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Study of Teacher Workforce in Montgomery County Public Schools: Attrition and Mobility

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Purpose of the Study

This report focuses on teacher turnover in MCPS among two groups: (1) Teachers who left MCPS due to resignation or termination (*teacher attrition*), and (2) elementary teachers who transferred or moved to other schools within MCPS (*elementary teacher mobility*). The ultimate goal of this report is to inform policies and practices that will support successful teacher staffing in MCPS.

Methodology

The analysis of teacher attrition due to resignation or termination used a sample of all classroom teachers at any school level from FY 2010 to 2018 and was conducted in three time frames: (1) over the course of two years (FY 2016-2018), (2) over the course of five years (FY 2013-2018), and (3) over the course of eight years (FY 2010-2018). The analysis of elementary teacher mobility was conducted for each year from FY 2010 to 2017, and used a sample of elementary classroom teachers during this eight-year period who stayed in the same school or moved to a different school in a consecutive year.

A multilevel binary logistic regression was used to test the relationships of teacher and school-level factors with: (1) the likelihood of teachers leaving MCPS by resignation or termination; and (2) the likelihood of elementary teachers moving to a different school within MCPS. Additional analysis was conducted to observe if elementary teachers moved to more or less complex schools from FY 2010 to FY 2017.

Note: The complexity index is a composite measure or index of school level demographic characteristics that represents the differences and similarities among schools. It includes school levels of proportion of ever FARMS, ESOL, SPED, and percent total of Black or African American and Hispanic/Latino students. Schools in the first quintile (level 1) represent the least complex schools whereas the schools in the fifth quintile (level 5) represent the most complex ones.

What factors are related to teacher attrition (i.e., leaving due to resignation or termination) in MCPS?

Factors related to teacher attrition in elementary schools:

- Teachers with a master's degree or higher were less likely to leave than their peers with lower degrees
- Teachers who lived in Montgomery County were less likely to leave than their peers who did not live in the county
- Teachers with more years of teaching experience in MCPS were less likely to leave than their less-experienced peers
- Teachers in schools with an experienced group of teachers were less likely to leave than their peers in schools with less-experienced teachers

Factors related to teacher attrition in middle schools:

- Teachers with a master's degree or higher were less likely to leave than their peers with lower degrees
- Teachers with more years of teaching experience in MCPS were less likely to leave than their less-experienced peers
- Teachers who taught science were more likely to leave than their peers who did not teach science

Factors related to teacher attrition in high schools:

- Teachers with a master's degree or higher were less likely to leave than their peers with lower degrees
- Teachers with more years of teaching experience in MCPS were less likely to leave than their less-experienced peers
- Teachers who taught science were less likely to leave than their peers who did not teach science
- Teachers in schools with a high percentage of students receiving FARMS services were less likely to leave than their peers located in low-poverty schools
- Teachers in schools with a large student enrollment (school size) were less likely to leave than their peers in smaller schools

Note: Only statistically significant factors ($p < .05$) in at least one of the three examined periods are reported.

What is the mobility rate of elementary teachers within MCPS and what factors are related to their mobility?

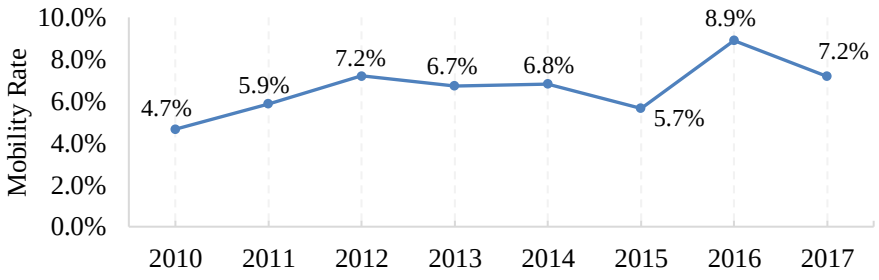

Figure I. Mobility rate of elementary teachers from FY 2010 to 2017

The proportion of elementary teachers who moved to other schools was higher in recent years compared to FY 2010 (Figure I).

