

Factors Associated with Grade 9 Math Success in Denver Public Schools

June 2026
REL 2026-008
U.S. DEPARTMENT OF EDUCATION

A Publication of the National Center for Education Evaluation and Regional Assistance at IES



U.S. Department of Education

Linda E. McMahon

Secretary

Institute of Education Sciences

Matthew Soldner

Acting Director

National Center for Education Evaluation and Regional Assistance

Sarah Brasiel

Project Officer

In addition to the Institute of Education Sciences (IES) staff mentioned above, the following former IES staff provided helpful guidance on the development of the report and substantive feedback on drafts: Anousheh Shayestehpour, project officer; Chris Boccanfuso, REL Branch Chief; and Liz Eisner, Associate Commissioner.

IES is the independent, nonpartisan statistics, research, and evaluation arm of the U.S. Department of Education. The IES mission is to provide scientific evidence on which to ground education practice and policy and to share this information in formats that are useful and accessible to educators, parents, policymakers, researchers, and the public.

We strive to make our products available in a variety of formats and in language that is appropriate for a variety of audiences. You, as our customer, are the best judge of our success in communicating information effectively. If you have any comments or suggestions about this or any other IES product or report, we would like to hear from you. Please direct your comments to ncee.feedback@ed.gov.

This report was prepared for IES under Contract 91990022C0015 by Mathematica. The content of the publication does not necessarily reflect the views or policies of IES or the U.S. Department of Education nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.

June 2026

This report is in the public domain. Although permission to reprint this publication is not necessary, it should be cited as:

Seifert, S., Shiferaw, M., and Stone, R. (2026). *Factors Associated with Grade 9 Math Success in Denver Public Schools* (REL 2026-008). U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance. <https://ies.ed.gov/use-work/resource-library/reports>.

ORCID IDs

Sophia Seifert 0000-0003-2513-9335

Menbere Shiferaw 0000-0001-5401-6786

Riley Stone 0009-0001-5649-0390

Factors Associated with Grade 9 Math Success in Denver Public Schools

Sophia Seifert, Menbere Shiferaw, and Riley Stone

June 2026

Leadership at Denver Public Schools in Colorado seeks to increase the number of students who successfully transition from middle school to high school, in part by increasing the number of students who receive a passing grade in their grade 9 math course. To inform future efforts to support successful transitions, this study identified the student characteristics and experiences that were strongly associated with grade 9 math success and whether these associations differed for student groups of interest (those who may be at higher risk for unsuccessful transitions): Black students, Hispanic students, students with an Individualized Education Program, and multilingual learner students.

The factors found to be strongly associated with being successful in grade 9 math included attending a high school with above-average Hispanic enrollment, having higher attendance rates in middle school, and meeting the proficiency benchmark on the middle school English language arts standardized exam. These factors were also strongly associated with grade 9 math success for most student groups of interest.

Factors found to be strongly associated with being unsuccessful in grade 9 math included receiving a failing grade in any middle school math course; attending a high school with above-average enrollment of students eligible for the National School Lunch Program; attending a high school with a newcomer center; and receiving any suspension in middle school, which was the factor with the strongest association (positive or negative) with grade 9 math success. These factors were also strongly associated with being unsuccessful in grade 9 math for most student groups of interest.

Given these associations, Denver Public Schools might choose to learn more about how school characteristics, discipline, and attendance are directly associated with grade 9 math success and might consider implementing an early warning system to identify middle school students for additional supports.

Why this study?

According to Denver Public Schools (DPS) administrative data for 2023, nearly one in five students did not pass their grade 9 math course. This is worrying because math success in middle school and in grade 9 predict high school achievement and graduation across the nation (Allensworth et al., 2014; Balfanz, 2009; Easton et al., 2017; Riegle-Crumb, 2006; Roderick & Camburn, 1999; Schiller & Hunt, 2011). This same association has been observed in Denver historically. For the class of 2007 in DPS high schools, for example, receiving a failing semester grade during grade 9 was associated with a lower likelihood of on-time high school graduation (Mac Iver et al., 2009).

Leadership at DPS is committed to substantially increasing all students' success in the transition from middle to high school, a time when many students experience achievement declines (Neild, 2009; Rice, 1997). According to DPS officials, math success decreases between grade 8 and 9. DPS sees a student's grade 9 math success—receiving a passing grade in their grade 9 math course—as a way to determine whether a student has made a successful high school transition. To ensure that all students succeed in grade 9 math, DPS also seeks to increase

For additional information, including study methods, supporting analyses, and other analyses, see the appendices for the report at the [Institute of Education Sciences website](#).

academic success for student groups that might be at higher risk for unsuccessful transitions, including Black students, Hispanic students, students with an Individualized Education Program (IEP), and multilingual learner students. In 2023, although nearly 95 percent of White students succeeded in grade 9 math, only about three-quarters of Black students, Hispanic students, students with an IEP, or multilingual learner students did so. To inform future efforts that support successful transitions from middle school to high school, DPS leaders want to learn more about which factors—for grade 9 students overall and for student groups of interest—are associated with grade 9 math success in their local context.

Prior studies have found that student, school, and contextual factors are associated with math success in middle school and high school. For example, student attendance (Gottfried, 2010; Smerillo et al., 2018), non-promotional school transfers¹ (Welsh, 2017), and school suspensions (Ibrahim & Johnson, 2020) all predict math achievement. In addition, school practices that provide additional opportunities for learning, including tutoring (Dietrichson et al., 2020; Nickow et al., 2020), “double-dose” math courses² (Nomi et al., 2021; Taylor, 2014), and out-of-school-time programming (Casing & Casing, 2024; Lauer et al., 2006), can also improve math outcomes. Finally, school characteristics—including the average characteristics of enrolled students, such as socioeconomic status, and the characteristics of a school’s teachers, such as years of experience—are also associated with students’ math outcomes (Qiu & Wu, 2019).

In this study, the Regional Educational Laboratory Central study team sought to identify student characteristics and experiences that were strongly associated with grade 9 math success and thus could be used to identify students who might benefit from additional supports to succeed in grade 9 math (see box 1 for definitions of key terms used in this report and box 2 for a summary of study methods). Student characteristics, such as race/ethnicity and sex, are included to determine whether they are strongly associated with grade 9 math success.³ School policies and practices are unlikely to influence student characteristics, but some policies and practices could affect student experiences.⁴ For example, a school’s disciplinary policies or tutoring programs likely do not influence whether students are eligible for the National School Lunch Program (NSLP). However, these and other school policies or practices could shape student experiences and student-level outcomes, such as attendance rates and suspensions, along with the characteristics of the middle school and grade 9 learning environment. Furthermore, the characteristics of schools and teachers, such as the demographic makeup of a school, the average achievement of peers, and teachers’ average years of experience, contribute to the learning environment to which a student is exposed. (For a description of all student characteristics and experiences examined in this study, see table A2 in appendix A.)

Though the findings of this descriptive study do not isolate which experiences cause students to be more successful in grade 9 math, DPS can use the findings to identify policies and practices that they might want to investigate further. For example, if attendance is found to be associated with success in grade 9 math, DPS could consider studying policies and practices that might influence attendance to better understand this association. Findings that differ for student groups of interest can suggest whether some policies and practices may benefit certain students at higher risk of unsuccessful transitions to high school. Leaders at DPS can also use these findings to ascertain which early indicators might be most useful in identifying students who might need additional support in the transition from middle to high school. In other words, DPS leadership can identify key characteristics and experiences that might identify students at high risk of not succeeding in grade 9 math. Though this study is focused on DPS, the findings could also help other districts that are focused on middle to high school transitions and grade 9 math success better understand which student and school factors might be associated with math success in their context.

