		0.107**
		(0.052)		(0.038)		(0.036)
Temporary condition		0.092*		-0.089		-0.062
		(0.046)		(0.056)		(0.053)
Autism		-0.052		-0.101*		-0.074
		(0.040)		(0.051)		(0.049)
Dermatology condition		-0.068*		-0.021		-0.007
		(0.034)		(0.044)		(0.042)
Neurological condition		-0.193***		-0.132*		-0.027
		(0.054)		(0.066)		(0.063)
Musculoskeletal condition		0.011		-0.028		-0.019
		(0.058)		(0.067)		(0.063)
Seizure		-0.243***		-0.127*		-0.153*
		(0.054)		(0.063)		(0.061)
Cardiovascular condition		-0.099		-0.064		-0.158**
		(0.052)		(0.060)		(0.057)
Other condition		-0.026		0.045		0.019
		(0.021)		(0.023)		(0.022)
Fall test score		0.030***		0.050***		0.040***
		(0.000)		(0.000)		(0.000)
Grade level (Relative to Kindergarten)						
1st grade	-0.056***	0.034***	-	-	-	-
	(0.015)	(0.010)	-	-	-	-
2nd grade	-0.104***	0.329***	-	-	-	-
	(0.018)	(0.012)	-	-	-	-

	K-2 PALS Score (z-score)		3rd Grade MAP Math (z-score)		3rd Grade MAP Reading (z-score)	
School year (relative to 2012-2013)						
2013-2014	0.041	0.122***	-0.037	0.049**	0.020	0.075***
	(0.027)	(0.018)	(0.032)	(0.017)	(0.032)	(0.016)
2014-2015	0.201***	0.230***	0.093**	0.121***	0.112***	0.085***
	(0.026)	(0.017)	(0.032)	(0.017)	(0.032)	(0.016)
2015-2016	0.293***	0.311***	0.013	0.016	0.119***	0.052**
	(0.026)	(0.017)	(0.032)	(0.017)	(0.032)	(0.016)
2016-2017	0.258***	0.323***	0.210***	0.166***	0.268***	0.123***
	(0.026)	(0.017)	(0.032)	(0.017)	(0.032)	(0.016)
Constant	0.154**	-1.880***	0.394***	-9.302***	0.240***	-7.584***
	(0.051)	(0.040)	(0.062)	(0.096)	(0.063)	(0.077)
Observations	22,153	22,153	8,031	8,031	7,980	7,980
R-squared	0.112	0.610	0.162	0.772	0.151	0.790

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05

Table C3. Grades K-3 Pooled Models Predicting Report Card Grades

	1st - 3rd Grade Language Arts Grades (z-score)		1st - 3rd Grade Math Grades (z-score)		1st - 3rd Grade Socioemotional Grades (Pr[SEL]==3)	
Absences						
Excused (0 to 1)	-0.047	-0.039	-0.039	-0.043	-0.000	0.006
	(0.053)	(0.037)	(0.052)	(0.038)	(0.029)	(0.026)
Excused (1 to 2)	0.034	0.013	-0.004	-0.021	0.010	-0.003
	(0.032)	(0.022)	(0.032)	(0.023)	(0.017)	(0.016)
Excused (2 or more)	-0.006***	-0.002**	-0.008***	-0.005***	-0.002**	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Unexcused (0 to 1)	-0.386***	-0.025	-0.409***	-0.050***	-0.119***	-0.031**
	(0.020)	(0.015)	(0.020)	(0.015)	(0.011)	(0.010)
Unexcused (1 to 2)	-0.286***	-0.054**	-0.326***	-0.068***	-0.108***	-0.033**
	(0.024)	(0.017)	(0.024)	(0.017)	(0.013)	(0.012)
Unexcused (2 or more)	-0.023***	-0.006***	-0.021***	-0.004***	-0.007***	-0.001
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Female		0.113***		-0.079***		0.126***
		(0.009)		(0.009)		(0.006)
Low-income		-0.134***		-0.128***		-0.072***
		(0.014)		(0.014)		(0.010)
Student with disability		-0.293***		-0.217***		-0.056***
		(0.016)		(0.016)		(0.011)
English language learner		-0.011		-0.030*		0.037***
		(0.015)		(0.015)		(0.010)
Race/Ethnicity (Relative to white)						
Black or African American		-0.110***		-0.170***		-0.090***
		(0.016)		(0.016)		(0.011)
Hispanic/Latino		-0.030		-0.062***		-0.004
		(0.017)		(0.017)		(0.012)
Asian		-0.006		0.070***		0.033*
		(0.019)		(0.020)		(0.014)
Other		-0.018		-0.035*		-0.045***
		(0.016)		(0.016)		(0.011)
Parent Education (Relative to High School)						
Less than high school		-0.022		-0.012		0.029*
		(0.021)		(0.021)		(0.014)
Some college		0.046**		0.071***		0.008
		(0.015)		(0.015)		(0.010)
Bachelor's		0.134***		0.169***		0.044***
		(0.018)		(0.018)		(0.012)
Master's or higher		0.222***		0.264***		0.078***
		(0.017)		(0.018)		(0.012)
Not reported		0.044*		0.056**		0.031*
		(0.018)		(0.019)		(0.013)