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Factors related to elementary teacher mobility:

- Teachers with a master's degree or higher were more likely to move than their peers with lower degrees
- Teachers with more years of teaching experience in MCPS were less likely to move than their peers with less experience
- Teachers in schools with an experienced group of teachers were less likely to move than their peers in schools with less-experienced teachers
- Teachers in schools with a high percentage of students receiving FARMS services were more likely to move than their peers in low-poverty schools
- Teachers in schools with a large student enrollment (school size) were less likely to move than their peers in smaller schools
- Teachers in schools that had a change of principal were more likely to move than their peers who did not experience a change of principal

Note: For factors related to elementary teacher mobility, only statistically significant factors ($p < .05$) in at least one of the eight years examined are reported.

Among the elementary teachers who changed schools from FY 2010 to FY 2017, did they go to a school with higher, lower, or same level of complexity?

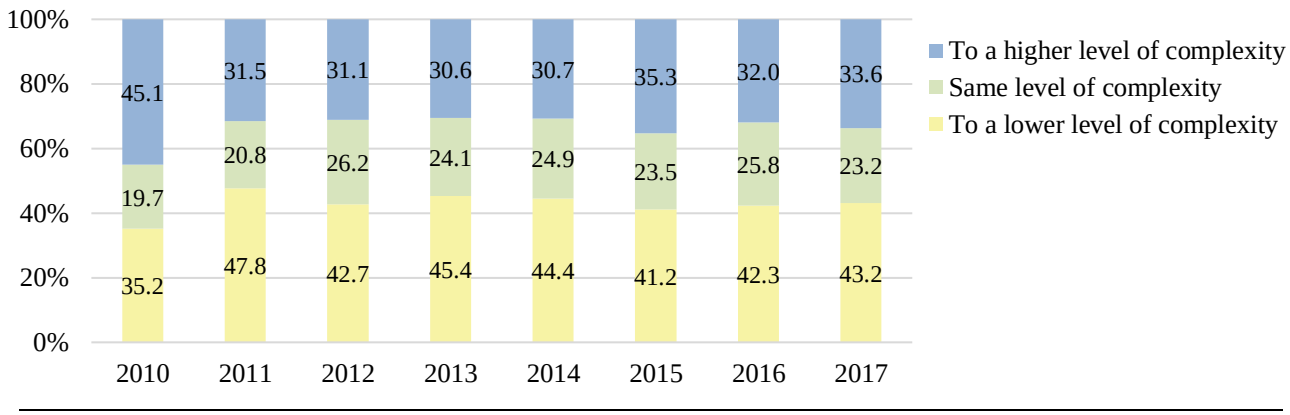

Figure II. Percentages of Elementary Moves by School Complexity

When elementary mobility was examined across years, close to one half of elementary teachers who changed schools moved to less complex schools, whereas about a third of them moved to more complex schools, except for FY 2010 (Figure II).

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Executive Summary

At the request of the Office of the Superintendent of Schools in Montgomery County Public Schools (MCPS), the Office of Shared Accountability (OSA) conducted a study of the teacher workforce in MCPS. The first report described the characteristics of MCPS teachers, teacher attrition and vacancies, and compared trends observed for MCPS with those of Maryland and the nation (Davila Valencia, Wade, & Wolanin, 2018). This second report focuses on teacher turnover among two groups of teachers: those who leave MCPS due to resignation or termination, and those elementary teachers who transfer or move to other schools within MCPS. Ultimately both reports aim to inform policies and practices that will support successful teacher staffing in MCPS.

Summary of Methodology

Analysis of teacher and school-level factors related to attrition (resignations and terminations) used a sample of all classroom teachers at any level (i.e., kindergarten through Grade 12) who taught in MCPS during FY 2010 through FY 2018. Three time frames were examined: attrition over the course of two years (FY 2016 – FY 2018); attrition over five years (FY 2013 – FY 2018); and attrition over eight years (FY 2010 – FY 2018). Teachers who retired or moved to an administrative position within MCPS were removed from the sample.

Analysis of elementary teacher mobility used a sample of elementary classroom teachers who taught in MCPS during FY 2010 through FY 2018. Mobility was examined for each of the eight years by analyzing whether teachers stayed in the same school or moved to a different school in a consecutive year.