-
1. Defined as when students change schools on their own accord, rather than due to grade configurations (Welsh, 2017).
 2. Nomi et al. (2021) define *double-dose math courses* as when schools require two periods of math—one as the main course and another as support if students score below a certain threshold on their math assessments. Taylor (2014) defines them similarly, as when schools require one regular and one remedial math course at the same time.
 3. These include race/ethnicity, sex, home language, National School Lunch Program eligibility, and newcomer status.
 4. These include schoolwide student attendance, suspensions, and achievement; student supports; school learning environment; school characteristics; and teacher characteristics.

Box 1. Key terms

Association. When a factor is associated with grade 9 math success, it means that the factor and grade 9 math success change together in predictable ways (they are correlated). With associations, it is not possible to tell whether a factor is directly causing grade 9 math success (causal) or whether the change is caused by some other unobserved factor that is associated with both the factor and grade 9 math success. Positive associations imply that having a characteristic or experience is associated with a higher likelihood of grade 9 math success, while negative associations imply that having the characteristic or experience is associated with a lower likelihood of math success (or a higher likelihood of being unsuccessful in grade 9 math).

Colorado Measures of Academic Success (CMAS). The primary state summative assessment for English language arts and math during grades 3-8. These standardized tests are aligned to the state's rigorous academic standards and designed to gauge how well students are mastering the standards and are prepared for their next grade.

Factor. A characteristic or experience that may be associated with a study outcome. Factors can be binary (having only two possible values that indicate whether a characteristic or experience is present or absent) or continuous (measured on a numeric scale with many possible values).

Failing grade in middle school math. Whether, during any middle school grade (grade 6, 7, or 8), a student received a failing grade (F) in a math course in any marking period (such as any quarter or trimester) or standard. (Some middle schools in DPS use standards-based grading, in which a student receives grades based on mastery of each standard, such as equations or expressions, rather than by marking period.)

Grade 9 math success. Receiving a passing grade in a grade 9 math course. This is the study's primary outcome. Eighty-six percent of students in the sample passed their grade 9 math course, meaning that they earned a letter grade between A and D on an A-F scale or earned a grade at or above the passing threshold for other grading scales. Construction of the primary outcome is detailed in appendix A.

Newcomer center. A high school- or middle school-based center designed for students who are new to the United States (enrolled for less than two semesters), have a history of limited or interrupted education, and have minimal literacy skills in both their home language and English. Newcomer center students receive English instruction, with low student-to-adult ratios, that focuses on accelerating both English and content proficiency. Not all students in a school that hosts a newcomer center receive supports from the center.

Strong association. A factor was considered to have a strong association with an outcome if it was statistically significant at the 95 percent confidence level and if having the characteristic or experience (a one-unit change in a binary factor or a one-standard-deviation change in a continuous variable) was associated with at least a 5 percentage point difference in the likelihood of grade 9 math success. This is the equivalent of increasing the likelihood that a student succeeds in grade 9 math from 85 percent to 90 percent, for example. While not statistically derived, a 5 percentage point difference is of practical significance for DPS.

Student groups of interest. DPS identified four student groups that might be at higher risk for unsuccessful transitions from middle school to high school: Black students, Hispanic students, students with an Individualized Education Program, and multilingual learner students.

Research questions

This study addressed two research questions to identify which factors were strongly associated with grade 9 math success for students who enrolled in grade 9 in DPS from 2017/18 to 2022/23:

1. What student characteristics and experiences are strongly associated with grade 9 math success in DPS?
2. How do the strongest associations with success in grade 9 math differ for student groups of interest in DPS?

The data sources, samples, methods, and limitations are summarized in box 2 and detailed in appendix A.

Box 2. Data source, sample, methods, and limitations

Data source. Denver Public Schools (DPS) provided administrative data on students, teachers, and schools for grade 9 students in 2017/18–2022/23. To conduct a retrospective study and capture the transition from middle to high school, the data included grades 6–9, covering school years 2014/15–2022/23.

Sample. The study population (the focal population) included students who attended traditional DPS schools (noncharters) at some point in middle school (grade 6, 7, or 8) and were in grade 9 for the first time in 2017/18, 2018/19, 2020/21, 2021/22, or 2022/23.¹ The study sample that contributed to the findings on the primary outcome included 17,249 DPS students across 48 high schools.² This sample represented 94 percent of the study’s focal population.

On average across the sample, more than four of five students were successful in grade 9 math. Overall, 68 percent of students in the sample identify as being in at least one of the student groups of interest in DPS, with Black students constituting 13 percent of the sample; Hispanic students, 51 percent; students with Individualized Education Program (IEP), 13 percent; and multilingual learner students, 38 percent. These groups are not mutually exclusive, and students can identify as being in more than one of these groups. Summary statistics for the study’s sample are in table A3 in appendix A.

Methodology. To answer research question 1, the study team used regression analyses to examine which student characteristics and middle school experiences were strongly associated with grade 9 math success for grade 9 students. The regression model accounts for factors of policy interest to DPS as well as for additional factors that may be associated with passing the grade 9 math course but were not of policy interest. These other factors include a student’s cohort and grade 9 experiences, such as the grade 9 math course or courses that they took, whether they took multiple math courses in grade 9, and whether they transferred schools. The study team considered an association to be strong if it was statistically significant (unlikely to happen by chance) and if it was associated with at least a 5 percentage point difference in likelihood of grade 9 math success; for example, increasing the likelihood that a student succeeds from 85 percent to 90 percent.

To answer research question 2, the study team repeated the analyses used for research question 1 separately for each of the four student groups of interest in DPS: Black students, Hispanic students, students with an IEP, and multilingual learner students. For these groups, each coefficient represents the adjusted difference in grade 9 math success for a higher value of the factor compared with otherwise similar students from the same student group of interest. Because the student groups of interest are not mutually exclusive, a Black student with an IEP, for example, would be included in the analysis for both Black students and students with an IEP.³

For more information on the data sources, sample, and methodology (including a full list of factors examined in this study), see appendix A. For full regression results of analyses discussed in this report, see appendix B. For additional analyses, including findings for the study’s secondary outcome (meeting or exceeding the Preliminary SAT 9 math proficiency benchmark), for differences between the study’s focal population and the study sample, for factors that strongly predict grade 9 math success only for student groups of interest, for samples that include charter school students, and for analyses that include the experiences of students while in grade 9, see appendix C.

Limitations. There are several limitations to consider when interpreting the study results. First, the study is descriptive, meaning that identifying a factor as strongly associated with grade 9 math success does not suggest that the factor causes grade 9 math success. For example, although the study found that students who met or exceeded the Colorado Measures of Academic Success English language arts (ELA) exam proficiency benchmark during middle school were more likely to succeed in grade 9 math than students who did not, it is possible that students who met or exceeded ELA proficiency systematically differed from students who did not in ways that this study did not measure. For example, the students who met or exceeded ELA proficiency may be more knowledgeable about and more proactive in using supports offered in their schools that aided them in achieving ELA proficiency and in passing their grade 9 math course.

Second, data were not available on other factors that research has suggested could be associated with grade 9 math success, such as student participation in tutoring. Although the study included a rich set of controls in the regression analyses, this type of unobserved factor might influence math success and might also be associated with some of the measures the study team did examine. Future research on grade 9 math success in DPS schools might collect additional quantitative

data on factors that are known to be associated with grade 9 math success—such as tutoring, extended learning time, teacher knowledge of math content and pedagogy, and curriculum. In addition, it might be helpful to collect qualitative data on factors that cannot be measured quantitatively but that might explain variation in success or that could suggest additional factors to incorporate into future quantitative studies.

Third, limited or missing data could diminish the generalizability of the study results. The study addressed limited or missing data in a variety of ways, such as by including cohort effects in the regression model to account for missing data that could have resulted from schooling interruptions due to the Covid-19 pandemic. For more information on additional approaches the study took to address missing data, see appendix C.

