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Understanding the Relationships between Poverty, School Factors and Student Achievement

PREPARED BY:

Cara Jackson, Ph.D.

Kecia L. Addison, Ph.D.

Applied Research

850 Hungerford Drive
Rockville, Maryland 20850
301-740-3000

Dr. Jack R. Smith
Superintendent of Schools

Dr. Janet S. Wilson
Associate Superintendent, Office of Shared Accountability

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Executive Summary

The Office of Shared Accountability (OSA) in Montgomery County Public Schools (MCPS) conducted a study to examine the impact of student poverty on student achievement. This is the first study in MCPS to examine student poverty longitudinally. Using longitudinal data, students enrolled in Free and Reduced-priced Meals System (FARMS) services every year between kindergarten and Grade 5 were defined as persistently impacted by poverty, while students who received FARMS services in some years but not every year between kindergarten and Grade 5 were considered transitorily impacted by poverty.

The purpose of this quantitative descriptive study was to explore the relationship between poverty, school factors, and student achievement. Drawing on previous literature regarding student and school factors that influence student achievement gains, this work explores whether these factors explain variation in student achievement gains across schools in MCPS. Information included in this report can inform school and district leaders of areas that need increased attention to improve student performance and lead to equity of access for all.

The following research questions were examined for the 2016–2017 cohort of Grade 5 students.

1) What is the nature of poverty-based achievement gaps among MCPS Grade 5 students?
    a. How do gaps compare between students transitorily and persistently impacted by poverty?
    b. How do students persistently impacted by poverty compare to their peers who were less impacted by poverty?

2) How do elementary schools serving high concentrations of students persistently impacted by poverty compare to MCPS schools with lower concentrations of students persistently impacted by poverty among key school factors, including student attendance, school climate, and the proportion of novice teachers?

3) Do school factors of poverty, attendance, school climate, and proportion of novice teachers explain differences between schools in student achievement gains?

Methodology

Quantitative descriptive statistics were used to examine relationships between student poverty and student achievement, and school factors and student achievement, as measured by Partnership for Assessment of Readiness for College and Careers (PARCC) and Measures of Academic Progress (MAP) assessments. The analyses include exploration of student characteristics and achievement from kindergarten through Grade 5. Statistical procedures included analysis of variance and multilevel regression models. More detailed descriptions of the statistical approaches are provided in the Methodology section of the report.

Summary of Findings

The nature of poverty-based achievement gaps among MCPS Grade 5 students

Comparing students who received FARMS services to those who did not, the gap in Grade 5 PARCC scores was 0.88 standard deviations for mathematics and 0.87 standard deviations for English Language Arts (ELA). Achievement gaps were wider for students persistently impacted by poverty compared to students transitorily impacted by poverty. Observable characteristics, such as students' race/ethnicity and gender, reduced but did not fully explain poverty-based achievement gaps. In general, average achievement scores decreased as the number of years of poverty impact increased. Relative to students never impacted by poverty, students in persistent poverty were more likely to be English language learners and receiving special education services; they had lower attendance rates and were less likely to be enrolled in Math 5/6.

Comparisons of elementary schools serving higher and lower proportions of students persistently impacted by poverty.

Schools that served the highest concentration of students impacted by persistent poverty had significantly higher proportions of Black or African American and Hispanic/Latino students and higher proportions of students with limited English proficiency, compared to schools serving the lowest concentration of students persistently impacted by poverty. In addition, schools that served the highest concentrations of students persistently impacted by poverty had lower proportions of students enrolled in Math 5/6 and lower average daily attendance relative to schools serving fewer students impacted by poverty. In schools serving higher proportions of students in persistent poverty, staff perceptions of school climate were less positive relative to perceptions of school climate in low-poverty schools. Higher poverty schools had lower test scores than schools serving lower concentrations of students persistently impacted by poverty.

School factors related to differences in student achievement gains

After controlling for a variety of student factors, school poverty and school climate were not related to student achievement gains. The proportion of novice teachers in a school was not related to PARCC mathematics gains, but students in schools with more novice teachers had significantly lower gains on PARCC ELA. Students in schools with higher average daily attendance had higher PARCC ELA gains. Though school attendance was not a significant predictor of PARCC mathematics, there was a significant cross-level interaction between school attendance and persistent poverty, such that persistently impacted students had higher gains in PARCC mathematics in schools with higher average attendance.

Understanding the Relationships between Poverty, School Factors, and Student Achievement

Cara Jackson, Ph.D.
Kecia L. Addison, Ph.D.

Introduction

The observed, persistent disparities in academic performance between groups of students is an issue that has garnered national interest. These inequities in achievement outcomes can be measured by examining differences based on socioeconomic status, race/ethnicity, and special services (i.e., special education, limited English proficiency). Historically, the children most at risk for academic failure have been children of color, specifically African American and Latino youth, and those impacted by poverty. To achieve educational equity in schools, differences in achievement outcomes that exist among diverse and underrepresented groups must be addressed, and doing so has become a priority for many school districts. Montgomery County Public Schools (MCPS) and its community partners have a history of engaging in efforts to mitigate the impact of poverty on student achievement. Although these efforts have been successful for some, inequities in achievement related to student poverty persist.

As stated by McCall, Hauser, Cronin, Kingsbury, and Houser (2006), inequitable achievement is "a perennial topic in U.S. educational policy and research" (p. 2). Recent research suggests that more refined measures of student poverty may be useful for understanding these differential achievement outcomes (Michelmore & Dynarski, 2017). Examining how poverty is related to student achievement can inform ongoing efforts to ensure all students have opportunities to learn and enable stakeholders to more efficiently target resources and develop policies to address inequities that exist within MCPS. In addition, obtaining a more in-depth understanding of school factors related to student achievement can help in identifying practices that have the greatest potential to address inequities that exist and support academic excellence for all students.

Purpose

The purpose of this quantitative descriptive study was to explore the relationship between poverty, school factors, and student achievement to help MCPS identify factors related to inequities in achievement. This study replicates research conducted by Michelmore and Dynarski (2017), who examined the relationship between different levels of student poverty and student test scores. Drawing on previous literature regarding student and school factors that influence student achievement gains, this work also explores whether these factors explain variation in student achievement gains across schools in MCPS. Consistent with "school-effects research" (Raudenbush & Willms, 1995), this study explored how school factors including school-level poverty, schoolwide attendance, school climate, and the proportion of novice teachers were associated with mathematics and English language arts test scores across schools. This study examines the effect of poverty across multiple years on student academic achievement. The longitudinal data allow for creating levels of poverty quantified by the number of years students

were impacted by poverty. By focusing on the cohort of students in Grade 5 during the 2016–2017 school year, it is possible to explore the relationship between poverty and student achievement across all years in elementary school. Information included in this report can inform school and district leaders of areas that need increased attention to improve student performance and lead to equity of access for all.

Literature Review

Attendance and Absenteeism

At the student level, attendance is a prerequisite for having an opportunity to learn, and several studies have documented a relationship between absenteeism and student outcomes (Baltimore Education Research Consortium, 2011; Goodman, 2014; Gottfried, 2014; Gottfried, 2015; Romero & Lee, 2007). Romero and Lee (2007), based on a descriptive quantitative analysis of a nationally representative dataset, found that chronic absenteeism in kindergarten was associated with lower achievement in reading and mathematics in later grades, even after controlling for a variety of student characteristics. Additionally, chronic absenteeism was linked to poor socio-emotional outcomes in a study using a nationally representative dataset and robust empirical methods that (Gottfried, 2014). A study set in Baltimore that used logistic regression found that chronic absenteeism successfully predicted whether students graduated from high school (Baltimore Education Research Consortium, 2011). Student absences were strongly related to achievement, particularly in math, based on data from Massachusetts analyzed with student and school fixed effects models (Goodman, 2014). These results were confirmed using models that were able to disentangle the impact of student absences from the impact of school closures. In addition to impacts on students' own achievement, chronically absent students were found to have spillover effects on their classmates' reading and mathematics testing outcomes, based on a study that used a longitudinal dataset with comprehensive information on entire cohorts within a large urban district (Gottfried, 2015).

Enrichment and Acceleration

Differences in student achievement may also stem from differential access to enriched curriculum and accelerated instruction. In one study using nationally representative data, advanced middle school mathematics courses boosted student achievement, though a positive impact may be contingent on student academic readiness (Domina, 2014). Results from a meta-analysis indicated that acceleration had a positive impact on high-ability learners' academic achievement (Steenbergen-Hu & Moon, 2011). Yet low-income students were underrepresented in gifted education programs (Card & Giuliano, 2015), and were less likely to take advanced math courses (DeArmond, Denice, Gross, Hernandez, & Jochim, 2015). These findings suggest that differential access to enriched or accelerated instruction may pay a role in explaining variation in student achievement.

School Factors and Student Achievement

Numerous aspects of school climate are salient to students' outcomes, both directly and through the impact climate has on teachers. In New York City, increases in school safety and academic expectations, as measured by school climate surveys, corresponded with student achievement gains (Kraft, Marinell, & Yee, 2016). School leadership (Boyd, 2011; Johnson, Berg, & Donaldson, 2005; Ladd, 2011), teacher collaboration and shared goals (Rosenholtz, 1989), relational trust (Bryk & Schneider, 2002), and school personnel's shared meanings and patterns of behavior (Rinke & Valli, 2010) were found to be aspects of school climate that impacted teachers' satisfaction and professional growth. Teachers working in more supportive professional environments improve more over time than their peers in less supportive environments (Kraft & Papay, 2014). One research synthesis of studies published between 2000 and 2015 found that a positive school climate mediates the relationship between student and school socioeconomic status and academic achievement (Berkowitz, Moore, Astor, & Benbenishty, 2017).

In addition to the role of school climate, differences across schools in teacher quality may influence student achievement. Numerous studies demonstrate that, on average, new teachers are less effective than those with some teaching experience (Rice, 2013). Prior studies have demonstrated that teachers are unevenly distributed both within schools, such that students in lower academic tracks have had less well-qualified teachers (Kelly, 2004; Oakes, 1990), and across schools, such that qualifications of teachers tend to be lower in disadvantaged, low-income, and high-minority schools (Clotfelter, Ladd, Vigdor, & Wheeler, 2007; Rivkin, Hanushek, & Kain, 2005). Inequity in the distribution of novice teachers within and across schools may contribute to achievement gaps between more and less advantaged students.

Poverty and Student Achievement

Researchers have extensively documented the relationship between poverty (often measured by eligibility for subsidized meals) and student achievement. Studies have examined both the relationship between the socioeconomic background of families and student achievement and the relationship between school-level poverty and student achievement.

At the student level, a meta-analysis of 75 independent samples from 58 published journal articles conducted by Sirin (2005) found a medium to strong relationship between family socioeconomic status and students' achievement. In another study that applied descriptive quantitative analyses to longitudinal data, Michelmore and Dynarski (2017) found a negative, linear relationship between the number of years eligible for subsidized meals and eighth-grade test scores. Research conducted by Reardon (2011) indicates that the gap in standardized test scores between students from low-income families (at the 10th percentile of the income distribution) and their peers from high-income families (at the 90th percentile) was found to be 40 percent larger than it was 25 years ago (Reardon, 2011). Further, the test score gap between students from low-income and high-income families was twice as large as the test score gap between Black and White students (Reardon, 2011).

At the school level, researchers have used the school aggregate of students eligible for subsidized meals (i.e. the proportion of students receiving free or reduced-price meals) to assess the contextual

effect of concentrated poverty, with varied findings. In one study, researchers found that students in high socioeconomic status schools had more positive academic growth compared to their counterparts in low- and mixed-socioeconomic status schools (Belfi, Haelermans, & Fraine, 2016). Another study found that serving a higher proportion of students eligible for subsidized meals was negatively related to fifth-grade students' reading achievement, though the relationship was not statistically significant for mathematics (Goddard, Goddard, & Kim, 2015). Similarly, Raudenbush (2004) found slightly higher rates of reading growth in low poverty schools compared to high poverty schools, but school poverty concentration was not statistically related to growth rates for mathematics.