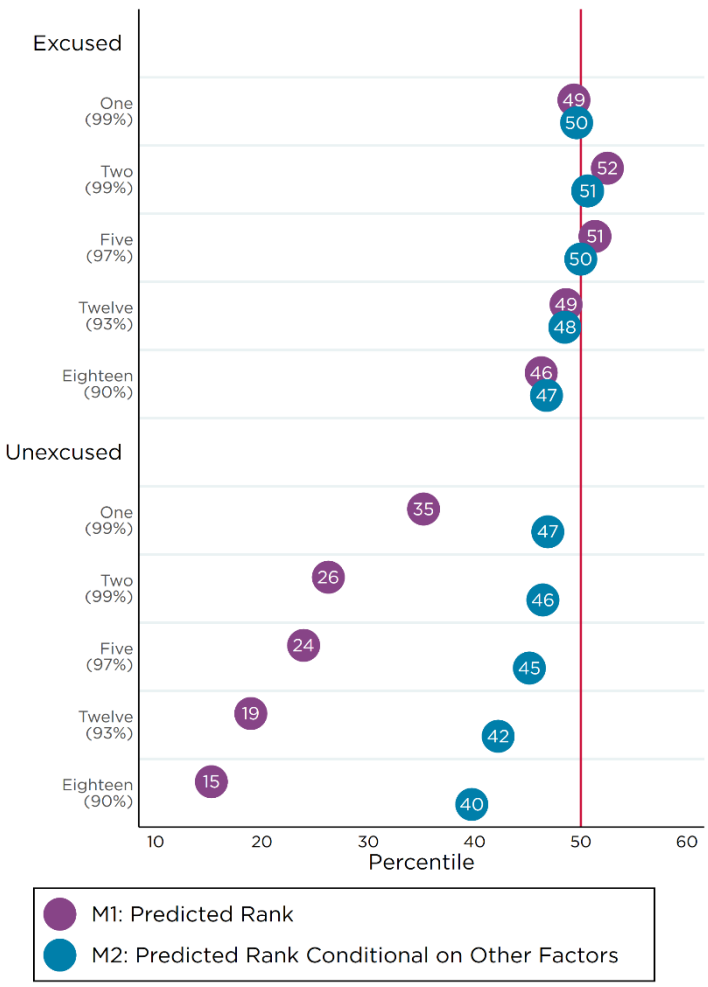
	1st - 3rd Grade Language Arts Grades (z-score)		1st - 3rd Grade Math Grades (z-score)		1st - 3rd Grade Socioemotional Grades (Pr[SEL]==3)	
Asthma		-0.027		-0.005		-0.027**
		(0.015)		(0.015)		(0.011)
Environmental allergy		0.010		-0.012		-0.011
		(0.015)		(0.015)		(0.010)
Food allergy		-0.001		-0.017		-0.013
		(0.022)		(0.022)		(0.015)
Other allergy		0.024		0.027		0.014
		(0.039)		(0.040)		(0.027)
ADD/ADHD		-0.082***		-0.072***		-0.084***
		(0.020)		(0.021)		(0.014)
Mental health condition		-0.016		-0.073		-0.008
		(0.038)		(0.039)		(0.027)
Gastrointestinal condition		0.066*		0.008		-0.017
		(0.029)		(0.030)		(0.021)
Headache		0.073		0.073		0.032
		(0.037)		(0.038)		(0.026)
Temporary condition		-0.007		-0.003		-0.054
		(0.047)		(0.048)		(0.033)
Autism		-0.070		-0.082*		-0.098***
		(0.038)		(0.038)		(0.027)
Dermatology condition		-0.009		0.035		-0.004
		(0.036)		(0.037)		(0.025)
Neurological condition		-0.106*		-0.012		0.010
		(0.052)		(0.053)		(0.037)
Musculoskeletal condition		0.002		-0.081		-0.010
		(0.058)		(0.060)		(0.041)
Seizure		-0.126*		-0.199***		-0.064
		(0.049)		(0.051)		(0.035)
Cardiovascular condition		0.000		-0.066		-0.040
		(0.052)		(0.053)		(0.036)
Other condition		0.013		-0.032		-0.036*
		(0.020)		(0.021)		(0.014)
Prior year report card grades		0.926***		1.020***		0.409***
		(0.008)		(0.010)		(0.010)
Grade level (Relative to 1st grade)						
2nd grade	0.002	0.029**	-0.007	0.105***	-0.062***	-0.052***
	(0.015)	(0.011)	(0.015)	(0.011)	(0.008)	(0.007)
3rd grade	-0.025	0.062***	-0.037*	0.223***	-0.044***	-0.013
	(0.015)	(0.011)	(0.015)	(0.011)	(0.008)	(0.008)