Finally, the study data do not support linking specific teachers to students. Therefore, the study could only average the characteristics of teachers in a student’s school. Other studies that link students to teachers have found associations based on teacher characteristics, especially racial and ethnic congruence between students and teachers (Egalite et al., 2015; Grissom et al., 2020; Lindsay et al., 2021). This study also found that some average teacher characteristics were associated with student success in grade 9 math, but the association cannot be assumed to be causal. Given this limitation, the study considers the average teacher characteristics in a school to be a part of the general learning environment that a student experiences in a school.

Notes

1. Students who entered grade 9 in school year 2019/20, during the first year of the Covid-19 pandemic when many schools closed in spring 2020, were not part of the focal population.
2. DPS has 53 high schools. Five DPS high schools did not enroll any students who attended DPS middle schools and had outcome data.
3. The analytic sample included 465 Black students with an IEP, 386 Black multilingual learner students, 1,238 Hispanic students with an IEP, 5,550 Hispanic multilingual learner students, and 771 multilingual learner students with an IEP. For more information about students who are included in two student groups of interest, see table A5. DPS expressed interest in outcomes separately for the study’s four groups of interest, so the study did not conduct separate analyses for students who are in multiple groups of interest.

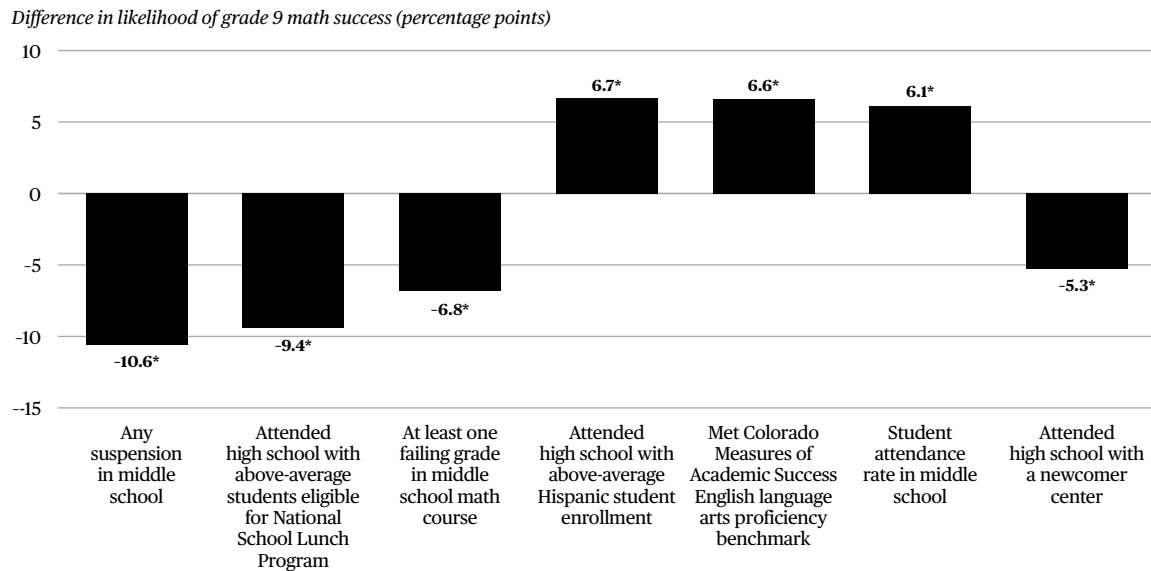
Findings

This section presents findings on the student characteristics and experiences that were strongly associated with grade 9 math success in DPS after other factors were controlled for. When a factor capturing a characteristic or experience (such as having been suspended during middle school) is associated with grade 9 math success, it means that the factor and grade 9 math success change together in predictable ways (they are correlated). Positive associations imply that having a characteristic or experience (one unit higher for binary factors and one standard deviation higher for continuous factors) is linked to a higher likelihood of grade 9 math success, while negative associations mean that having a characteristic or experience is linked to a lower likelihood of grade 9 math success (or, put differently, a higher likelihood of being unsuccessful in grade 9 math). The findings presented here summarize results for factors that are strongly associated with grade 9 math success for grade 9 DPS students overall and the degree to which the same factors are strongly associated with grade 9 math success for the four student groups of interest in DPS. For student groups of interest, each finding represents how much more or less likely a student in that group was to succeed in grade 9 math if they had a characteristic or experience compared with otherwise similar students in the same group of interest who did not have that characteristic or experience.

Receiving any suspension in middle school was strongly associated with being unsuccessful in grade 9 math and was the strongest association for grade 9 students overall and for multilingual learner students

Receiving any suspension in middle school was negatively associated with grade 9 math success for grade 9 students overall and for all student groups of interest. Students who received any suspension during middle school were 10.6 percentage points less likely to succeed in grade 9 math than students who did not (figure 1). About 17 percent of students experienced any suspension—in-school or out-of-school—in middle school. The strong negative association between having any suspension and grade 9 math success was larger than the association for any other factor, including achievement in middle school, attendance in middle school, and middle school

Figure 1. Receiving a suspension in middle school was more strongly associated (positively or negatively) with grade 9 math success than prior achievement, attendance, or school characteristics, 2014/15-2022/23



* Significant at $p < .05$.

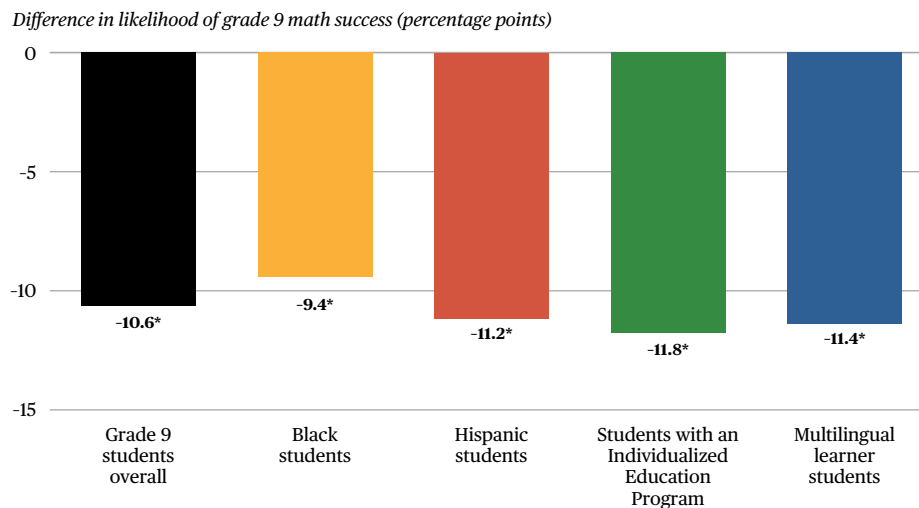
Note: This figure shows regression coefficients for seven factors found to be strongly associated with grade 9 math success for Denver Public Schools students overall. The study considered an association to be strong if it was statistically significant at the 95 percent confidence level and if having the characteristic or experience was associated with at least a 5 percentage point difference in the likelihood of grade 9 math success. Each coefficient represents the adjusted difference (after other factors are controlled for) in the likelihood of grade 9 math success for students who had the characteristic or experience (one unit higher for binary factors and one standard deviation higher for continuous factors) compared with otherwise similar students who did not. Regression results are in table B1 in appendix B, and the list of all variables included in the regression is in table A2 in appendix A.

Source: Authors' analysis based on 2014/15-2022/23, except 2019/20, administrative data from Denver Public Schools.

or high school characteristics (see figure 1). Additionally, suspension rates at the middle school level were not associated with grade 9 math success after other factors were controlled for, suggesting that each student's experience with being suspended, rather than variation in schools' discipline rates, is driving this association. This association does not mean that suspensions cause students to be unsuccessful in grade 9 math. There are multiple ways that experiencing a suspension could relate to success in grade 9 math. For example, when students are suspended, they are removed from the classroom and thus receive less instruction than students who are not suspended; that in turn could reduce success in later math courses. Alternatively, the behaviors that lead students to be suspended could reflect other factors in those students' lives that might also influence math success, such as a stressful home environment.