Research Questions

The following research questions were examined:

1) What is the nature of poverty-based achievement gaps among MCPS Grade 5 students?
    a. How do gaps compare between students transitory and persistently impacted by poverty?
    b. How do students persistently impacted by poverty compare to their peers who were less impacted by poverty?

2) How do elementary schools serving high concentrations of students persistently impacted by poverty compare to MCPS schools with lower concentrations of students persistently impacted by poverty among key school factors, including student attendance, school climate, and the proportion of novice teachers?

3) Do school factors of poverty, attendance, school climate, and proportion of novice teachers explain differences between schools in student achievement gains?

Methodology

Quantitative descriptive statistics were used to examine relationships between student poverty and student achievement, and school factors and student achievement, as measured by Partnership for Assessment of Readiness for College and Careers (PARCC) and Measures of Academic Progress (MAP) assessments. The analyses include exploration of student characteristics and achievement from kindergarten through Grade 5.

Analytic Sample

The sample consisted of a cohort of 12,900 Grade 5 students in MCPS during the 2016–2017 school year. The percent of Grade 5 students who received Free and Reduced-priced Meals System (FARMS) services ranged from 0 to 93 percent across schools, with an average of 36 percent of Grade 5 students receiving FARMS services.

Study Measures

Academic Outcomes. Student achievement was measured using test scores on PARCC and MAP. These measures are described below.

- *Partnership for Assessment of Readiness for College and Careers (PARCC).* PARCC is the state of Maryland's end-of-year mathematics and English Language Arts (ELA) assessments. The PARCC assessments measure students' achievement relative to college and career readiness standards in English language arts/literature (ELA) and mathematics. PARCC ELA focuses on text analysis and effective writing, while PARCC mathematics focuses on applications of skills and concept and multistep problem solving. PARCC scores from school year 2016–2017 were used as the outcome, and PARCC scores from school year 2015–2016 (when the students in the sample were in Grade 4) were used a control variable in a number of analyses. For most analyses, scores were standardized within year, and are therefore interpreted as standard deviations and capture a student's performance relative to other students in MCPS who were part of the cohort of Grade 5 students in school year 2016–2017.

- *Measures of Academic Progress (MAP).* MAP is a computer adaptive, nationally normed assessment. MAP mathematics was designed to measure the following areas: operations and algebraic thinking, numbers and operations, measurement and data, and geometry. RIT (Rasch unIT) vertically equated scores range from 100 to 300 and are used to measure student achievement and growth. This study used MAP mathematics RIT scores from school year 2011–2012 (when the students in this cohort were in kindergarten) through school year 2016–2017 (when the students were in Grade 5). For some analyses, MAP scores were standardized within the school year, and are therefore interpreted as standard deviations and capture a student's performance relative to other students in MCPS who were part of the cohort of Grade 5 students in school year 2016–2017.

Student characteristics. Indicators of student race/ethnicity, gender, and whether the student had limited English proficiency (LEP) or received special education services (special education) during school year 2016–2017 were examined. Student socioeconomic status indicators were generated using longitudinal data on students' receipt of FARMS. These indicators are defined as follows:

1. Persistently impacted by poverty – Students who received FARMS services every year between kindergarten and Grade 5
2. Transitory poverty – Students who received FARMS services in some years but not every year between kindergarten and Grade 5
3. Never impacted – Students who did not receive FARMS services in any year between kindergarten and Grade 5

The dataset also included information on students' average daily attendance rate (attendance), an indicator of whether the student had been in MCPS every year between kindergarten and Grade 5

(always MCPS), and an indicator of whether the student was enrolled in accelerated and enriched instruction in mathematics during Grade 5 (Math 5/6).

School factors. A variety of school factors were examined. Each of these factors is described below.

- *Median household income*: median income of households in the zip code in which the school is located. Obtained from the American Community Survey.
- *School poverty*: the proportion of Grade 5 students receiving FARMS services during school year 2016–2017. Schools in which 30 percent or more of the students were persistently impacted by poverty were considered high poverty; schools in which 9 percent or fewer of the students were persistently impacted by poverty were considered low poverty. See Appendix A for a list of schools by percent of students persistently impacted by poverty.
- *Average attendance*: the average of average daily attendance for students in Grade 5 during school year 2016–2017.
- *School climate*: constructed by conducting factor analysis of aggregated teacher responses to a school climate survey. Responses from 3,876 Montgomery County Education Association staff (most of whom are teachers) in elementary schools in school year 2016–2017 informed the school climate results. The school climate survey includes 17 items that measure perceptions of the school environment (see Appendix B for a list of items and factor loadings).
- *Percent of new teachers*: the proportion of teachers in the first year of teaching.

Data Analyses

To examine the first research question, the SPSS MIXED procedure was used to adjust for correlation in test scores among students nested within the same school. Test scores gaps were estimated using multilevel regression models both with and without controls for student characteristics, school fixed effects, and the median household income of the zip code in which the school is located. Average PARCC scores by number of years receiving FARMS services were obtained by regressing fifth-grade scores against a set of six dummies that indicate the number of years that a student received FARMS services between kindergarten and fifth grade; the regressions also included the demographic controls. In the analyses of average MAP mathematics scores in each grade from kindergarten through Grade 5, the sample was limited to students with data on FARMS status and MAP mathematics test scores in every year between kindergarten and fifth grade.

To answer the second research question, the sample of schools was divided into three categories based on the proportion of students persistently impacted by poverty, as described in the measures section. Group means for schools in these categories were computed for all model variables, and analysis of variance (ANOVA) was used to compare school characteristics of schools serving higher and lower concentrations of students persistently impacted by poverty. These descriptive analyses explore how the characteristics of students and schools vary according to the school level of poverty.

The third research question is consistent with "school-effects research" (Raudenbush & Willms, 1995), in that it investigated how school factors were associated with mathematics and English language arts test scores across schools. Analyses for research question 3 used SPSS MIXED to estimate multilevel regression models, which is equivalent to estimation based on school averages and adjusts for correlation in test scores among students nested within the same school. Models were estimated separately for each outcome, where the outcome being estimated is the mathematics or ELA PARCC scores of a given student in a given school. Models include whether the student experienced persistent or transient poverty, race/ethnicity, English language learner status, receipt of special education services, whether the student had been in MCPS throughout elementary school, and the prior year test score in the same subject. The school variables (school poverty, attendance, climate, and proportion of novice teachers) were each examined in a separate model.

Limitations

Limitations of this study are related to study design and narrow outcomes. As a quantitative descriptive analysis, one limitation of this research is the inability to answer whether specific student or school factors cause student achievement gains. The descriptive analyses presented here are exploratory and cannot be interpreted as causal impacts of various factors related to student achievement gains. Another limitation of this study is that it looks only at standardized test scores. While some of the school factors examined here do not appear to impact achievement on state assessments, these school factors may matter for other outcomes of interest not examined here, such as students' behavior or persistence in educational obtainment.

Results

An overall descriptive analysis of the sample is presented first, followed by more detailed findings for each research question. As seen in Table 1, among Grade 5 students in school year 2016–2017, 54 percent had never received FARMS services, 22 percent had received FARMS services every year of elementary school and 24 percent had received FARMS services in some years but not others. White students were overrepresented in the never FARMS category relative to their proportion among all fifth grades, while Black or African American and Hispanic/Latino students were overrepresented among students in poverty, whether measured by ever FARMS, persistent or transitory poverty, or current FARMS. Students never impacted by poverty live in wealthier neighborhoods, as indicated by the median household income of nearly $120,000, and few were in schools with high poverty levels. In contrast, students persistently impacted by poverty lived in neighborhoods where the median household income is approximately $84,000 and nearly 70 percent attended schools in which 50 percent or more of the students received FARMS services.

Table 1
MCPS Context: Characteristics of Fifth Graders by Poverty Indicators, School Year

			Persistence Measures			Contemporaneous Measures	
Variable	All fifth graders	Never Impacted by Poverty	Ever Impacted by Poverty	Persistent Poverty	Transitory Poverty	FARMS	Not FARMS
Share of total sample	100%	54%	46%	22%	24%	37%	63%
Share of ever received FARMS			100%	47%	53%		
Ever received FARMS	46%	0%	100%	100%	100%	100%	14%
Number of years received FARMS	2.02	0.00	4.41	6.00	2.98	4.78	0.40
Proportion of years received FARMS	39%	0%	86%	100%	73%	94%	7%
Female	48%	48%	49%	48%	50%	49%	49%
White	29%	49%	5%	3%	8%	4%	43%
Black or African American	21%	13%	31%	30%	33%	31%	15%
Hispanic/Latino	31%	12%	53%	61%	46%	56%	16%
Characteristics of home zip code							
Median household income (2015$)	104,499	119,702	86,518	84,148	88,654	85,051	115,899
Characteristics of school in Grade 5							
White	29%	39%	18%	16%	19%	17%	37%
Black or African American	21%	16%	26%	26%	26%	26%	18%
Hispanic/Latino	30%	21%	41%	45%	38%	43%	23%
Fraction of school received FARMS							
50%-75%	24%	13%	36%	37%	35%	36%	16%
75%-90%	13%	3%	25%	29%	22%	27%	5%
Over 90%	1%	0%	2%	3%	2%	3%	0%
Number of observations	12,900	6,990	5,910	2,801	3,109	4,767	8,133

Source. OSA data files. Students who were in fifth grade during 2016–2017. Median household income from the American Community Survey 5-year averages (2010 to 2014).

Findings for Research Question 1

1) What is the nature of poverty-based achievement gaps among MCPS Grade 5 students?
    a. How do gaps compare between students transitory and persistently impacted by poverty?
    b. How do students persistently impacted by poverty compare to their peers who were less impacted by poverty in terms of demographics and educational opportunities?

Poverty-based achievement gaps among MCPS Grade 5 students were wider for students persistently impacted by poverty. Initially, models were estimated using the conventional measure of the income gap in academic achievement by comparing the scores of students who did not receive FARMS services to students who did receive FARMS services during the school year in which they were tested. The gap in Grade 5 PARCC scores was 0.88 standard deviations for mathematics and 0.87 standard deviations for English language arts (see Table 2).

Table 2
Gaps in Achievement (in standard deviation units) by Poverty Definition for Grade 5 Students: 2016–2017

Subject	**Mathematics score difference**		**English Language Arts score difference**	
Measure	PARCC	MAP	PARCC	MAP
Contemporaneous measure				
Not FARMS v. FARMS	.88	.86	.87	.86
Persistence measures				
Never v. transitorily impacted	.87	.84	.82	.81
Never v. persistently impacted	.99	.98	1.00	.97
Transitorily v. Persistently impacted by poverty	.12	.14	.18	.17
Number of observations	11,222	11,155	11,081	11,122

Source. OSA data files.
Note. Mathematics and ELA test scores standardized by grade and year.

Achievement gaps observed were wider for students persistently impacted by poverty compared to those who were never impacted by poverty. In both mathematics and English language arts, the score difference between students never impacted by poverty and students persistently impacted by poverty was about a standard deviation (Table 2); in mathematics, the score difference is just over 10 percent larger than the conventional measure and in English language arts, the score difference is 15 percent larger than the conventional measure.