	1st - 3rd Grade Language Arts Grades (z-score)		1st - 3rd Grade Math Grades (z-score)		1st - 3rd Grade Socioemotional Grades (Pr[SEL]==3)	
School year (Relative to 2012-2013)						
2013-2014	-0.055**	0.071***	0.011	0.221***	-0.004	-0.001
	(0.018)	(0.012)	(0.017)	(0.013)	(0.010)	(0.009)
2014-2015	0.012	0.149***	0.074***	0.247***	-0.010	-0.009
	(0.018)	(0.012)	(0.017)	(0.013)	(0.009)	(0.009)
2015-2016	0.027	0.122***	0.108***	0.263***	-0.008	-0.002
	(0.018)	(0.012)	(0.017)	(0.013)	(0.009)	(0.009)
Constant	0.337***	-2.686***	0.345***	-2.962***	0.575***	-0.675***
	(0.042)	(0.043)	(0.042)	(0.047)	(0.023)	(0.037)
Observations	22,449	22,449	22,474	22,474	21,107	21,107
R-squared	0.127	0.571	0.145	0.554	0.057	0.221

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05

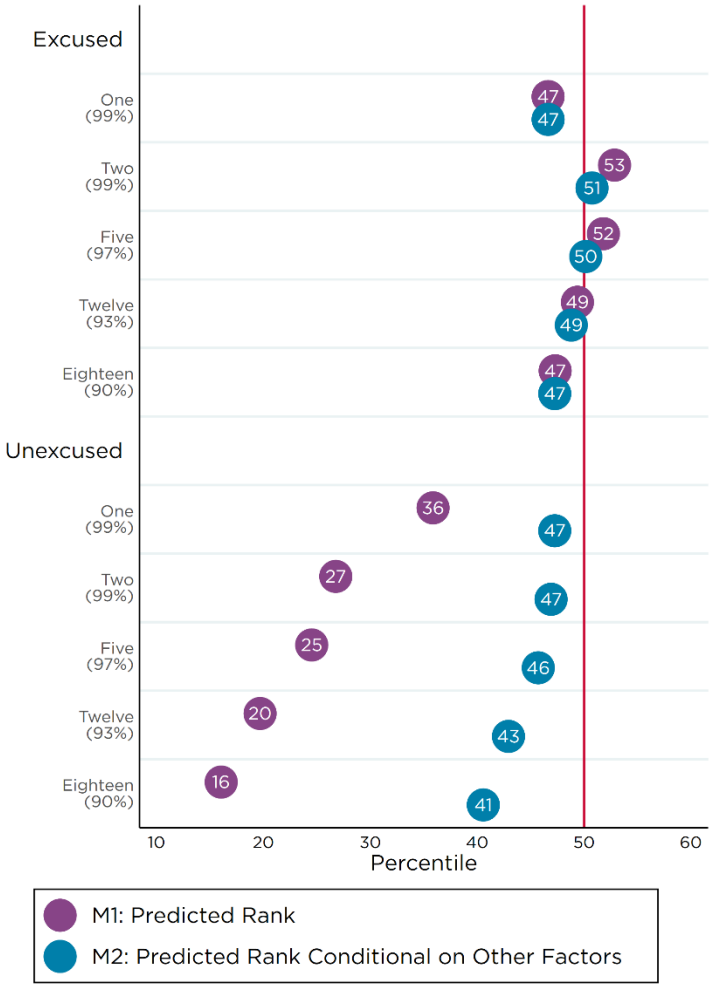
Appendix D. Kindergarten Report Card Grade Models