For all student groups of interest, experiencing a suspension during middle school was strongly associated with being unsuccessful in grade 9 math. Hispanic students, multilingual learner students, and students with an IEP who received any suspension in middle school were all about 11 percentage points less likely to succeed in grade 9 math than otherwise similar students who did not receive a suspension (figure 2). Black students who received any suspension in middle school were 9.4 percentage points less likely to succeed in grade 9 math than Black students who did not receive a suspension, after other factors were controlled for. All student groups of interest except multilingual learner students experienced above-average suspension rates, with the highest suspension rates among Black students (32 percent) and students with an IEP (27 percent) (see table A6 in appendix A for suspension rates by student group).

Figure 2. Receiving a suspension in middle school was strongly associated with being unsuccessful in grade 9 math for grade 9 students overall and for all student groups of interest, 2014/15–2022/23



* Significant at $p < .05$.

Note: This figure shows regression coefficients for an in-school or out-of-school suspension in any middle school year (a binary variable). The study considered an association to be strong if it was statistically significant at the 95 percent confidence level and if having the characteristic or experience was associated with at least a 5 percentage point difference in the likelihood of grade 9 math success. For grade 9 students overall, the coefficient represents the adjusted difference (after other factors are controlled for) in the likelihood of grade 9 math success for students who received a suspension in middle school compared with otherwise similar students who did not. For student groups of interest, each coefficient represents the adjusted difference in the likelihood of grade 9 math success for students who received a suspension in middle school compared with otherwise similar students in the same student group of interest who did not. Regression results are in table B1 in appendix B, and the list of all variables included in the regression is in table A2 in appendix A.

Source: Authors' analysis based on 2014/15–2022/23, except 2019/20, administrative data from Denver Public Schools.

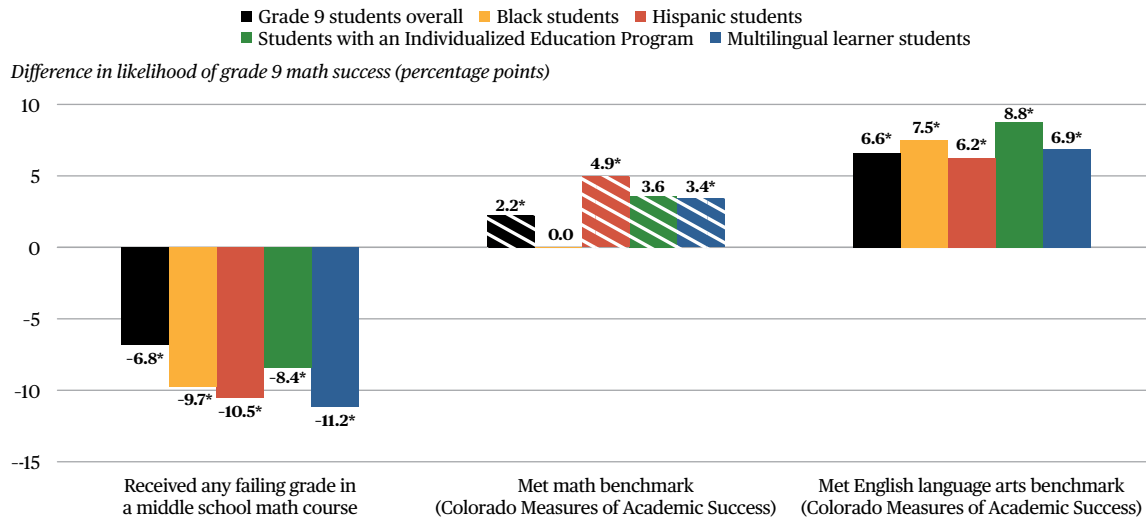
Higher performance during middle school on the Colorado Measures of Academic Success English language arts standardized exam and in middle school math courses was strongly associated with grade 9 math success for grade 9 students overall and for most student groups of interest

Overall, students who met or exceeded the Colorado Measures of Academic Success (CMAS) English language arts (ELA) exam proficiency benchmark at any point in middle school were 6.6 percentage points more likely to succeed in grade 9 math than were similar students who did not meet the benchmark (figure 3). In all student groups of interest, students who met or exceeded the ELA proficiency benchmark in middle school were also more likely to succeed in grade 9 math than otherwise similar students in the same student group who did not. The difference was particularly large for students with an IEP, who were 8.8 percentage points more likely to succeed in grade 9 math than were similar students with an IEP who did not meet the ELA proficiency benchmark. The difference was also large for Black students, who were 7.5 percentage points more likely to succeed in grade 9 math than were similar Black students who did not meet the ELA proficiency benchmark. For the CMAS math exam, meeting the proficiency benchmark was associated with grade 9 math success for grade 9 students overall, Hispanic students, and multilingual learner students but was not strongly associated. These findings suggest that the types of reading and writing skills that the CMAS ELA exam assesses may be transferable to grade 9 math success—perhaps even more so than the specific skills covered by the CMAS math exam.⁵

Students who received a failing grade in any middle school math course were 6.8 percentage points less likely to succeed in grade 9 math than students who received all passing grades (see figure 3). Additionally, for every

5. Because factors that were strongly associated with grade 9 math success differed from those that were strongly associated with proficiency on the Preliminary SAT 9 math exam (secondary outcome), these findings suggest that DPS should not assume that a single intervention will simultaneously influence course grades and standardized test scores, even in the same subject area. See appendix C for the secondary outcome analysis and implications.

Figure 3. Performance in middle school math courses and on the middle school English language arts exam were strongly associated with grade 9 math success for grade 9 students overall and for all student groups of interest, 2014/15-2022/23



* Significant at $p < .05$.

Note: This figure shows regression coefficients for three middle school academic achievement factors (all binary variables). The solid bars indicate a strong association with grade 9 math success, while the striped bars indicate no strong association. The study considered an association to be strong if it was statistically significant at the 95 percent confidence level and if having the characteristic or experience was associated with at least a 5 percentage point difference in the likelihood of grade 9 math success. For grade 9 students overall, the coefficient represents the adjusted difference (after other factors are controlled for) in the likelihood of grade 9 math success for students who had each experience compared with otherwise similar students who did not. For student groups of interest, each coefficient represents the adjusted difference in the likelihood of grade 9 math success for students who had each experience compared with otherwise similar students in the same student group of interest who did not. Regression results are in table B1 in appendix B, and the list of all variables included in the regression is in table A2 in appendix A.

Source: Authors' analysis based on 2014/15-2022/23, except 2019/20, administrative data from Denver Public Schools.

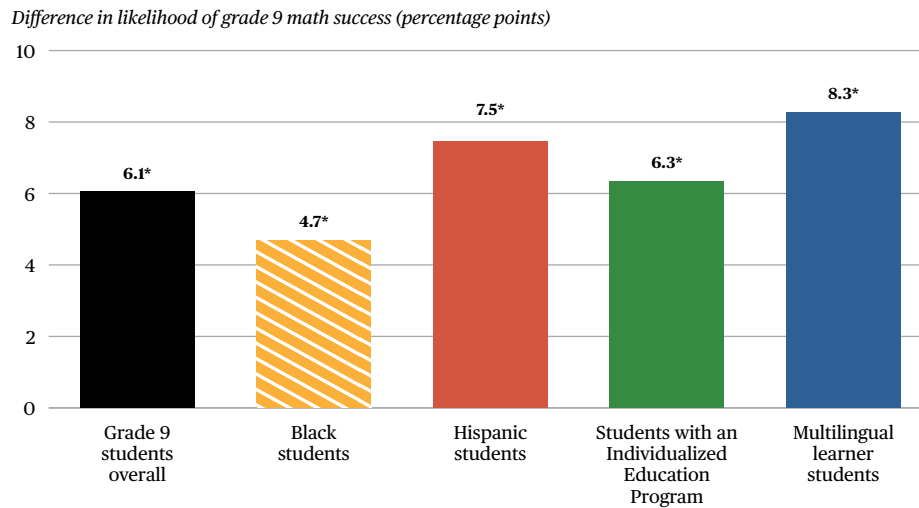
student group of interest, students who received any failing grade in a middle school math course were less likely to succeed in grade 9 math than were similar students in the same student group who passed all terms of their middle school math courses. Black students, Hispanic students, and multilingual learner students who received any failing grade in a middle school math course were 10-11 percentage points less likely to succeed in grade 9 math than similar students in those groups who never received a failing grade, while students with an IEP who received any failing grade were about 8.4 percentage points less likely to do so.