Observable characteristics reduced but did not fully explain poverty-based achievement gaps. A key question is whether observable characteristics, such as race, ethnicity, gender, or school characteristics, can "explain" achievement differences of students impacted by poverty and those not impacted by poverty. To explore this question, a multilevel model to account for the clustering of students within schools and adjust for correlation in test scores among students who attend the same school was used (see Table 3). Panel A displays poverty measured based on receipt of FARMS services. Panel B displays measures of persistent poverty, differentiating between those who never received FARMS services between kindergarten and fifth grade (never impacted, the reference group), those who received FARMS services in one or more, but not all years of elementary school (transitorily impacted), and those who received FARMS services all years in elementary school (persistently impacted). Each column/panel combination in Table 3 represents a separate regression. Column 1 (No controls) includes only the measures of poverty, column 2 (+ Demographic controls) adds demographic characteristics, column 3 (+ School FE) adds school fixed effects to control for differences in the quality of schools that students in poverty and students not impacted by poverty may attend, column 4 (+ Zip code income) adds controls of median household income in a household's zip code, and column 5 (+ Prior test scores) includes controls for prior-year test scores.

As seen in Table 3, with no controls in the model, students who received FARMS services scored 0.71 standard deviations lower than those who did not receive FARMS services during the 2016–2017 school year. Using the measures of persistent and transitory poverty, the difference between students who never received FARMS services and those in transitory poverty was 0.73 standard deviations, and the difference between students who never received FARMS services and those persistently impacted by poverty was 0.86 standard deviations. Thus, the differences in achievement vary depending on the measure of disadvantage used; larger gaps were observed for students known to have been impacted by poverty for a longer period of time. Looking at scores instead of standard deviation units, the difference using the conventional measure (current FARMS vs. not FARMS) is 25 points on the 200-point PARCC scale, while the difference between never impacted and persistently impacted is 30 points.

Table 3

Multilevel Regressions of PARCC Mathematics Score Gaps, Fifth Graders in School Year 2016–2017

Variable	No controls	+ Demographic controls	+ School FE	+ Zip code income	+ Prior test scores
Panel A: Current FARMS					
Current FARMS	-.709	-.475	-.465	-.458	-.066
	(.020)	(.020)	(.021)	(.021)	(.012)
Panel B: Years of FARMS					
Persistent poverty	-.856	-.644	-.635	-.627	-.095
	(.023)	(025)	(.026)	(.026)	(.014)
Transitory poverty	-.728	-.490	-.476	-.470	-.060
	(.023)	(.024)	(.024)	(.024)	(.013)
Demographic controls		X	X	X	X
School FE			X	X	X
Zip code controls				X	X
Number of observations	11,222	11,222	11,222	11,222	11,222

Source. OSA data files.

Note. Multilevel regressions of standardized fifth-grade test scores on indicators for subsidized-meal eligibility. Each column in the panel represents a separate regression. Demographic controls consist of race and gender indicators, interactions of race and gender indicators, and whether the student was missing at least 1 year of data between kindergarten and fifth grade. School fixed effects were for fifth-grade school. Zip code income is median household income in fifth-grade zip code from American Community Survey 5-year estimates, 2010 to 2014. Prior test scores measured in fourth grade.

Controls for race/ethnicity and gender, as well as interactions between these variables, were added to the model. Controlling for these variables moderately reduced all of the test score gaps observed (demographic controls), but the gap between students never impacted by poverty and students persistently impacted by poverty (23 points, or 0.64 standard deviations) was nearly 36% larger than the gap based on the conventional measure of current FARMS status (17 points, or 0.48 standard deviations).

Controlling for school fixed effects did little to reduce gaps (+ School FE). School fixed effects control for time-constant characteristics of schools that may partially explain why students in poverty have lower standardized test scores than students not impacted by poverty. Accounting for school fixed effects allows for identifying the test score gap between students impacted by poverty and students not impacted by poverty attending the same school. After including school fixed effects, the within-school gap between students never impacted by poverty and students persistently impacted remains 37% larger than the gap based on the standard measure of current FARMS. The difference in the test score gaps using persistent poverty versus current FARMS status does not appear to be due to differences in the quality of schools that students in poverty attend.

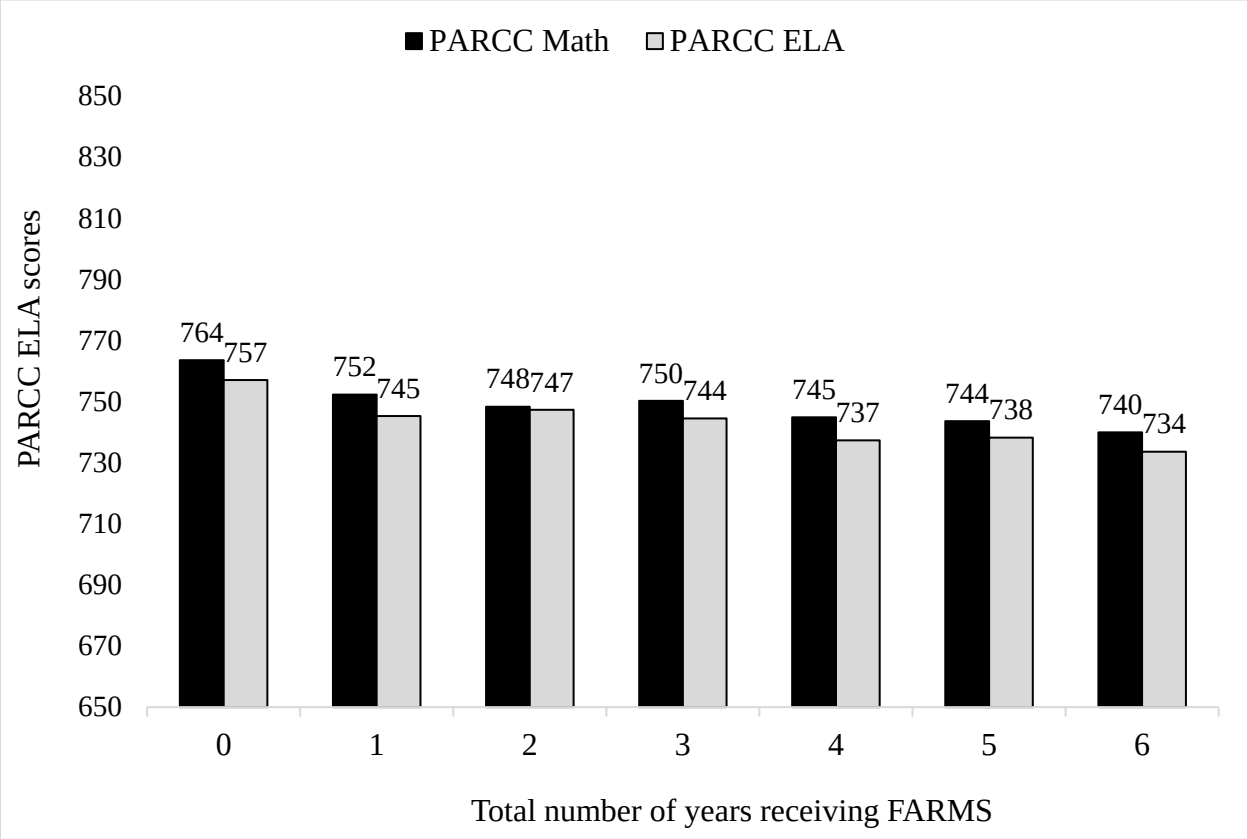
Persistent poverty is not solely a geographic phenomenon. Even within schools, there was substantial variation in the performance of students persistently impacted versus students with transitory poverty. This could be because schools draw on neighborhoods with widely varying household incomes and levels of persistent poverty. However, controlling for household income in the child's home zip code (+ Zip code income) does very little to change these within-school results.

To examine whether persistent poverty explained additional variation in gaps once lagged scores were included, prior year PARCC performance was explored. Adding Grade 4 PARCC mathematics scores to the regression shrinks gaps considerably, but the measure of persistent poverty in Panel B still generates a larger gap than the conventional measure (current FARMS status) in Panel A (3 points or 0.095 standard deviations and 2 points or 0.066 standard deviations, respectively). The gap based on the persistent poverty measure is 44% larger than that based on current FARMS status, even after including demographics, schools effects, and lagged test scores.

Achievement gaps were related to number of years in poverty. For this section, analyses were conducted based on the number of years a student received FARMS services, rather than analysis of students categorized as persistent versus transitory poverty. The average PARCC mathematics and ELA scores in fifth grade by the number of years a student received FARMS services are displayed in Figure 1. In both mathematics and ELA, students impacted by poverty in one year between kindergarten and fifth grade scored about 12 points lower than students never impacted by poverty. In general, average scores decreased as the number of years in poverty increased. Results were similar for models that included school fixed effects.

These analyses rule out two potential explanations for why the achievement gap widens with additional years impacted by poverty: that students impacted by poverty for multiple years differ in their demographic characteristics and that the quality of their schools differs from the quality of schools attended by students who were not impacted by poverty. The relationship between the

number of years in which a student received FARMS and PARCC scores in both mathematics and English language arts persisted after controlling for these factors.



Note. Analyses limited to students not missing data on FARMS in any year from 2011–2012 through 2016–2017.

Figure 1. *Grade 5 PARCC mathematics and ELA scores by number of years receiving FARMS.*

There are at least two explanations for the pattern observed in Figure 1, which shows scores tend to be lower for students who spent more years receiving FARMS services. One explanation is that students do worse in school for every additional year in poverty. The other is that students who will ultimately be in poverty for six years start school at a greater disadvantage. The Grade 5 PARCC data used to create Figure 1 cannot shed light on which explanation is more likely, but longitudinal MAP data prove beneficial. The longitudinal MAP data can be used to explore these competing explanations. Figures 2 and 3 take advantage of the availability of MAP mathematics RIT scores from fall of kindergarten through spring of fifth grade to better understand the relationship between poverty and achievement.

MAP mathematics score averages for students never impacted by poverty, transitorily impacted by poverty, and persistently impacted by poverty are presented in Figure 2. Across all three categories of students, average MAP mathematics scores increased from kindergarten through fifth

grade. Within any given grade, students in persistent poverty had the lowest average performance and students never impacted by poverty had the highest performance.