A multilevel binary logistic regression analysis was used to test the relationships of teacher and school-level characteristics with: a) the likelihood of teachers leaving MCPS by resignation or termination; and b) the likelihood of elementary teachers moving to a different MCPS school. This analysis included both teacher-level characteristics (such as gender, race, years of experience, or education) and school-level characteristics (such as percent of students in the school receiving Free and Reduced-price Meals System (FARMS) services, school enrollment size, or average years of teachers' experience in school). Additional analysis was conducted to observe if elementary teachers moved to more or less complex schools during the period FY 2010 – FY 2017.

Summary of Key Findings

Research Question 1: What teacher and school characteristics are related to teacher attrition (i.e., leaving due to resignation or termination) in MCPS?

- Among elementary, middle, and high school teachers, those with more years of experience and those with a master's degree equivalent or higher were less likely to leave MCPS. Among elementary teachers, those living outside of Montgomery County were more likely to leave; however, this was not a significant ($p > .05$) predictor for middle or high school teachers.
- Among middle school teachers, science teachers had a greater likelihood of leaving than non-science teachers, but among high school teachers, science teachers were less likely to leave than

non-science teachers. No other subjects had statistically significant relationships with teacher attrition.

- School-level factors varied across school levels in their association with attrition. Among elementary teachers, the average years of experience among teachers in the school was significantly ($p < .05$) related to the likelihood of leaving, with teachers in schools with higher average years of experience less likely to leave. None of the school-level factors tested were statistically significant in predicting attrition in middle school. Among high school teachers, those in schools with higher percentages of students receiving FARMS services and those in schools with larger student populations were less likely to leave than teachers in low-FARMS schools or schools with smaller student populations.

Research Question 2: What is the mobility rate among elementary school teachers within MCPS (i.e., movement to another school)? What teacher and school characteristics are related to the mobility of elementary teachers?

Mobility rate

- During the eight years included in the scope of the study, the mobility rate of elementary teachers increased, with the lowest rate in FY 2010 (4.7%) and the highest rate in FY 2016 (8.9%). On average, 6.6% of elementary teachers moved to another MCPS school each year, and among those who moved, 87.3% of them went to another elementary school, 11.5% went to a middle school and 1.1% went to a high school.

Characteristics of elementary teachers who moved or stayed

- The proportion of female teachers staying in the same school was greater than the proportion of male teachers. Similarly, the proportion of Black or African American or Hispanic/Latino teachers moving to a different school was greater than the proportion of White or Asian teachers.
- Among teachers who stayed in the same school, on average 65% had five years or more of teaching experience; however, among teachers who moved to a different school, 54% had five years or more years of teaching experience.
- The average proportion of teachers with a master's degree equivalent or higher was similar for those who stayed or moved to a different school during the eight-year period of analysis (around 75%).
- The average percentages of students receiving FARMS and ESOL services at destination schools (schools where teachers moved to) were lower than the average percentages at origin schools (schools where teachers moved from) in seven of the eight years of analysis. Similar differences, but in smaller magnitudes, were found in the average percentages of students identified as Black of African American, and Hispanic/Latino between origin and destination schools.

Teacher and school characteristics related to the likelihood of elementary teachers' mobility

- Both a teacher's years of experience and the average years of experience in the school were significantly ($p < .05$) related to elementary teacher mobility in most years of the study; the likelihood of moving to a different school was lower with more experience.
- In three of the years of the study, elementary teachers with a master's degree equivalent or higher were more likely to move to a different school compared with those without a master's degree.

- In three of the years of the study, elementary teachers in schools with higher percentages of students receiving FARMS services were more likely to move to a different school.
- In two of the years analyzed, an interaction between teacher experience and school FARMS participation was statistically ($p < .05$) significant, indicating that among the elementary teachers located in high FARMS schools, experienced teachers were more likely to move to a different school than their less experienced peers.
- In one of the years of analysis, elementary teachers working in schools that experienced a change of principal were more likely to move to a different school.
- Race/ethnicity of elementary teachers was not significantly ($p > .05$) related to teachers' mobility in any of the eight years of analysis.

Research Question 3: Among the elementary teachers who moved to another MCPS school from FY 2010 to FY 2017, what proportion of teachers moved to a school with a higher, lower, or same level of complexity?

- During this period, the largest number of elementary teachers who moved to different schools went to MCPS schools with similar complexity levels (same level, +1, or -1 complexity level).
- Except for FY 2010, close to one half of elementary teachers who changed schools moved to less complex schools, whereas about a third of them moved to more complex schools.