Higher attendance in middle school was strongly associated with grade 9 math success for grade 9 students overall and for almost all student groups of interest

For grade 9 students overall and for most student groups of interest, higher attendance in middle school was strongly associated with grade 9 math success.⁶ Specifically, for grade 9 students overall, students with higher attendance rates in middle school were 6.1 percentage points more likely to succeed in grade 9 math than were similar students with lower attendance rates in middle school (figure 4). Among all student groups of interest except Black students, students with higher rates of attendance in middle school were also more likely to succeed in grade 9 math. Higher attendance in middle school is likely associated with grade 9 math success because it increases the amount of instruction a student receives and may reflect greater motivation to succeed in school, as well as a more stable, safe home environment, all of which might drive better course performance (Keppens, 2023).

6. Because school attendance is a continuous factor, the study considered higher attendance rates to be an increase in attendance of one standard deviation. One standard deviation is about 17 days for grade 9 students overall, about 20 days for Black students, about 18 days for Hispanic students, about 17 days for students with an IEP, and about 16 days for multilingual learner students.

Figure 4. Higher attendance in middle school was strongly associated with grade 9 math success for grade 9 students overall and for all student groups of interest except Black students, 2014/15–2022/23



* Significant at $p < .05$.

Note: This figure shows regression coefficients for overall attendance rates in middle school (a continuous variable). The solid bars indicate a strong association with grade 9 math success, while the striped bar indicates no strong association. The study considered an association to be strong if it was statistically significant at the 95 percent confidence level and if having the characteristic or experience was associated with at least a 5 percentage point difference in the likelihood of grade 9 math success. For grade 9 students overall, the coefficient represents the adjusted difference (after other factors are controlled for) in the likelihood of grade 9 math success for students whose attendance rate in middle school was one standard deviation higher than that of otherwise similar students. For student groups of interest, each coefficient represents the adjusted difference in the likelihood of grade 9 math success for students whose attendance rate in middle school was one standard deviation higher than that of otherwise similar students in the same student group of interest. Regression results are in table B1 in appendix B, and the list of all variables included in the regression is in table A2 in appendix A.

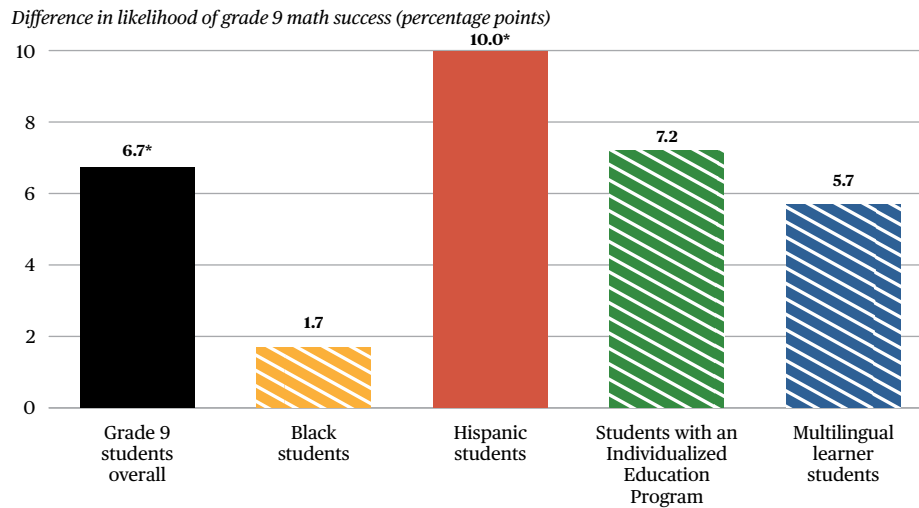
Source: Authors' analysis based on 2014/15–2022/23, except 2019/20, administrative data from Denver Public Schools.

High school composition was strongly associated with grade 9 math success for grade 9 students overall and for Hispanic students

The concentration of Hispanic students in a high school is associated with grade 9 math success for grade 9 students overall and for Hispanic students. Specifically, DPS students who attended a high school with above-average Hispanic student enrollment were 6.7 percentage points more likely to succeed in grade 9 math than similar students who attended a high school with below-average Hispanic student enrollment (figure 5). Hispanic students attending a high school with above-average Hispanic enrollment were 10.0 percentage points more likely to succeed in grade 9 math than similar Hispanic students who attended a high school with fewer Hispanic peers. Attending a high school with above-average Hispanic enrollment was not strongly associated with grade 9 math success for any other student group of interest. More than half of DPS students are Hispanic (52–58 percent during the study period). The experiences of Hispanic students, as the largest student group in this study, may be driving this association for DPS students overall. This finding is consistent with hypotheses that when peers have a similar background, it leads to stronger friendships and social supports during adolescence. This could, in turn, improve academic performance (Chung & Kim, 2024; Haskell, 2023). It is also possible that the association reflects something else happening in schools with higher Hispanic student enrollment, such as offering tutoring, that might increase student engagement and achievement.

In contrast to attending a high school with above-average Hispanic enrollment, attending a high school with above-average enrollment of students eligible for the NSLP was strongly associated with being unsuccessful in grade 9 math for grade 9 students overall (figure 6). Attending a high school with above-average enrollment of students eligible for the NSLP was also strongly associated with being unsuccessful in grade 9 math for Hispanic

Figure 5. Attending a high school with above-average Hispanic student enrollment was strongly associated with grade 9 math success for grade 9 students overall and for Hispanic students, 2014/15–2022/23



* Significant at $p < .05$.

Note: This figure shows regression coefficients for attending a high school with above-average Hispanic student enrollment (a binary variable). The solid bars indicate a strong association with grade 9 math success, while the striped bars indicate no strong association. The study considered an association to be strong if it was statistically significant at the 95 percent confidence level and if having the characteristic or experience was associated with at least a 5 percentage point difference in the likelihood of grade 9 math success. For grade 9 students overall, the coefficient represents the adjusted difference (after other factors are controlled for) in the likelihood of grade 9 math success for students who attended a high school with above-average Hispanic student enrollment compared with otherwise similar students who attended a high school with below-average Hispanic student enrollment. For student groups of interest, each coefficient represents the adjusted difference in the likelihood of grade 9 math success for students who attended a high school with above-average Hispanic student enrollment compared with otherwise similar students in the same student group of interest who attended a high school with below-average Hispanic student enrollment. Regression results are in table B1 in appendix B, and the list of variables included in the regression is in table A2 in appendix A.

Source: Authors' analysis based on 2014/15–2022/23, except 2019/20, administrative data from Denver Public Schools.