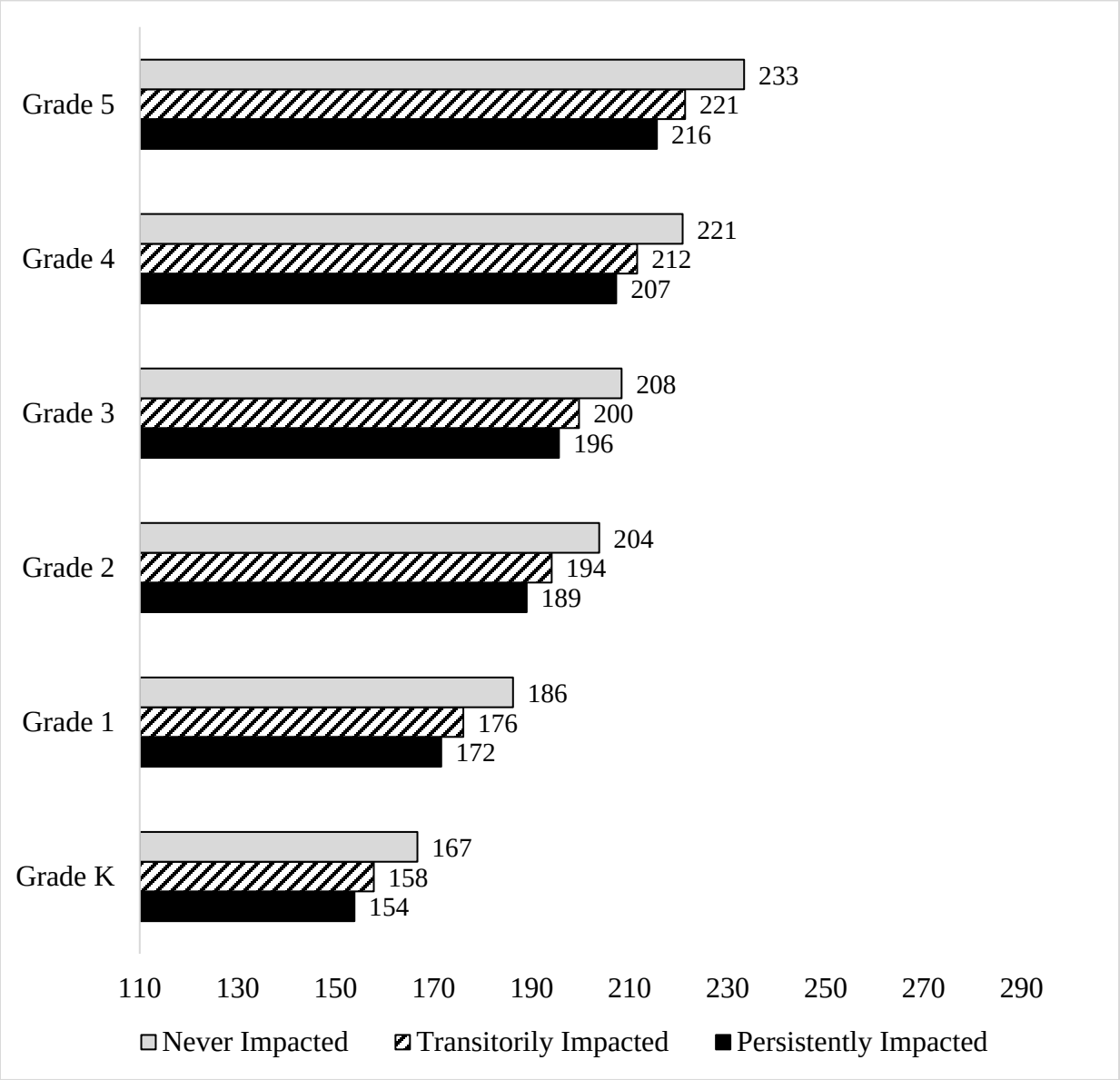


Figure 2. *MAP mathematics scores over time for Grade 5 students persistently, transitorily, and never impacted by poverty.*

To further illustrate the relationship between student poverty and achievement score gaps over time, MAP mathematics scores were standardized so that the differences between the means of students in each category were on a common scale (standard deviation units) across grades. Using this common scale helped clarify whether gaps changed as students progressed through elementary school.

In the fall of kindergarten, students transitorily impacted by poverty scored 0.6 standard deviations lower on MAP mathematics than students never impacted by poverty (see Figure 3). The students

persistently impacted by poverty during elementary school scored 0.9 standard deviations lower than students never impacted by poverty in the fall of kindergarten. These score gaps changed slightly across the grades, but were nearly identical to the gaps that existed in the spring of Grade 5. These gaps were also similar to the gaps in Grade 5 PARCC scores described in column 1 (No controls) of Table 3.

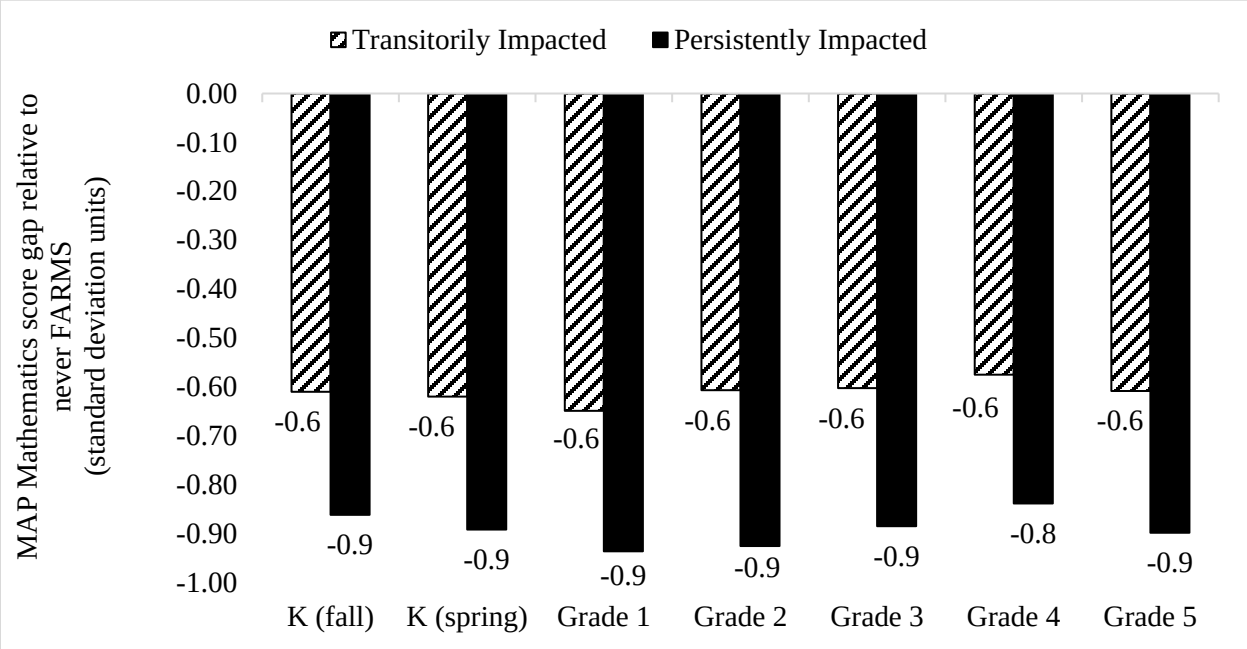


Figure 3. *MAP mathematics scores of students transitorily and persistently impacted by poverty, relative to student never impacted by poverty.*

Thus, students persistently impacted by poverty (those who will ultimately receive FARMS services for all years of elementary school) entered kindergarten with test score gaps relative to the never impacted students that are similar to the gaps observed at the end of elementary school. This finding is consistent with the nationally documented phenomenon of "inequality at the starting gate" (Burkam & Lee, 2002). Using data from U.S. Department of Education's Early Childhood Longitudinal Study, Kindergarten Cohort, Burkham and Lee documented differences in young children's achievement scores in literacy and mathematics by socioeconomic status as they began kindergarten. In MCPS, students' mathematics scores in the fall of kindergarten indicate that students persistently impacted by poverty throughout elementary school entered kindergarten about a standard deviation behind their never impacted peers. Students transitorily impacted by poverty also entered kindergarten scoring lower than their peers who were never impacted, though the difference is not as dramatic. This analysis suggests that the number of years of receiving FARMS serves as a proxy for the depth of poverty a student faces from early childhood on. For additional visualizations of the relationship between years in poverty and achievement, see Appendix C.

Poverty status was related to demographics and educational opportunities. Descriptive statistics were used to summarize student information across students who have never received FARMS services, always received FARMS services (persistent poverty), or sometimes received FARMS services (transitory poverty). As seen in Table 4, nearly half of students in

persistent poverty were Limited English Proficient (LEP), compared to just 7 percent of students never impacted by poverty, and the rate of special education among the persistently poor was nearly twice the rate among students never impacted by poverty. Students in persistent poverty had slightly lower attendance than students never impacted by poverty. Among students in persistent or transitory poverty, the proportion enrolled in Math 5/6 was less than 10 percent, while more than a third of students never impacted were enrolled in Math 5/6.

Table 4
Comparisons of Student Factors, by Persistent Poverty, Transitory Poverty, or Never Impacted by Poverty

Measure	All (*n*=11,081)	Persistent Poverty (*n*=2,696)	Transitory Poverty (*n*=2,293)	Never Impacted by Poverty (*n*=6,092)	Sig.
LEP	23.0%	48.5%	36.5%	6.7%	***
Special education	12.5%	18.6%	12.7%	9.8%	***
Always MCPS	81.1%	100.0%	61.7%	80.1%	***
Average daily attendance	95.4%	94.8%	95.2%	95.8%	***
Math 5/6	22.5%	6.6%	8.1%	35.0%	***

Note. Analytic sample limited to students with full data on variables included in analyses for research question 3 (*N*=11,081). Students can only be identified as persistently impacted by poverty if they exist in the MCPS databases every year, which is why 100 percent of students persistently impacted by poverty were always MCPS. Test of mean differences between groups. ~$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Findings for Research Question 2

2) How do elementary schools serving high concentrations of students persistently impacted by poverty compare to MCPS schools with lower concentrations of students persistently impacted by poverty among key school factors, including student attendance, school climate, and the proportion of novice teachers?

Schools with higher proportions of persistently impacted students have different student populations and school characteristics. To address research question 2, descriptive statistics were used to summarize how elementary schools serving high concentrations of students persistently impacted by poverty compared to MCPS schools serving lower concentrations of students persistently impacted by poverty among key aspects of human and social capital, such as student attendance, proportion of novice teachers, and evidence of social capital derived from school climate surveys.

Findings revealed schools that served the highest concentration of students impacted by persistent poverty had significantly higher proportions of Black or African American and Hispanic/Latino students compared to schools serving the lowest concentration of students persistently impacted by poverty (see Table 5). Schools with high concentrations of students persistently impacted by poverty had over three times the proportion of students with limited English proficiency compared to schools serving the lowest concentration of students persistently impacted by poverty (42 percent versus 12 percent). In addition, schools that served the highest concentrations of students persistently impacted by poverty had lower proportions of students enrolled in Math 5/6 (9 percent,

compared to 30 percent in the low poverty schools). Average daily attendance was somewhat lower in schools serving a high concentration of students persistently impacted by poverty (94.6 percent, compared to 95.5 percent in the low poverty schools).

Table 5
Comparisons of School Average Demographics and School Factors for Schools Serving High, Medium, and Low Concentrations of Students Persistently Impacted by Poverty

Measure	High Poverty (*n*=42)	Middle Poverty (*n*=44)	Low Poverty (*n*=41)	Sig.
Never impacted by poverty	20.8%	57.6%	86.4%	***
Transitory poverty	37.7%	24.0%	9.7%	***
Persistent poverty	41.5%	18.4%	3.9%	***
Asian	7.9%	13.8%	20.9%	***
Black or African American	28.8%	23.1%	9.1%	***
Hispanic/Latino	51.0%	26.0%	11.4%	***
Other	3.2%	6.3%	7.0%	***
Female	48.0%	48.7%	48.3%	
Special education	11.9%	13.1%	9.0%	***
LEP	42.0%	19.8%	12.3%	***
Always MCPS	73.0%	77.4%	69.9%	***
Math 5/6	9.1%	18.1%	30.3%	***
Average daily attendance	94.6%	95.1%	95.5%	***
Novice teachers	9.1%	5.4%	5.7%	***
One to two years of experience	16.4%	12.0%	9.9%	***
Ten+ years of experience	47.3%	60.2%	57.7%	***

Note. Test of mean differences between groups. ~$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$. Total schools = 127; special schools not included in this analysis.

High-poverty schools had less positive school climates relative to low-poverty schools. In addition to differences in demographics and school characteristics, school climate, as perceived by staff (most of whom are teachers), varied significantly across schools. With the exception of open communication in MCPS and having a clean and maintained building, statistically significant differences between the high and low poverty schools existed for each school climate variable and for the overall factor score, favoring the schools serving a low concentration of students in persistent poverty (see Table 6). Turning to comparisons between high and middle poverty schools, ratings were not significantly different on 12 of the 17 individual school climate items. Middle poverty schools had significantly higher ratings than high poverty schools on whether the school is a good place to work, school is safe, teachers were involved in decisions, staff were recognized for quality work, and respect and collaboration among staff, as well as the overall climate score.