Discussion and Implications for MCPS

The higher rate of attrition and mobility among teachers with less experience is not unique to MCPS; the literature consistently reports that teachers in the early years of their career are more likely to leave their teaching positions or change schools. However, this study's finding that elementary teachers in schools with higher average years of experience are less likely to leave MCPS or move to a different school suggests that working in a school with more experienced staff may offer benefits that support teachers' retention. Further, the findings point to the importance of initiatives such as the Teacher Induction, Retention, and Advancement (TIRA) in MCPS, designed to support teachers in their first years with the goal of offsetting some of the risks for attrition and mobility that beginning teachers bring.

As discussed in the first report, MCPS has strived to recruit, support, and retain a diverse teaching staff, and some gains in the racial/ethnic diversity of the teaching staff have been observed in the last five years (see Davila Valencia, Wade, and Wolanin, 2018 for details). Although studies from other districts have found that Black or African American or Hispanic/Latino teachers are more likely to leave their teaching positions, it was not the finding in the current MCPS study. In fact, the results of these analyses trended in the opposite direction—Black or African American and Hispanic/Latino teachers were less likely to leave than other teachers. Efforts in place in MCPS such as the Teacher Workforce Diversity Strategic Plan (MCPS, 2014) and the Building our Network of Diversity (BOND) Project (MCPS, 2018) may be having a positive impact not only on increasing the diversity of the teaching staff, but on sustaining it as well, by expanding support networks within schools and across the district.

Further, studies of teachers in Texas and in North Carolina found that having a graduate degree was associated with an increased likelihood of leaving. In MCPS, however, among elementary and high school teachers (in all the time frames analyzed) and among middle school teachers (in one of the three time frames analyzed), a master's degree or equivalent was associated with a lower likelihood of leaving. Personnel policies and practices, financial support of graduate education, and a supportive professional

learning community may influence the relationship between teachers' education level and attrition in a positive way in MCPS.

This study examined teacher attrition and mobility over the years, considering variables important to teacher and school success. It is recognized that some factors not available for this study (e.g., changes in position allocations, implementation of programs within schools) may influence teacher attrition and mobility in a particular school, in a specific year, or across the school system. However, the current findings provide information about teacher and school characteristics related to teacher movement, and results of the study indicate where the needs are the greatest, particularly in terms of promoting retention and supporting early-career teachers in their schools.

Study of Teacher Workforce in Montgomery County Public Schools: Part 2

Juan Carlos Davila Valencia, Julie Wade, and Elizabeth Cooper-Martin

At the request of the Office of the Superintendent of Schools in Montgomery County Public Schools (MCPS), the Office of Shared Accountability (OSA) conducted a study of the teacher workforce in MCPS. A first report addressed the following: (a) the characteristics of all current (2017–2018 school year) teachers as well as the characteristics of newly-hired teachers, both across the district and in different types of schools; (b) the rates of teacher attrition and position vacancies for the 2017–2018 school year and previous school years; and (c) a comparison of the status and trends reported for MCPS with those of Maryland and the nation to provide a wider context for the findings (Davila Valencia, Wade, & Wolanin, 2018). This report focuses on turnover among two groups of teachers: those who leave MCPS due to resignation or termination and those elementary teachers who transfer or move to other schools within MCPS. Ultimately both reports aim to inform policies and practices that will support successful teacher staffing in MCPS.

Scope and Research Questions

The first report on the workforce in MCPS described teachers as highly experienced (42% had more than 15 years of teaching experience) and increasingly diverse with fewer new White teachers, and more Black or African American and Hispanic/Latino teachers (Davila Valencia, Wade, & Wolanin, 2018). Additional findings from the first report were as follows. MCPS schools with higher levels of poverty had, on average, teachers with fewer years of experience and higher proportions of Black or African American teachers and Hispanic/Latino teachers. Between FY 2014 and FY 2017, there was an increase in teacher attrition (i.e., departures due to resignation or termination). However, among teachers who started at MCPS between FY 2008 and FY 2012, an average of 72% stayed employed as teachers in the district for at least five years. Based on descriptive analyses, the first report found no differences in attrition by gender or race/ethnicity, but schools with high levels of poverty experienced higher teacher attrition than schools with low levels of poverty.