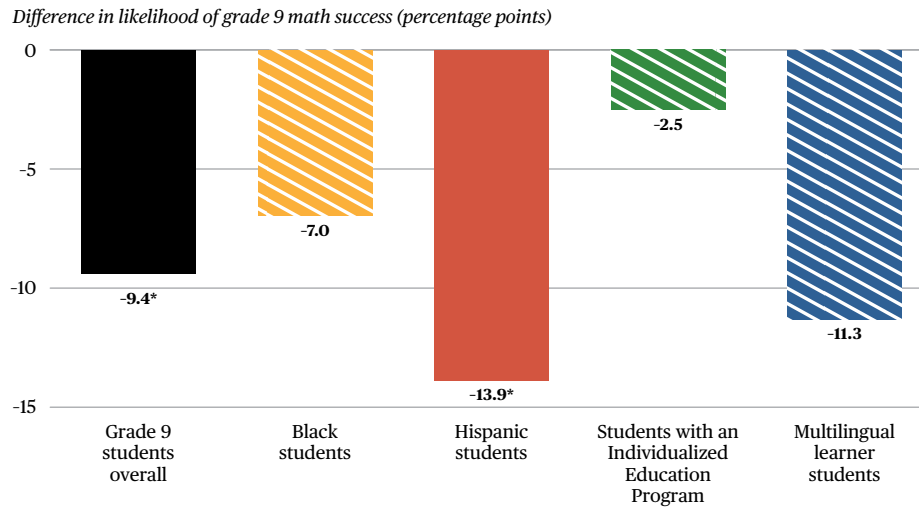
students, for whom this was the factor that predicted grade 9 math success most strongly. As with Hispanic enrollment, NSLP eligibility was not strongly associated with grade 9 math success for other student groups of interest. Approximately two-thirds of DPS students are eligible for the NSLP (60–70 percent during the study period), so a school with above-average enrollment of these students would be classified as “mid-high poverty” (50–75 percent of students eligible for the NSLP) or “high poverty” (more than 75 percent of students eligible for the NSLP) (National Center for Education Statistics, 2023). The association between school poverty level and math success is in line with research indicating that students attending high-poverty schools tend to have lower achievement, which could be due to factors such as teacher morale, parent involvement, or behavior issues (Palardy et al., 2015; Reardon, 2015; Schwartz, 2012).

Attending a high school with a newcomer center was strongly associated with being unsuccessful in grade 9 math, but the study could not determine the cause of this association and did not find a similar association in middle schools

Because newcomer centers (see box 1) aim to support improved student outcomes by offering targeted supports to students who are new to the United States and have additional education needs, DPS was interested in whether this support was associated with grade 9 math success. Attending a high school with a newcomer center during grade 9 was strongly associated with being unsuccessful in grade 9 math for grade 9 students overall, Hispanic students, students with an IEP, and multilingual learner students (figure 7).⁷ Students who

7. None of the other school characteristics studied were strongly associated with grade 9 math success for grade 9 students overall. However, some school characteristics were strongly associated with grade 9 math success for some of the student groups of interest (see appendix C for additional details).

Figure 6. Attending a high school with above-average enrollment of students eligible for the National School Lunch Program was strongly associated with being unsuccessful in grade 9 math for grade 9 students overall and for Hispanic students, 2014/15-2022/23



* Significant at $p < .05$.

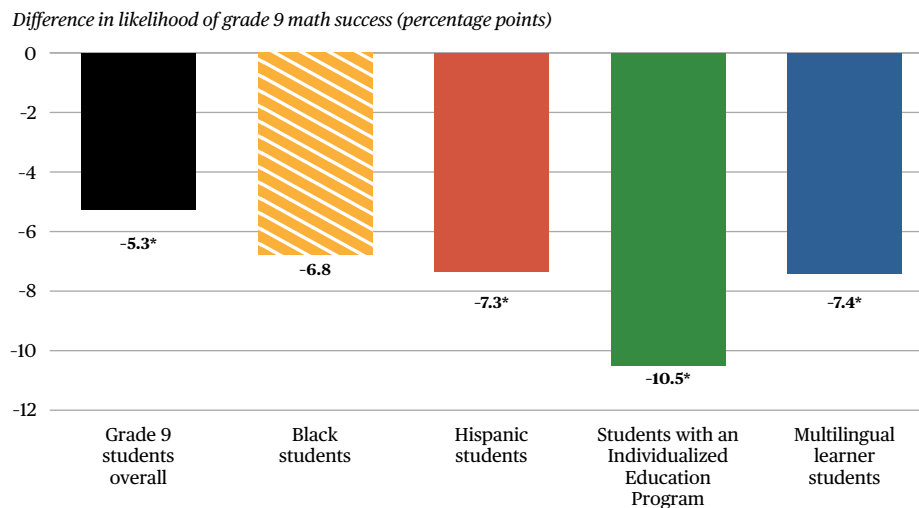
Note: This figure shows regression coefficients for attending a high school with above-average enrollment of students eligible for the National School Lunch Program (NSLP, a binary variable). The solid bars indicate a strong association with grade 9 math success, while the striped bars indicate no strong association. The study considered an association to be strong if it was statistically significant at the 95 percent confidence level and if having the characteristic or experience was associated with at least a 5 percentage point difference in the likelihood of grade 9 math success. For grade 9 students overall, the coefficient represents the adjusted difference (after other factors are controlled for) in the likelihood of grade 9 math success for students who attended a high school with above-average enrollment of students eligible for the NSLP compared with otherwise similar students who attended a high school with below-average enrollment of students eligible for the NSLP. For student groups of interest, each coefficient represents the adjusted difference in the likelihood of grade 9 math success for students who attended a high school with above-average enrollment of students eligible for the NSLP compared with otherwise similar students in the same student group of interest who attended a high school with below-average enrollment of students eligible for the NSLP. Regression results are in table B1 in appendix B, and the list of all variables included in the regression is in table A2 in appendix A.

Source: Authors' analysis based on 2014/15-2022/23, except 2019/20, administrative data from Denver Public Schools.

attended one of three DPS high schools that host newcomer centers were 5.3 percentage points less likely to succeed in grade 9 math than students who attended a high school without a newcomer center. The result did not change even after other factors were controlled for, including whether the student was a multilingual learner or a newcomer and whether a school had above-average enrollment of students eligible for the NSLP.

Because many schools that host newcomer centers enroll students who received newcomer services in the past, these schools may serve a student population with greater and unobserved education needs than other DPS schools. Additionally, while approximately 2,850 grade 9 students, or 17 percent of the study sample, attended a high school with a newcomer center, more than two-thirds of these students (70 percent) did not receive newcomer services at any time in middle school or grade 9. In fact, fewer than 900 students (5 percent) in the sample were identified as newcomers. Further, attending a middle school with a newcomer center was not associated with grade 9 math success. That so few students in the sample received newcomer center support and that the association is not consistent across grade levels suggest that other unobserved characteristics of schools that host newcomer centers are associated with grade 9 math success rather than the newcomer center itself.

Figure 7. Attending a high school with a newcomer center was strongly associated with being unsuccessful in grade 9 math for grade 9 students overall, Hispanic students, students with an Individualized Education Program, and multilingual learner students, 2014/15-2022/23



* Significant at $p < .05$.

Note: This figure shows regression coefficients for attending a high school with a newcomer center (a binary variable). The solid bars indicate a strong association with grade 9 math success, while the striped bar indicates no strong association. The study considered an association to be strong if it was statistically significant at the 95 percent confidence level and if having the characteristic or experience was associated with at least a 5 percentage point difference in the likelihood of grade 9 math success. For grade 9 students overall, the coefficient represents the adjusted difference (after other factors are adjusted for) in the likelihood of grade 9 math success for students who attended a high school with a newcomer center compared with otherwise similar students who did not. For student groups of interest, each coefficient represents the adjusted difference in the likelihood of grade 9 math success for students who attended a high school with a newcomer center compared with otherwise similar students in the same student group of interest who did not. Regression results are in table B1 in appendix B, and the list of all variables included in the regression is in table A2 in appendix A.

Source: Authors' analysis based on 2014/15-2022/23, except 2019/20, administrative data from Denver Public Schools.