Table 6
Comparisons of Measures of School Climate between Schools Serving High, Medium, and Low Concentrations of Students Persistently Impacted by Poverty

Measure	High Poverty (*n*=42)	Middle Poverty (*n*=44)	Low Poverty (*n*=41)	Sig.
Opportunities for professional growth	3.01	3.01	3.19	*
Staff morale is positive	1.97	2.26	2.59	*
Good place to work	2.28	2.70	3.04	*
Necessary resources available	2.64	2.77	3.04	*
School is safe	2.88	3.21	3.48	*
Collaborative work environment	2.58	2.79	3.03	*
Clear expectations	2.54	2.75	2.96	*
Teachers involved in decisions	2.19	2.44	2.72	*
Open communication - school	2.12	2.39	2.65	*
Open communication – MCPS	2.00	2.02	2.12	
Timely feedback on performance	2.55	2.68	2.92	*
Recognition for quality work	2.44	2.70	2.86	*
Culture of respect for all students	3.02	3.18	3.44	*
Respect & collaboration among staff	2.50	2.75	3.02	*
High expectations	3.08	3.22	3.44	*
Variety of methods to help students	3.15	3.24	3.46	*
Clean and maintained building	2.82	3.05	3.07	
Overall climate	-.531	-.038	.585	***

Note. Tukey HSD post-hoc multiple comparison tests of mean differences between schools serving high and low concentrations of students persistently impacted by poverty at ~$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$. Overall climate derived from a factor analysis of 15 of the 17 questions posed to teachers; MCPS communication and school cleanliness omitted.

Note. Test of mean differences between groups. ~$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$. Total schools = 127; special schools not included in this analysis.

High-poverty schools had lower average PARCC scores. Average scores on PARCC and MAP assessments for students in high, middle, and low poverty schools are presented in Figures 4 and 5. The level of school poverty was significantly related to average outcomes along all four measures. Students in schools serving relatively low concentrations of students persistently impacted by poverty had higher test scores, on average, than students in schools serving higher concentrations of students persistently impacted by poverty.

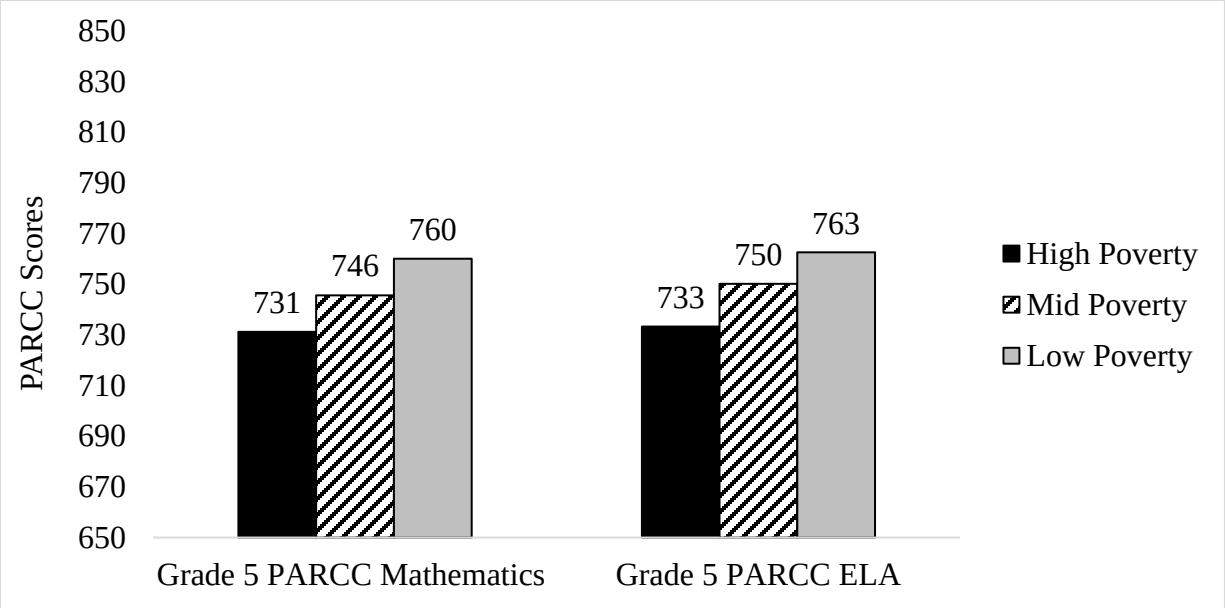


Figure 4. *Grade 5 PARCC score averages in schools serving high, middle, and low concentrations of students persistently impacted by poverty.*

On the PARCC exam, students in schools serving a high concentration of students persistently impacted by poverty scored about 30 points lower, on average, than did students in schools serving a low concentration of students persistently impacted by poverty, for both mathematics and ELA. On the spring administration of MAP, the average differences between high and low poverty schools were 16 points in mathematics and 14 points in ELA (see Table B2 in Appendix B for details).

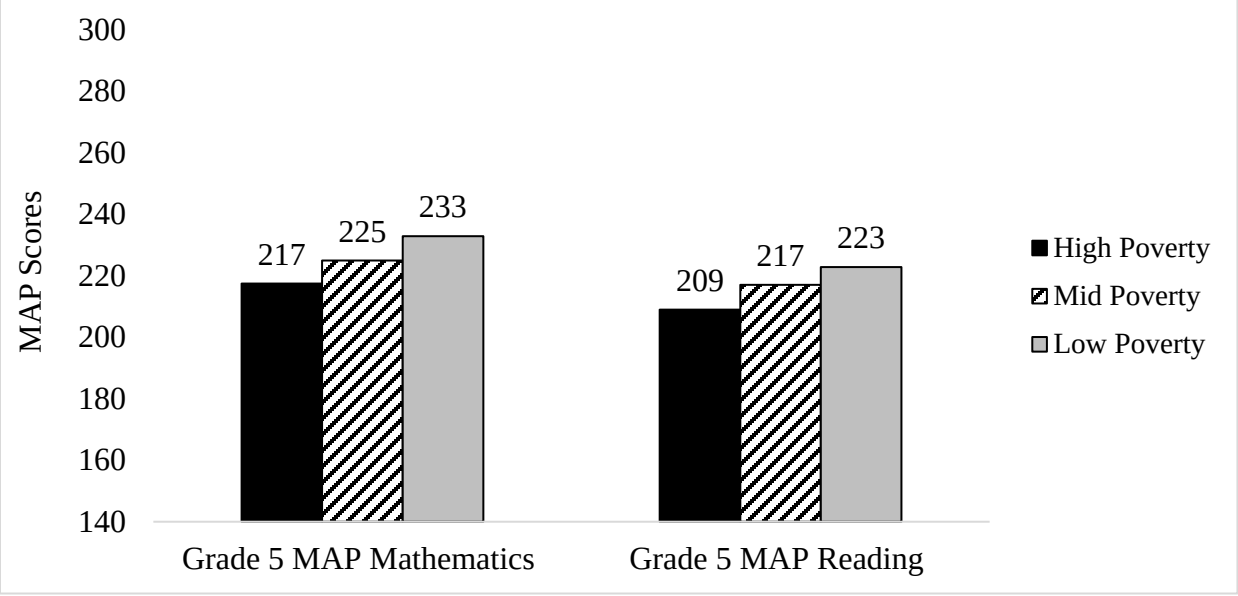


Figure 5. *Grade 5 spring MAP score averages in schools serving high, middle, and low concentrations of students persistently impacted by poverty.*

In sum, schools with a higher concentration of students persistently impacted by poverty had very different demographic characteristics, school climates, and student achievement compared to schools serving fewer students persistently impacted by poverty. The next section explores whether students' academic gains between fourth and fifth grade were impacted by school factors after controlling for individual student characteristics.

Findings for Research Question 3

3) Do students' opportunities to learn and school factors of poverty, attendance, school climate, and proportion of novice teachers explain differences between schools in student achievement gains?

Drawing on prior research, the relationship between two dimensions of students' opportunities to learn (average daily attendance and enrollment in Math 5/6) and student learning was examined. The coefficients on each of the variables in Tables 7 and 8 can be interpreted as the increase or decrease in PARCC performance associated with that variable, controlling for other variables in the model.

Table 7

Estimated Coefficients (Standard Errors) Describing the Relationship between School Factors and PARCC Scores in Mathematics among MCPS Fifth Graders in School Year 2016–2017

	School Poverty		**Average Attendance**		**School Climate**		**% New Teachers**	
Intercept	-1.022 (.102)		-1.594 (1.303)		-1.020 (.101)		-1.018 (.102)	
Persistent poverty	-.075 (.014)	***	-2.914 (1.376)	*	-.076 (.014)	***	-.075 (.014)	***
Transitory poverty	-.051 (.013)	***	-.052 (.013)	***	-.051 (.013)	***	-.051 (.013)	***
Asian	.097 (.014)	***	.097 (.014)	***	.097 (.014)	***	.097 (.014)	***
Black or African American	-.096 (.015)	***	-.096 (.015)	***	-.096 (.015)	***	-.095 (.015)	***
Hispanic/Latino	-.046 (.014)	***	-.046 (.014)	***	-.047 (.014)	***	-.046 (.014)	***
Other	-.014 (.019)		-.013 (.019)		-.014 (.019)		-.014 (.019)	
Female	-.034 (.008)	***	-.034 (.008)	***	-.034 (.008)	***	-.034 (.008)	***
LEP	-.032 (.012)	**	-.032 (.012)	**	-.032 (.012)	**	-.032 (.012)	**
Special education	-.070 (.014)	***	-.071 (.014)	***	-.070 (.014)	***	-.070 (.014)	***
Always MCPS	.022 (.011)	*	.022 (.011)	*	.022 (.011)	*	.022 (.011)	*
Attendance	.011 (.001)	***	.011 (.001)	***	.011 (.001)	***	.011 (.001)	***
Math 5/6	.246 (.013)	***	.246 (.013)	***	.246 (.013)	***	.246 (.013)	***
PARCC Grade 4	.757 (.007)	***	.757 (.007)	***	.757 (.007)	***	.757 (.007)	***
School level								
% FARMS	.006 (.051)							
% Daily attendance			.006 (.014)					
% Daily attendance*persistent poverty			.030 (.014)	*				
Overall climate					-.069 (.028)			
% Novice teachers							-.041 (.252)	

Notes. PARCC mathematics score standardized by grade and year. Standard errors in parentheses. ~$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$. Attendance is for current school year. Results reflect gains on PARCC between Grades 4 and 5, controlling for all variables in the model. Standard errors in parentheses.

Table 8

Estimated Coefficients (Standard Errors) Describing the Relationship between School Factors and PARCC Scores in English Language Arts (ELA) among MCPS Fifth Graders in School Year 2016–2017

	School Poverty		**Average Attendance**		**School Climate**		**% New Teachers**	
Student level	-.870 (.115)		-3.810 (1.350)		-.904 (.114)		-.862 (.115)	
Persistent poverty	-.109 (.016)	***	-.112 (.016)	***	-.112 (.016)	***	-.112 (.016)	***
Transitory poverty	-.083 (.015)	***	-.085 (.015)	***	-.085 (.015)	***	-.085 (.015)	***
Asian	.103 (.016)	***	.102 (.016)	***	.102 (.016)	***	.102 (.016)	***
Black or African American	-.068 (.016)	***	-.070 (.016)	***	-.070 (.016)	***	-.070 (.016)	***
Hispanic/Latino	-.023 (.016)		-.025 (.016)		-.025 (.016)		-.025 (.016)	
Other	.034 (.022)		.033 (.022)		.033 (.022)		.033 (.022)	
Female	.089 (.009)	***	.089 (.009)	***	.089 (.009)	***	.089 (.009)	***
LEP	-.132 (.014)	***	-.133 (.014)	***	-.132 (.014)	***	-.132 (.014)	***
Special education	-.236 (.016)	***	-.236 (.016)	***	-.236 (.016)	***	-.236 (.016)	***
Always MCPS	.001 (.013)		.001 (.013)		.001 (.013)		.001 (.013)	
Attendance	.010 (.001)	***	.010 (.001)	***	.010 (.001)	***	.010 (.001)	***
PARCC Grade 4	.728 (.006)	***	.728 (.006)	***	.729 (.006)	***	.729 (.006)	***
School level								
% FARMS	-.101 (.054)							
% Daily attendance			.031 (.014)	*				
Overall climate					.009 (.014)			
% Novice teachers							-.601 (.265)	*

Notes. PARCC ELA score standardized by grade and year. Standard errors in parentheses. ~$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$. Attendance is for current school year. Results reflect gains on PARCC between Grades 4 and 5, controlling for all variables in the model. Standard errors in parentheses.