Figure D1. Kindergarten Language Arts Grades Model



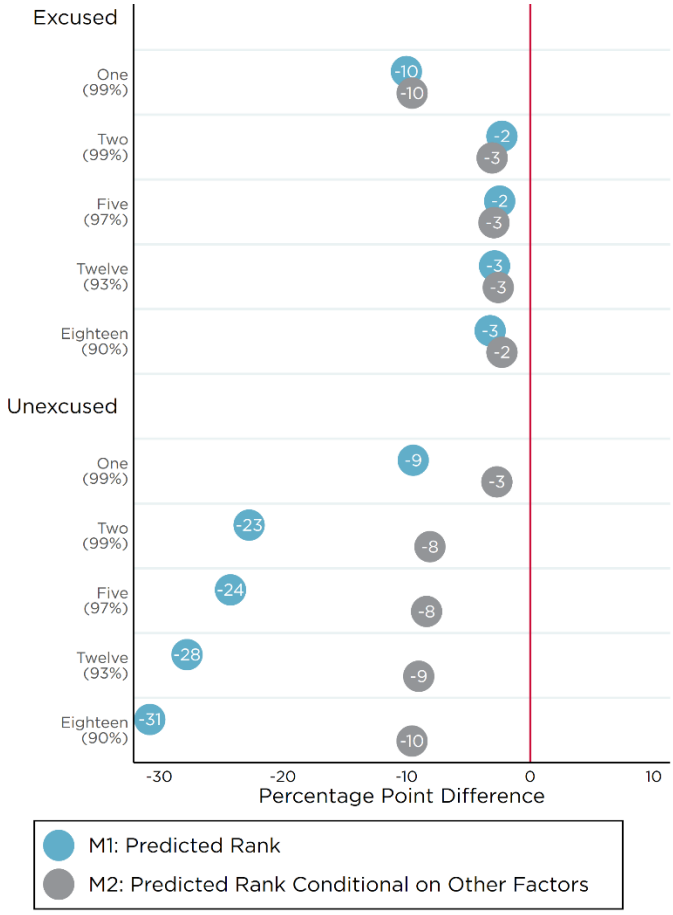
Note: Model 2 accounts for Fall PALS test score.
Labels on y-axis refer to the number of each type of absence. Percentages in parentheses refer to the attendance rate associated with each quantity of absences.

Figure D2. Kindergarten Mathematics Grades Model



Note: Model 2 accounts for Fall PALS test score.
Labels on y-axis refer to the number of each type of absence. Percentages in parentheses refer to the attendance rate associated with each quantity of absences.

Figure D3. Kindergarten Socioemotional Grades Model



Note: Model 2 accounts for Fall PALS test score.
Labels on y-axis refer to the number of each type of absence. Percentages in parentheses refer to the attendance rate associated with each quantity of absences.