Implications

This study identified several student characteristics and experiences that were strongly associated with success in grade 9 math in DPS, with some differences for student groups of interest. Some of these findings are consistent with the prior literature (for example, that suspensions and attendance predict high school achievement). Some may warrant more attention within the DPS context (such as the connection between schools hosting newcomer centers and grade 9 math success). Although these associations do not isolate which factors cause some students to be successful or unsuccessful in grade 9 math, learning more about what is driving these associations could help DPS identify promising approaches to increase success for all students.

This study has two overarching implications for DPS and other districts that are interested in successful middle school to high school transitions and grade 9 math success: districts might want to consider learning more about the mechanisms behind experiences that were strongly associated with being successful or unsuccessful in grade 9 math and consider establishing an early warning system to identify students for additional supports.

Consider learning more about the mechanisms behind experiences that were strongly associated with grade 9 math success, including suspensions, attendance, school demographics, and attending a school with a newcomer center

Investigate discipline: DPS might explore the mechanisms through which suspensions are associated with being unsuccessful in grade 9 math, the experiences of students who are suspended, and whether implementing alternative disciplinary approaches could improve grade 9 math success. Paralleling other research that shows that being suspended or attending a school with a high rate of suspensions predicts lower high school math achievement

(Ibrahim & Johnson, 2020; Perry & Morris, 2014), this study found that experiencing any suspension in middle school was the factor most strongly associated with being unsuccessful in grade 9 math, for students overall and for multilingual learner students. As discussed in the Findings section, there are multiple mechanisms through which being suspended might be associated with being unsuccessful in grade 9 math, including lost instructional time and other factors, such as stress, that might simultaneously influence students' behavior and learning. Further, students who are less engaged academically might also be more likely to exhibit disruptive behaviors and be suspended, in which case lower engagement may be driving both suspensions and lack of success in grade 9 math. An effective and consistent discipline policy that offers supports and consequences to students as needed is a priority for DPS. As DPS continues to refine its discipline policies, it might consider learning more about the experiences of students who are suspended; why being suspended is negatively associated with grade 9 math success; and whether strategies to reduce suspensions or apply alternative discipline strategies can improve academic outcomes for all students, including those who exhibit disruptive behavior and other students who might be exposed to disruptive behavior.

Study attendance: Examine current programs that aim to increase attendance or pilot new evidence-based attendance interventions. Higher attendance in middle school was strongly associated with being successful in grade 9 math, which is in line with prior research linking poor attendance to lower academic outcomes (Allensworth & Easton, 2007; Gottfried, 2010). DPS is focused on increasing attendance for all students and reducing chronic absenteeism (Denver Public Schools, 2024). This study finding provides further evidence to support these efforts. DPS might want to examine current programs that aim to increase attendance or pilot new evidence-based attendance interventions, such as “excessive absences” policies, which take credits away from students who miss a certain number of days or enroll them in truancy intervention programs (Railsback, 2004).

Consider high school composition: Learn more about factors shaping success at high schools with high enrollment of Hispanic students or students who are eligible for the NSLP. For grade 9 students overall and for Hispanic students, attending a high school with above-average Hispanic enrollment was associated with grade 9 math success, but attending a high school with above-average enrollment of students eligible for the NSLP was associated with being unsuccessful in grade 9 math, though neither students' individual ethnicity nor their NSLP eligibility was strongly associated. This finding is consistent with other studies showing that schools' ethnic or socioeconomic composition is more important than individual characteristics in explaining differences in math achievement (Armor et al., 2018; Mickelson et al., 2013). At the same time, this finding is inconsistent with prior literature showing that attending schools with high concentrations of racial/ethnic minorities, including Hispanic students, has a small, negative association with math achievement (Mickelson et al., 2013).

As discussed in the Findings section, some researchers hypothesize that attending school with similar peers can have a supportive effect on achievement (Chung & Kim, 2024; Haskell, 2023). That could explain why this study found that attending a high school with above-average Hispanic enrollment is positively associated with grade 9 math success. Alternatively, other unobserved factors at schools with above-average enrollment of Hispanic students or students eligible for the NSLP could be driving these associations. To better understand these associations, DPS could consider conducting research to identify whether a school's composition causes changes in grade 9 math achievement. DPS might also explore the experiences of Hispanic students who attend schools with more peers who share their background and of students who attend schools with high concentrations of students eligible for the NSLP. Additionally, a positive school climate can shape the association between school socioeconomic composition and academic outcomes (Berkowitz et al., 2016). DPS might consider research that examines whether offering additional supports to improve school climate at high schools with high proportions of students eligible for the NSLP improves math success.

Understand newcomer centers: Learn more about the characteristics, selection criteria, and supports for schools with a newcomer center and whether this model affects math success. According to DPS, newcomer centers aim to support positive student outcomes. However, this study found that grade 9 students who attended a school that hosted a newcomer center were less likely to succeed in grade 9 math, even after other student characteristics

and average school achievement were controlled for. As discussed, being unsuccessful in grade 9 math is not likely to be driven by newcomer center programming because most students attending these schools are not classified as newcomers and so would not receive newcomer center supports. There are several other possible explanations for the association between attending a high school with a newcomer center and being unsuccessful in grade 9 math. For example, schools chosen to host newcomer centers may differ from other schools in ways that are not captured in the study data. Similarly, the characteristics and experiences of the students who attend schools with newcomer centers may differ in unobserved ways from those of students attending other schools. Whatever the explanation, understanding what might be behind the negative association between schools with a newcomer center and grade 9 math success warrants additional attention from DPS. DPS could collect more information about schools hosting newcomer centers and the experiences of students attending those schools. For example, DPS could consider conducting research to understand any differences between students who are served by a newcomer center and those who are not to generate evidence on how to enhance the programs implemented in these schools to meet DPS policy goals.

Consider creating and evaluating an early warning system to identify students for additional supports

DPS might consider developing an early warning system to identify students for additional supports based on middle school factors that are associated with grade 9 math success—and, more generally, a successful transition from middle school to high school. For example, the Regional Educational Laboratory Midwest and the Midwest Dropout Prevention Alliance created an early warning data tool to identify students who were not on track for on-time graduation and studied its implementation and impacts (Faria et al., 2017). The study found that the early warning system improved outcomes in chronic absenteeism and course failure, which are leading indicators of on-time graduation. DPS might consider a similar approach focused on improving grade 9 math success. The system could include some of the middle school student experiences that were strongly negatively associated with grade 9 math success, such as being suspended, having a lower attendance rate, receiving any failing grade in a math course, and not meeting the CMAS ELA exam proficiency benchmark.

Once the early warning system identifies these students, DPS could explore whether offering them additional supports, such as attendance incentives or tutoring, increases grade 9 math success. If it does, DPS might consider expanding the early warning system to other outcomes of interest, such as ELA success or on-time graduation.

References

- Allensworth, E. M., Gwynne, J. A., Moore, P., & De la Torre, M. (2014). *Looking forward to high school and college: Middle grade indicators of readiness in Chicago Public Schools*. University of Chicago, Consortium on Chicago School Research. <https://eric.ed.gov/?id=ED553149>
- Allensworth, E. M., & Easton, J. Q. (2007). *What matters for staying on-track and graduating in Chicago Public High Schools: A close look at course grades, failures, and attendance in the freshman year*. University of Chicago, Consortium on Chicago School Research. <https://eric.ed.gov/?id=ED498350>
- Armor, D. J., Marks, G. N., & Malatinszky, A. (2018). The impact of school SES on student achievement: Evidence from U.S. statewide achievement data. *Educational Evaluation and Policy Analysis*, 40(4), 613-630. <https://eric.ed.gov/?id=EJ1195473>
- Balfanz, R. (2009). *Putting middle grades students on the graduation path* (Policy and practice brief). National Middle School Association. https://www.amle.org/wp-content/uploads/2020/04/Policy_Brief_Balfanz.pdf
- Berkowitz, R., Moore, H., Astor, R. A., & Benbenishty, R. (2016). A research synthesis of the associations between socioeconomic background, inequality, school climate, and academic achievement. *Review of Educational Research*, 87(2), 425-469. <https://eric.ed.gov/?id=EJ1133356>