Student factors, including attendance and enrollment in Math 5/6, were related to achievement. Students' poverty status mattered, even after controlling for prior achievement and school factors (see Tables 7 and 8). The achievement gains of students persistently impacted by poverty between fourth and fifth grade were about 8 percent of a standard deviation lower in mathematics and 10 percent of a standard deviation lower in ELA. That is, students who experienced persistent poverty made smaller gains in PARCC between Grade 4 and Grade 5 relative to students not impacted by poverty. Among students whose PARCC scores were average in Grade 4, those students not impacted by poverty were predicted to score 747 out of 850 possible points on PARCC mathematics in Grade 5; students with the same Grade 4 PARCC scores who experienced persistent poverty were predicted to score 3 points lower (744 points) in Grade 5. Students who experienced transitory poverty during elementary school also had smaller gains, though less dramatically so in ELA (5 percent of a standard deviation in ELA).

Students' attendance had a statistically significant, positive impact on achievement gains. A one percent increase in daily attendance rate was associated with about a hundredth of a standard deviation in PARCC mathematics and scores. Consistently being enrolled in MCPS had a similarly small, but significant, positive impact (.02 standard deviations) on PARCC mathematics, though not in ELA. Students who take Math 5/6 had gains on the PARCC mathematics assessment that were about .25 standard deviations higher than their peers not in Math 5/6. By educational intervention standards, that is a large effect size.

School factors related to achievement included school average attendance and the proportion of novice teachers. School poverty did not have a significant relationship with PARCC gains in either mathematics or ELA. This finding was robust to definitions of poverty (e.g. percent participating in free or reduced price lunch, 50% or more participate in free or reduced price lunch, percent persistently impacted by poverty). School climate also did not have a statistically significant relationship with PARCC gains in either mathematics or ELA. The proportion of novice teachers in a school was not related to PARCC mathematics gains, but had a statistically significant, negative relationship with PARCC ELA gains. That is, students in schools with a higher proportion of novice teachers made smaller gains in PARCC ELA between fourth and fifth grade relative to students in schools with lower proportions of novice teachers. For a 1 percent increase in the proportion of novice teachers, students' ELA gains decreased by about 60 percent of a standard deviation.

Students in schools with higher average daily attendance had higher PARCC ELA gains. Specifically, a 1 percent increase in the average daily attendance rate was associated with 2 percent of a standard deviation increase in ELA gains. School mean attendance was not a significant predictor of PARCC mathematics, once students' own attendance was controlled. However, there was a significant cross-level interaction between school mean attendance and persistent poverty.[1] Although school mean attendance was not related to students' scores in general, students persistently impacted by poverty appeared to perform better in schools with higher average daily

[1] To identify cross-level interactions, the relationship between a student-level predictor (in this case, persistent poverty) and outcomes was allowed to vary across schools. The relationship between persistent poverty and achievement varied significantly across schools for mathematics, but not ELA. Each of the school factor models were then re-fitted, adding an interaction between the school factor in question and persistent poverty; the interaction was only statistically significant for attendance.

attendance. This relationship is described in Figure 6, where the students persistently impacted by poverty are represented by the line that shows increasing scores as school mean attendance increases. A student persistently impacted by poverty in a school with above average attendance was estimated to have gains in mathematics that were about 6 percent of a standard deviation higher than a student persistently impacted by poverty in a school with below average attendance.

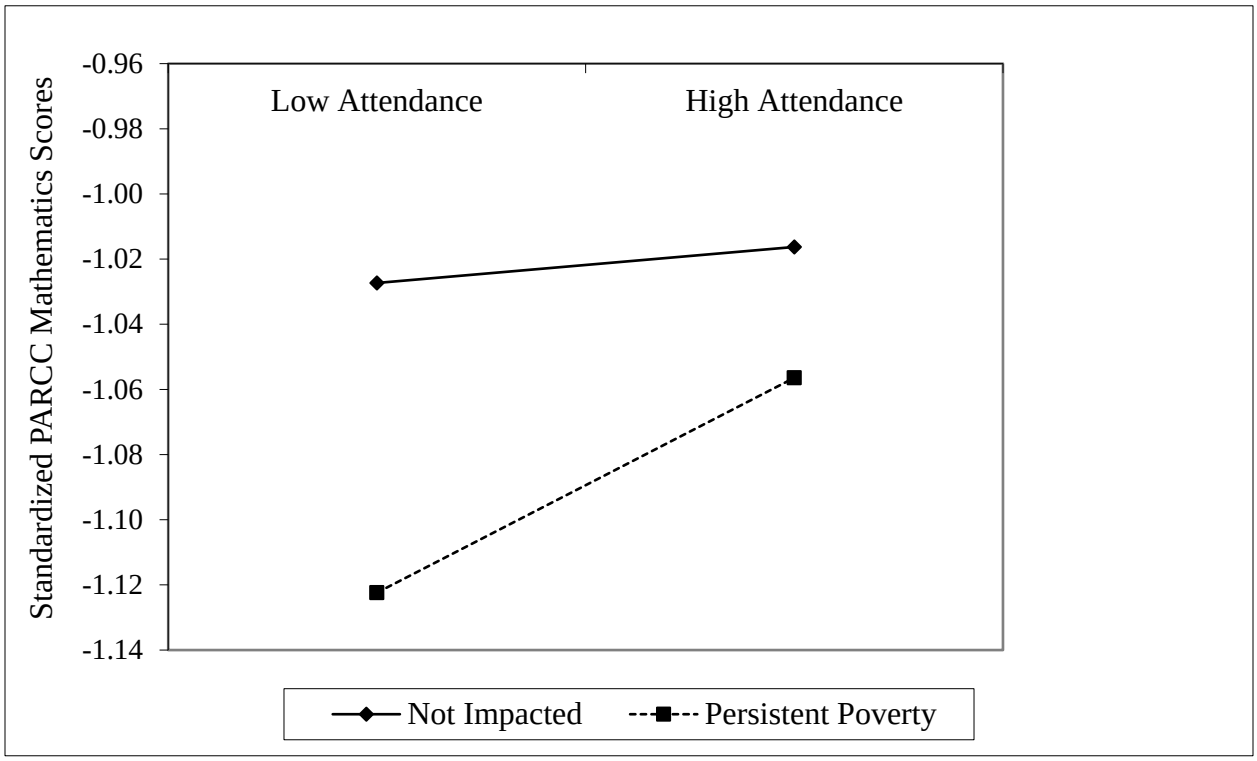


Figure 6. *Relationship between average daily attendance and PARCC mathematics, by poverty status.*

Discussion and Conclusion

This study sought to clarify the relationship between poverty and student achievement in MCPS and identify ways MCPS schools might disrupt the relationship between poverty and student achievement. As in other states and districts, students' socioeconomic status was strongly related to achievement outcomes, and persistent poverty had a stronger negative relationship with student achievement than did transitory poverty. The pattern observed in Figure 3 was consistent with the nationally documented phenomenon of "inequality at the starting gate" (Burkam & Lee, 2002); students who will ultimately spend the most years in poverty have large achievement gaps even as they enter kindergarten. These findings suggest that the number of years spent in poverty is correlated with the depth of a student's poverty. That is, consistent receipt of FARMS services appears indicative of a particularly low level of income.

Findings from this study support the notion that educational opportunities matter for student achievement. Enrollment in Math 5/6 had a strong positive relationship with student achievement gains in Grade 5 mathematics. Consistent with prior literature, student attendance was positively related to student achievement. In addition, attendance had a contextual effect on

ELA scores above and beyond the relationship at the student level. That is, students attending schools with higher average daily attendance had higher PARCC ELA scores relative to students attending schools with lower average daily attendance.

With regard to other school factors, students attending schools with a higher proportion of novice teachers had smaller PARCC ELA gains relative to students attending schools with a lower proportion of novice teachers. Research regarding teacher experience indicates that on average, new teachers are less effective than teachers with some experience (Rice, 2013). Attending to the distribution of novice teachers across schools can mitigate the potential for achievement gaps that arise in part due to inequitable access to experienced teachers. On the other hand, the climate and average socioeconomic status of the elementary schools in this study were not related to achievement after controlling for student factors.

Policy decisions can be informed by these findings to target resources and develop interventions that address factors related to student achievement. Recommendations are as follows:

- Consider using refined measures of student poverty when allocating funds and additional supports to schools
- Support additional investments in early education programs
- Target additional resources to address chronic absenteeism and high rates of novice teachers in high-poverty schools
- Ensure equitable access to accelerated instruction for all high-performing students

MCPS already provides additional funds to high-poverty schools and supports early education programs, but in both cases, the study findings may help the district refine its approach. As can be seen in Appendix A, most of the schools serving the highest proportions of students impacted by persistent poverty are Title I schools, but not all of them are. Findings also raise questions as to whether additional investments in early education programs, which currently include Head Start or prekindergarten programs in 64 elementary schools, might be warranted to mitigate the extent to which MCPS's persistently poor students enter kindergarten behind their peers who are not impacted by poverty.

While school average socioeconomic status did not appear related to achievement gains in MCPS, higher poverty schools had lower average daily attendance and higher proportions of novice teachers, which were factors related to student achievement. As such, MCPS may wish to consider targeting additional resources to higher-poverty schools to address these school factors. Recent research indicates that low-cost interventions, such as postcards or text messages to parents, can be effective ways to reduce absenteeism (Bergman & Chan, 2017; Rogers et al., 2017). Bonuses for teachers in high poverty schools have potential to reduce turnover rates, especially among experienced teachers (Clotfelter, Glennie, Ladd, & Vigdor, 2008).

The strong positive relationship between enrollment in Math 5/6 and achievement gains suggests that expanding access to accelerated educational opportunities may be beneficial. Districts can play a role in ensuring equitable course access. For example, Wake County Public Schools recently began assigning middle school students to accelerated math based on a prior achievement metric. In a study using a regression discontinuity approach, researchers found that

eligible low-income students' rates of acceleration more than doubled from 40 percent to close to 90 percent after this policy was established (Dougherty, Goodman, Hill, Litke, & Page, 2015). Given the strong positive relationship between enrollment in Math 5/6 and student achievement gains, increasing access to accelerated math for high-performing students impacted by poverty would be a promising approach to supporting the achievement of these students.