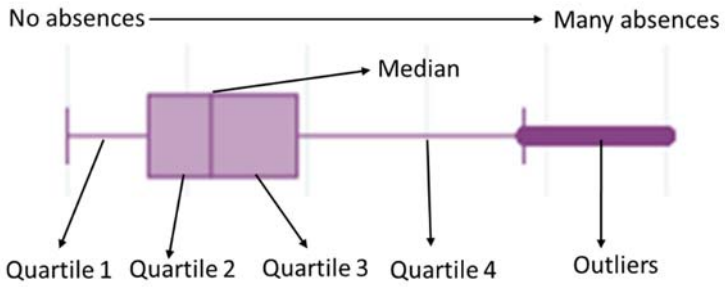
Appendix E: Glossary of Terms

Association or relationship of variables: Two variables are associated or have a relationship when it appears that a change in one variable may be related to a change in the other variable. For example, if patterns in the data show that a change in 4K site type attended corresponds to a change in literacy scores on PALS tests for a certain group of students.

- *Caution:* When variables show a statistically significant relationship it does not necessarily mean there is a causal relationship. This relationship may still occur due to sampling error or because of the influence of other unmeasured circumstances or variables.

Box plot (interpreting box plots): Box plots show how people are spread out, or "distributed" on a variable. We use box plots in this report to show how the spread of student absences of different groups differ from each other. Because boxplots show the exact middle of the distribution, and because student absences are much more highly concentrated in the middle of the distribution, box plots also show whether absences are more common in one group than another. Box plots divide the distributions of absences into four "quartiles" that each contain 25 percent of the students within the expected range. Values outside the expected range are called "outliers" and are shown as dots on the graph. Figure E1 shows the different parts of a box plot. Twenty-five percent of students with the fewest absences are in Quartile 1 which is represented by the line extending to the left of the box. Quartile 4, represented by the line extending to the right of the box, contains 25 percent of all students with the highest number of absences. The box itself represents the middle of the distribution, which contains half of all students. The vertical line in the box represents the median, which divides the entire distribution in half. In other words, half all students fall below the median number of absences and half fall above it.

Figure E1. Features of a Boxplot



Coefficients: Represent the average change in an outcome variable (Y) expected for a one unit change in a predictor variable (X), holding all other predictors in the model constant. For example, the average change in probability of a student meeting the PALS benchmark (Y) given one unexcused absence (X), taking into account all other student and family characteristics.

Conditional median regression: A statistical model that predicts the median value of a dependent variable as a function of a set of independent variables. Median regression is useful when outliers on the dependent variable make the arithmetic mean less useful as a measure of a typical outcome.

Descriptive analysis: A statistical summary of patterns of associations among variables, such as program type and PALS scores, that does not identify causal relationships, but can serve to identify potential causal relationships for further analysis.

Factor analysis: A statistical method used to analyze relationships within a set of measures to identify groups of variables that reflect a common underlying phenomenon.

Linear probability model: A statistical model that predicts the association between a set of variables and the probability of an event. One example from this brief is the model of the relationship between a student with one or more unexcused absences and a student being rated by the teachers as engaging in classroom effort most of the time.

Mean: The average of the data set. Adding all data together and dividing by the number of data points will give you the mean of the data.

Median: When observations are sorted from low to high the median is the value of the observation halfway between the top and the bottom.

Ordinary least squares regression (OLS): A statistical method for estimating the strength of a relationship, or accuracy of the prediction of the relationship, between two variables. Using OLS can help researchers better understand the amount of certainty in statistical predictions and associations compared to purely descriptive methods.

Socioemotional skills: The skills and understanding students need to understand and manage emotions, set and achieve positive goals, feel and show empathy for others, establish and maintain positive relationships and make decisions responsibly.

Student year of data: Measurement of student attendance by year, over years, naturally leads to students being represented multiple times in a multiyear data set. For instance, if Eduardo attended school in MMSD in Grades 1 through 3, we would have Eduardo's unique attendance record three times in our total data set, even though Edwardo's student and family characteristics were constant. This produces an issue that we address through statistical methods.

Summative assessment: Summative assessments measure student learning at the end of a unit or given time point.

Standard deviation: A measure of how spread out from the mean any data point in a given data set is. The standard deviation in our report indicates how close any individual student's attendance is to the attendance of the average student.

Variation: Variation in data describes how far or close to the mean, or average, a particular data point falls. For example, variation can be used to describe how clustered or spread out student scores are from the average score.