- Casing, P. I., & Casing, L. M. R. (2024). Fostering students' mathematics achievement through after-school program in the 21st century. *American Journal of Education Research*, 12(3), 118-122. <https://eric.ed.gov/?id=ED645884>
- Chung, W., & Kim, J. (2024). *The racial gap in friendships among high-achieving students* (EdWorkingPaper No. 24-1025). Annenberg Institute for School Reform at Brown University. <https://eric.ed.gov/?id=ED660151>
- Denver Public Schools. (2024). *Attendance*. Retrieved October 29, 2024, from <https://www.dpsk12.org/page/attendance>
- Dietrichson, J., Filges, T., Klokke, R. H., Viinholt, B. C. A., Bøg, M., & Jensen, U. H. (2020). Targeted school-based interventions for improving reading and mathematics for students with, or at risk of, academic difficulties in grade 7-12: A systematic review. *Campbell Systematic Reviews*, 16(2). <https://eric.ed.gov/?id=EJ1265997>
- Easton, J. Q., Johnson, E., & Sartain, L. (2017). *The predictive power of ninth-grade GPA*. University of Chicago, Consortium on School Research. <https://consortium.uchicago.edu/sites/default/files/2018-10/Predictive%20Power%20of%20Ninth-Grade-Sept%202017-Consortium.pdf>
- Egalite, A. J., Kisida, B., & Winters, M. A. (2015). Representation in the classroom: The effect of own-race teachers on student achievement. *Economics of Education Review*, 45, 44-52. <https://doi.org/10.1016/j.econedurev.2015.01.007>
- Faria, A. M., Sorensen, N., Heppen, J., Bowdon, J., Taylor, S., Eisner, R., & Foster, S. (2017). *Getting students on track for graduation: Impacts of the Early Warning Intervention and Monitoring System after one year* (REL 2017-272). U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Midwest. <https://ies.ed.gov/ncee/edlabs>
- Gottfried, M. A. (2010). Evaluating the relationship between student attendance and achievement in urban elementary and middle schools: An instrumental variables approach. *American Educational Research Journal*, 47(2), 434-465. <https://eric.ed.gov/?id=EJ887169>
- Grissom, J. A., Kabourek, S. E., & Kramer, J. W. (2020). Exposure to same-race or same-ethnicity teachers and advanced math course-taking in high school: Evidence from a diverse urban district. *Teachers College Record*, 122(7), 1-42. <https://eric.ed.gov/?id=EJ1271703>
- Haskell, N. (2023). The effects of being racially, ethnically, & socioeconomically different from peers. *Social Science Research*, 112, Article 102808.
- Ibrahim, H., & Johnson, O. (2020). School discipline, race-gender and STEM readiness: A hierarchical analysis of the impact of school discipline on math achievement in high school. *The Urban Review*, 52(1), 75-99. <https://eric.ed.gov/?id=EJ1241809>
- Keppens, G. (2023). School absenteeism and academic achievement: Does the timing of the absence matter? *Learning and Instruction*, 86, Article 101769. <https://doi.org/10.1016/j.learninstruc.2023.101769>
- Lauer, P. A., Akiba, M., Wilkerson, S. B., Apthorp, H. S., Snow, D., & Martin-Glenn, M. L. (2006). Out-of-school-time programs: A meta-analysis of effects for at-risk students. *Review of Educational Research*, 76(2), 275-313.
- Lindsay, C., Monarrez, T., & Luetmer, G. (2021). *The effects of teacher diversity on Hispanic student achievement in Texas*. Urban Institute. <https://eric.ed.gov/?id=ED618246>
- Mac Iver, M., Balfanz, R., & Byrnes, V. (2009). *Dropouts in the Denver Public Schools: Early warning signals and possibilities for prevention and recovery*. Johns Hopkins University, Center for Social Organization of Schools.
- Mickelson, R. A., Bottia, M. C., & Lambert, R. (2013). Effects of school racial composition on K-12 mathematics outcomes: A metaregression analysis. *Review of Educational Research*, 83(1), 121-158. <https://eric.ed.gov/?id=EJ994764>

- National Center for Education Statistics (2023). *Concentration of public school students eligible for free or reduced-price lunch*. <https://nces.ed.gov/programs/coe/indicator/clb/free-or-reduced-price-lunch>
- Neild, R. C. (2009). Falling off track during the transition to high school: What we know and what can be done. *The Future of Children*, 19(1), 53-76. <https://eric.ed.gov/?id=EJ842047>
- Nickow, A., Oreopoulos, P., & Quan, V. (2020). *The impressive effects of tutoring on preK-12 learning: A systematic review and meta-analysis of the experimental evidence*. National Bureau of Economic Research. <https://eric.ed.gov/?id=ED608491>
- Nomi, T., Raudenbush, S., & Smith, J. (2021). Effects of double-dose algebra on college persistence and degree attainment. *Proceedings of the National Academy of Sciences*, 118(207), 1-12. <https://doi.org/10.1073/pnas.2019030118>
- Palardy, G., Rumberger, R., & Butler, T. (2015). The effect of high school socioeconomic, racial, and linguistic segregation on academic performance and school behaviors. *Teachers College Record*, 117(12), 1-52. <https://eric.ed.gov/?id=EJ1080053>
- Perry, B. L., & Morris, E. W. (2014). Suspending progress: Collateral consequences of exclusionary punishment in public schools. *American Sociological Review*, 79(6), 1067-1087.
- Qiu, X., & Wu, S. (2019). Contextual variables of student math proficiency and their geographic variations in Missouri. *Applied Geography*, 109, Article 102040. <https://doi.org/10.1016/j.apgeog.2019.102040>
- Railsback, J. (2004). *Increasing student attendance: Strategies from research and practice*. Northwest Regional Educational Laboratory. <https://eric.ed.gov/?id=ED484551>
- Rearson, S. F. (2015). *School segregation and racial academic achievement gaps* (CEPA Working Paper No. 15-12). Stanford Center for Education Policy Analysis. <https://eric.ed.gov/?id=ED580373>
- Rice, J. K. (1997, March). *Explaining the negative impact of the transition from middle to high school on student performance in mathematics and science: An examination of school discontinuity and student background variables*. Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, IL. <https://eric.ed.gov/?id=ED409183>
- Riegle-Crumb, C. (2006). The path through math: Course sequences and academic performance at the intersection of race-ethnicity and gender. *American Journal of Education*, 113(1), 101-122. <https://eric.ed.gov/?id=EJ750308>
- Roderick, M., & Camburn, E. (1999). Risk and recovery from course failure in the early years of high school. *American Educational Research Journal*, 36(2), 303-343. <https://eric.ed.gov/?id=EJ600524>
- Schiller, K. S., & Hunt, D. J. (2011). Secondary mathematics course trajectories: Understanding accumulated disadvantages in mathematics in grade 9-12. *Journal of School Leadership*, 21(1), 87-118. <https://eric.ed.gov/?id=EJ923547>
- Schwartz, H. (2012). Housing policy is school policy: Economically integrative housing promotes academic success in Montgomery County, Maryland. In R. D. Kahlenberg (Ed.), *The future of school integration* (pp. 27-65). The Century Foundation.
- Smerillo, N. E., Reynolds, A. J., Temple, J. A., & Ou, S. R. (2018). Chronic absence, eighth-grade achievement, and high school attainment in the Chicago Longitudinal Study. *Journal of School Psychology*, 67, 163-178.
- Taylor, E. (2014). Spending more of the school day in math class: Evidence from a regression discontinuity in middle school. *Journal of Public Economics*, 117, 162-181.
- Welsh, R. O. (2017). School hopscotch: A comprehensive review of K-12 student mobility in the United States. *Review of Educational Research*, 87(3), 475-511. <https://eric.ed.gov/?id=EJ1141804>