The impact of expanding access to Math 5/6 to *all* students remains unclear, since the positive effects seen in this study reflect enrollment of select group of high-performing students.[2] The results of this study may in part reflect exposure to high-performing peers; if so, enrolling lower-performing students might mitigate the relationship between Math 5/6 and student outcomes. In addition, if teachers were positively selected into Math 5/6 (i.e. teachers considered to be highly effective or particularly good at math are selected to teach it), then the results might reflect sorting of students to specific teachers. Future research could investigate the extent to which the relationship between enrollment in Math 5/6 and student learning is attributable to the curriculum, rather than peer or teacher effects. For example, MCPS could pilot expanding enrollment to a less selective group of students and examine outcomes for these students, which could shed light on whether the positive impact holds when a more representative group of teachers and students are involved. Given that some states and districts that accelerated math instruction for all students have seen increased course failure and negative impacts on later math achievement (Allensworth, Nomi, Montgomery, & Lee, 2009; Clotfelter, Ladd, & Vigdor, 2015; Domina, McEachin, Penner, & Penner, 2015), it is important to consider both access and supports needed to ensure all students succeed.

[2] Nearly 90 percent of the students enrolled in 5/6 mathematics had achieved a MAP M RIT score at or above the 70th percentile in Grade 3 and about 84 percent of the students enrolled achieved a performance level of 4 or 5 on Grade 3 PARCC in mathematics.

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Appendix A: Schools by Persistent Poverty Percentage

Table A1. Schools sorted by proportion of school year 2016–2017 Grade 5 students persistently impacted by poverty

School #	School Name	Title 1 SY 17–18	% Persistently Impacted by Poverty	% Never Impacted by Poverty	% Transitorily Impacted by Poverty	PARCC_ ELA SY 16-17	PARCC_ M SY 16-17
965	Regional Institute for Children and Adolescents	No	0.00	0.00	1.00	683	685
652	Monocacy ES	No	0.00	0.83	0.17	750	754
422	Wyngate ES	No	0.00	0.99	0.01	765	756
408	Westbrook ES	No	0.00	0.99	0.01	761	765
238	Cold Spring ES	No	0.00	0.99	0.01	786	789
951	Longview School	No	0.00	1.00	0.00		
799	Stephen Knolls School	No	0.00	0.67	0.33		
783	Kensington Parkwood ES	No	0.01	0.92	0.08	762	758
410	Bradley Hills ES	No	0.01	0.97	0.03	756	760
420	Bannockburn ES	No	0.01	0.96	0.04	784	778
603	Seven Locks ES	No	0.01	0.91	0.09	774	771
220	Luxmanor ES	No	0.01	0.81	0.19	764	763
601	Potomac ES	No	0.01	0.99	0.01	772	770
216	Travilah ES	No	0.02	0.92	0.08	775	771
417	Wood Acres ES	No	0.02	0.95	0.05	759	759
226	Beverly Farms ES	No	0.02	0.91	0.09	760	757
513	Belmont ES	No	0.02	0.85	0.15	751	757
401	Bethesda ES	No	0.02	0.94	0.06	762	763
233	Fallsmead ES	No	0.02	0.84	0.16	766	761
405	Somerset ES	No	0.02	0.91	0.09	766	750
604	Carderock Springs ES	No	0.02	0.96	0.04	781	782
219	Farmland ES	No	0.03	0.87	0.13	760	760
419	Burning Tree ES	No	0.04	0.96	0.04	772	768
341	Wilson Wims ES	No	0.04	0.77	0.23	751	748
235	Wayside ES	No	0.04	0.93	0.07	772	779
653	Stone Mill ES	No	0.04	0.86	0.14	775	770
209	Lakewood ES	No	0.05	0.87	0.13	764	765
607	Bells Mill ES	No	0.05	0.92	0.08	767	761
425	Ashburton ES	No	0.05	0.83	0.17	753	748
512	Greenwood ES	No	0.05	0.84	0.16	761	756
501	Sherwood ES	No	0.05	0.83	0.17	754	750
229	College Gardens ES	No	0.05	0.78	0.22	755	744
51	Laytonsville ES	No	0.06	0.79	0.21	750	754

School #	School name	Title 1 SY 17–18	% Persistently Impacted by Poverty	% Never Impacted by Poverty	% Transitorily Impacted by Poverty	PARCC_ ELA SY 16-17	PARCC_ M SY 16-17
351	Darnestown ES	No	0.06	0.90	0.10	766	762
517	Sligo Creek ES	No	0.06	0.80	0.20	751	747
336	Little Bennett ES	No	0.06	0.76	0.24	762	760
403	Chevy Chase ES	No	0.06	0.86	0.14	775	770
703	Cedar Grove ES	No	0.06	0.81	0.19	757	756
308	Cloverly ES	No	0.08	0.64	0.36	751	738
159	Rachel Carson ES	No	0.08	0.80	0.20	759	757
207	Beall ES	No	0.09	0.71	0.29	749	747
153	Poolesville ES	No	0.09	0.78	0.22	755	760
204	Garrett Park ES	No	0.09	0.72	0.28	749	744
570	Diamond ES	No	0.09	0.74	0.26	766	758
415	North Chevy Chase ES	No	0.09	0.79	0.21	766	750
704	Woodfield ES	No	0.10	0.73	0.27	766	755
504	Westover ES	No	0.10	0.78	0.22	765	760
241	Dufief ES	No	0.10	0.77	0.23	750	750
227	Ritchie Park ES	No	0.11	0.69	0.31	751	749
505	Lucy V. Barnsley ES	No	0.11	0.72	0.28	764	760
523	Spark M. Matsunaga ES	No	0.11	0.75	0.25	776	758
502	Olney ES	No	0.12	0.73	0.27	754	759
506	Flower Vally ES	No	0.12	0.69	0.31	750	746
101	Clarksburg ES	No	0.12	0.68	0.32	755	748
316	Stonegate ES	No	0.12	0.66	0.34	747	743
508	Candlewood ES	No	0.13	0.68	0.32	759	748
706	Clearspring ES	No	0.13	0.74	0.26	767	764
511	Cashell ES	No	0.14	0.63	0.37	744	741
360	Jones Lane ES	No	0.14	0.69	0.31	745	744
764	Woodlin ES	No	0.15	0.68	0.32	746	752
702	Damascus ES	No	0.15	0.60	0.40	747	742
769	Oakland Terrace ES	No	0.15	0.61	0.39	745	748
773	Rock Creek Forest ES	No	0.15	0.64	0.36	748	747
158	Ronald McNair ES	No	0.16	0.62	0.38	757	751
156	Lois Rockwell ES	No	0.16	0.67	0.33	764	752
747	Charles R. Drew ES	No	0.16	0.59	0.41	759	763
337	William B. Gibbs, Jr. ES	No	0.17	0.65	0.35	748	743

School #	School name	Title 1 SY 17–18	% Persistently Impacted by Poverty	% Never Impacted by Poverty	% Transitorily Impacted by Poverty	PARCC_ ELA SY 16-17	PARCC_ M SY 16-17
749	Piney Branch ES	No	0.17	0.59	0.41	757	749
210	Maryvale ES	No	0.18	0.57	0.43	744	744
244	Thurgood Marshall ES	No	0.18	0.62	0.38	745	740
819	Rock Creek Valley ES	No	0.19	0.52	0.48	754	744
312	William Tyler Page ES	No	0.19	0.46	0.54	741	739
803	Forest Knolls ES	No	0.22	0.50	0.50	746	743
569	Strawberry Knoll ES	No	0.23	0.34	0.66	737	724
242	Dr. Sally K. Ride ES	No	0.24	0.46	0.54	736	729
102	Germantown ES	No	0.25	0.53	0.47	752	753
518	Brooke Grove ES	No	0.25	0.61	0.39	749	749
108	Lake Seneca ES	No	0.25	0.38	0.62	737	727
110	S. Christa McAuliffe ES	No	0.26	0.31	0.69	734	731
795	Rock View ES	No	0.26	0.40	0.60	733	731
340	Great Seneca Creek ES	No	0.26	0.44	0.56	736	729
566	Fields Road ES	No	0.27	0.48	0.52	745	739
106	Fox Chapel ES	No	0.28	0.43	0.57	761	763
514	Judith A. Resnik ES	No	0.28	0.37	0.63	748	743
568	Stedwick ES	No	0.28	0.30	0.70	736	729
761	Pine Crest ES	No	0.29	0.49	0.51	748	747
756	East Silver Spring ES	No	0.29	0.32	0.68	756	736
770	Flora M. Singer ES	No	0.30	0.49	0.51	744	743
767	Glenhaven ES	No	0.30	0.25	0.75	749	753
303	Fairland ES	No	0.30	0.27	0.73	735	726
546	Goshen ES	No	0.30	0.41	0.59	737	736
305	Jackson Road ES	Yes	0.32	0.11	0.89	729	723
109	Waters Landing ES	No	0.32	0.37	0.63	749	743
302	Burtonsville ES	No	0.32	0.30	0.70	738	727
784	Highland View ES	No	0.32	0.37	0.63	741	736
309	Burnt Mills ES	No	0.32	0.18	0.82	732	730
212	Meadow Hall ES	No	0.33	0.24	0.76	734	734
565	Sequoyah ES	No	0.33	0.43	0.57	741	746
334	Greencastle ES	No	0.34	0.24	0.76	735	727

School #	School name	Title 1 SY 17–18	% Persistently Impacted by Poverty	% Never Impacted by Poverty	% Transitorily Impacted by Poverty	PARCC_ ELA SY 16-17	PARCC_ M SY 16-17
556	Mill Creek Towne ES	No	0.34	0.39	0.61	726	730
558	Whetstone ES	No	0.34	0.25	0.75	735	737
215	Carl Sandburg Learning Center	No	0.35	0.47	0.53	689	688
786	Georgian Forest ES	Yes	0.36	0.14	0.86	721	721
559	Brown Station ES	Yes	0.36	0.21	0.79	728	732
313	Galway ES	No	0.36	0.25	0.75	749	735
310	Cannon Road ES	No	0.37	0.31	0.69	731	744
808	Cresthaven ES	Yes	0.37	0.20	0.80	731	728
561	Watkins Mill ES	Yes	0.37	0.20	0.80	718	722
549	Flower Hill ES	No	0.38	0.23	0.77	724	713
772	Viers Mill ES	No	0.38	0.30	0.70	737	730
822	Strathmore ES	No	0.38	0.19	0.81	738	726
555	Rosemont ES	No	0.39	0.29	0.71	741	741
817	Glenallan ES	No	0.40	0.19	0.81	724	723
111	Capt. James E. Daly ES	Yes	0.42	0.25	0.75	737	723
564	South Lake ES	Yes	0.42	0.10	0.90	720	716
100	Clopper Mill ES	No	0.43	0.20	0.80	735	725
206	Twinbrook ES	Yes	0.43	0.23	0.77	735	741
553	Gaithersburg ES	Yes	0.46	0.12	0.88	722	719
766	Oak View ES	Yes	0.47	0.21	0.79	742	733
807	Brookhaven ES	Yes	0.47	0.13	0.88	737	733
779	Sargent Shriver ES	Yes	0.49	0.08	0.92	720	726
563	Summit Hall ES	Yes	0.49	0.10	0.90	733	734
552	Washington Grove ES	Yes	0.50	0.20	0.80	740	732
805	Kemp Mill ES	Yes	0.50	0.11	0.89	731	738
771	Rolling Terrace ES	Yes	0.54	0.22	0.78	719	737
774	Highland ES	Yes	0.57	0.08	0.92	740	739
788	Wheaton Woods ES	Yes	0.57	0.08	0.92	743	738
777	Weller Road ES	Yes	0.57	0.13	0.87	745	739
790	Arcola ES	Yes	0.58	0.12	0.88	723	717
797	Harmony Hills ES	Yes	0.60	0.05	0.95	721	716
304	JoAnn Leleck ES at Broad Acres	Yes	0.60	0.01	0.99	736	742

Note. Gray highlight indicates SY 17-18 Title I schools. Green highlight indicates the top 10% mean PARCC scores. Pink highlight indicate the bottom 10% mean PARCC scores.

Appendix B: School Climate Survey

1= strongly agree to 5 = strongly disagree

1. I have opportunities for professional growth.
2. Staff morale is positive in this school.
3. I would recommend my school to friends and family as a good place to work.
4. I have the necessary resources to do my job successfully.
5. My school is safe for staff and students.
6. My school leadership team fosters a collaborative work environment.
7. My school leadership team sets clear expectations for staff.
8. The school leadership involves me in decisions affecting my work.
9. There is open communication within my school.
10. There is open communication throughout all levels of MCPS.
11. I receive timely feedback on my performance.
12. My school recognizes staff for their quality work and accomplishments.
13. This school promotes a culture of respect for all students.
14. My school promotes a culture of respect and collaboration among all staff.
15. Staff in this school have high expectations and believe every student can learn.
16. Staff in this school are committed to using a variety of methods to help every student succeed.
17. My building is clean and well maintained.

Appendix B

Table B1
Raw Factor Loadings for School Context Dimensions

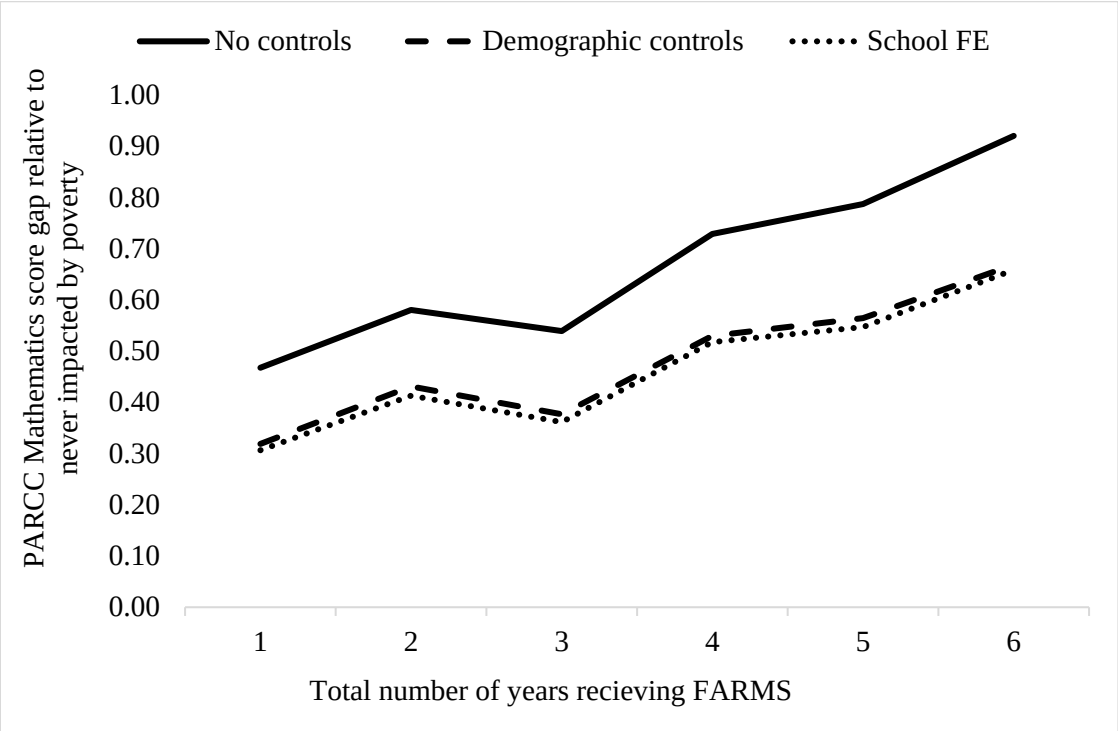
	Factor loading	% agree or strongly agree
1. I have opportunities for professional growth.	.806	81.0
2. Staff morale is positive in this school.	.938	54.5
3. I would recommend my school to friends and family as a good place to work.	.940	64.3
4. I have the necessary resources to do my job successfully.	.835	74.2
5. My school is safe for staff and students.	.745	83.9
6. My school leadership team fosters a collaborative work environment.	.940	68.9
7. My school leadership team sets clear expectations for staff.	.924	68.1
8. The school leadership involves me in decisions affecting my work.	.911	55.0
9. There is open communication within my school.	.942	56.2
10. There is open communication throughout all levels of MCPS.	N/A	38.1
11. I receive timely feedback on my performance.	.851	68.1
12. My school recognizes staff for their quality work and accomplishments.	.881	65.2
13. This school promotes a culture of respect for all students.	.902	86.3
14. My school promotes a culture of respect and collaboration among all staff.	.957	68.4
15. Staff in this school have high expectations and believe every student can learn.	.812	87.3
16. Staff in this school are committed to using a variety of methods to help every student succeed.	.795	88.2
17. My building is clean and well maintained.	N/A	75.3

Notes: based on *n*=5,432 survey responses aggregated to 127 schools. Only one factor was produced.

Table B2
Comparisons of Academic Performance Measures between Schools Serving High, Medium, and Low Concentrations of Students Persistently Impacted by Poverty

Measure	High Poverty (*n*=42)	Middle Poverty (*n*=44)	Low Poverty (*n*=41)	Sig.
Grade 5 PARCC Mathematics	731.21	745.64	760.07	***
	(9.041)	(10.097)	(10.810)	
Grade 5 PARCC ELA	733.34	750.21	762.60	***
	(8.635)	(10.092)	(9.943)	
Grade 5 MAP Mathematics	217.48	224.98	232.88	***
	(4.209)	(5.854)	(6.313)	
Grade 5 MAP Reading	208.97	217.04	222.83	***
	(3.924)	(4.556)	(4.012)	

Appendix C: Figures of Student Achievement by Years Received FARMS



Note. Analyses limited to students not missing data on FARMS in any year from 2011–2012 through 2016–2017.

Figure C1. *PARCC mathematics score gaps by number of years receiving FARMS.*

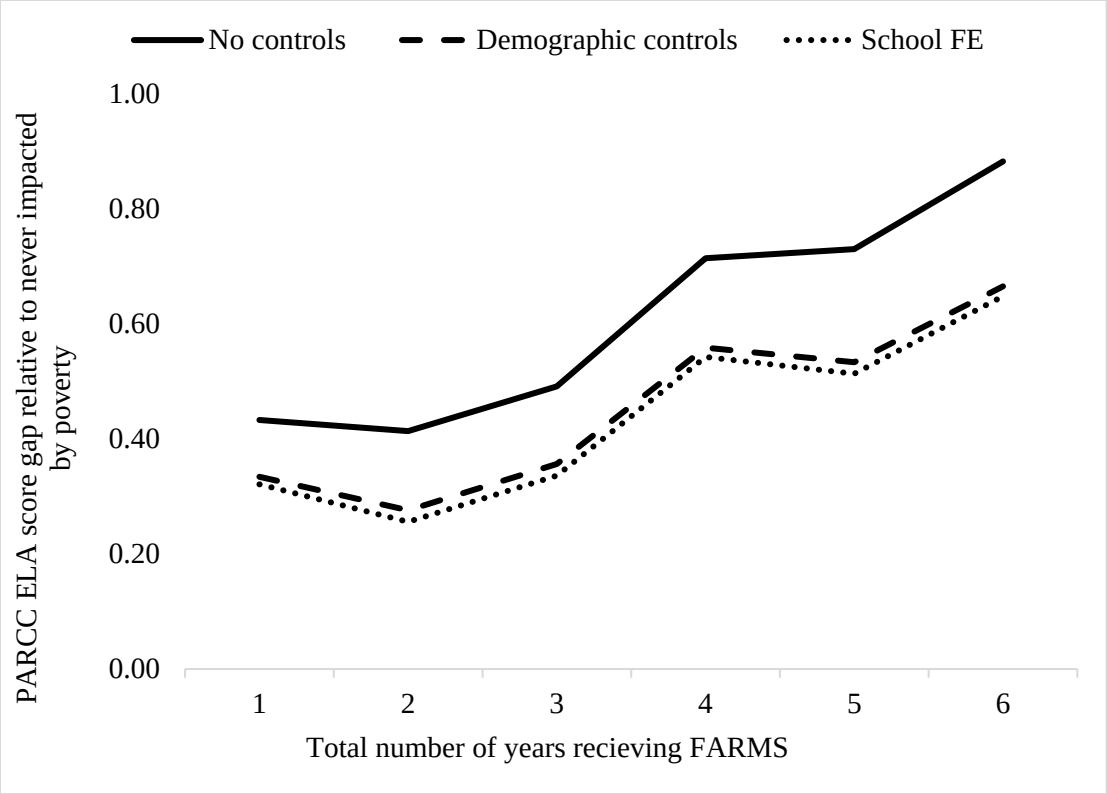
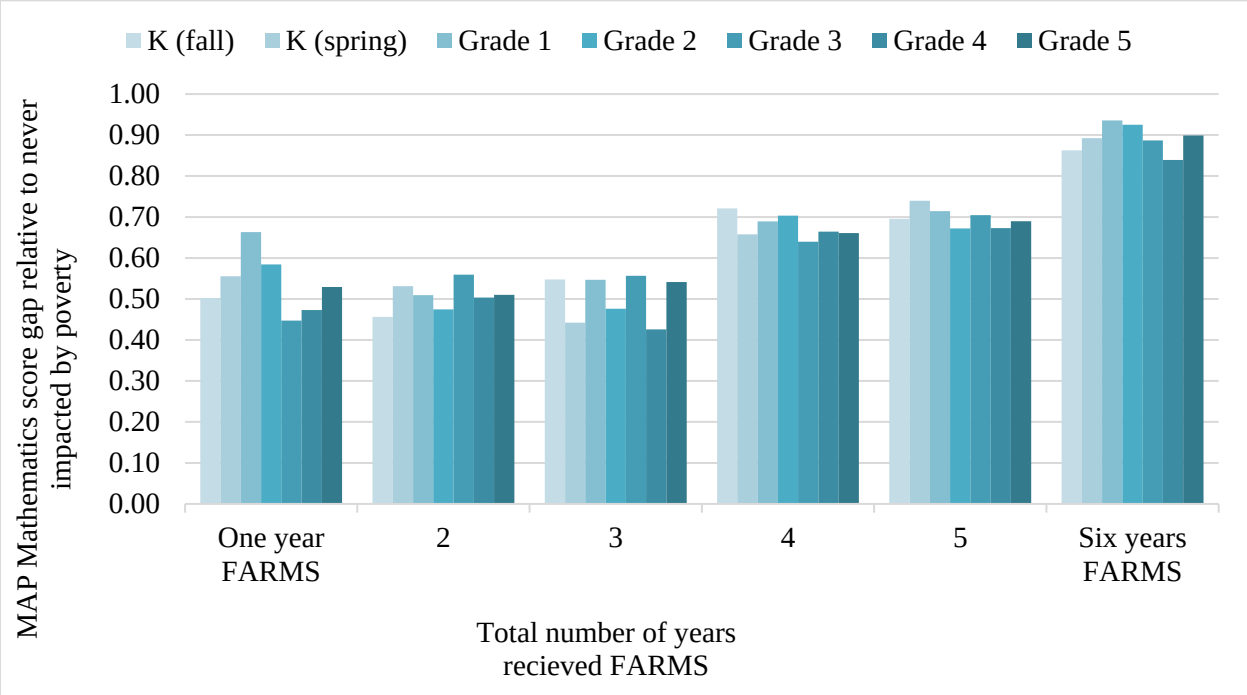


Figure C2. *PARCC ELA score gaps by number of years receiving FARMS.*



Note. Analysis limited to students with data on FARMS status and MAP mathematics test scores in every year between kindergarten and fifth grade.

Figure C3. *MAP mathematics score averages by grade and years receiving FARMS.*