The objective of this report was to provide a deeper understanding of turnover in two groups: 1) teachers who leave by attrition (i.e., due to resignation or termination) and 2) elementary teachers who are mobile (i.e., transfer or move to a different MCPS school). While the first report used descriptive analyses, the current one used advanced statistical analyses to expand on the findings related to teacher attrition. Further, the first report did not explore teacher mobility; this report addressed this topic for elementary school teachers.

The following research questions address the report's objective:

1. What teacher and school characteristics are related to teacher attrition (i.e., leaving due to resignation or termination) in MCPS?
2. What is the mobility rate among elementary school teachers within MCPS (i.e., movement between schools)? What teacher and school characteristics are related to the mobility of elementary teachers?

3. Among the elementary teachers who moved to another MCPS school from FY 2010 to FY 2017, what proportion of teachers moved to a school with a higher, lower, or same level of complexity?

Review of Selected Literature

To guide this research on teachers leaving MCPS or elementary teachers moving to other schools, the authors reviewed research that identified factors related to teacher mobility. A summary that includes both teacher and school factors follows, first for teachers who leave the profession and then for teachers who move to another school.

Factors Related to Leaving the System

This section of the literature review summarizes studies related to question 1 on teachers who leave the profession (leavers). In most studies, the authors had data on whether teachers left their system, but not on whether they left to teach in another district.

Teacher factors

A recent report on trends in teaching analyzed teacher turnover (Ingersoll, Merril, Stuckey, & Collins, 2018). These researchers used data from questionnaires that were given to a nationally representative sample of teachers and collected eight times from 1987–1988 through 2015–2016. They found that the percentage of leavers was significantly higher for the combined group of Black/African American and Hispanic teachers than for White teachers. Similarly, in a study of Texas teachers over five years (2011–2012 through 2015–2016), the percentage of leavers was higher for Black teachers than for White or Hispanic teachers (Sullivan, Barkowski, Lindsay, Lazarev, Nguyen, Newman, & Lin, 2017). However, in the Texas study, Hispanic teachers had the lowest percentage of leavers. These differing results suggest that it may not be appropriate to combine racial subgroups when analyzing turnover, as argued by Sun (2018).

Ingersoll and colleagues (2012) calculated that almost 45% of teachers leave the profession within five years of entry. Likewise, in the study of Texas teachers, the percentage of leavers was highest for those with 7 years or less of experience and also for those with 21 years or more of experience (Sullivan et al, 2017). Further, a study of teacher mobility in the School District of Philadelphia over six years (2009–2010 through 2015–2016) found that teachers with 21 years or more of experience had disproportionately high rates of leaving, perhaps due to retirement (Steinberg, Neild, Canuette, Park, Schulman, & Wright, 2018). Thus, the relationship between years of experience and likelihood of leaving has a U-shaped curve: it is highest among beginners and veterans (Steinberg et al).

The rate of leaving was higher for those with a graduate degree than for those with a bachelor's degree, in the study of Texas teachers (Sullivan et al, 2017). In this research, leavers included teachers who became administrators along with those who no longer taught in the state. Another study (using data from 2003–2004 through 2014–2015 for K-8 North Carolina teachers) found a higher percentage of teachers with graduate degrees among those who left teaching, compared to those who stayed or moved (Sun, 2019).

The study of Texas teachers also examined the rate of leavers across 12 areas of certification (Sullivan et al, 2017). The most striking difference was for special education; the percentage of teachers with special education certification who left teaching averaged 18.5% over five years. The five-year average for all other certification areas ranged from 9.3% to 11.6%. The study of teachers in Philadelphia also examined the subject taught (Steinberg et al, 2018). The rate of teachers leaving the district was higher among teachers of English, mathematics, and science, compared to social studies and all other subjects (these areas included middle school and high school teachers only). The rate of leavers was lowest for general education teachers, who usually taught in elementary schools. These results suggest a lower rate of leaving for elementary than middle school teachers.

In summary, previous research suggests that the following teacher factors are related to leaving the profession of teaching:

- Race/ethnicity
- Years of teaching
- Educational attainment
- Subject area
- School level

School factors

The study of teachers in Texas identified several school characteristics that were related to the likelihood that teachers leave the profession, using school-level mobility rates (Sullivan et al, 2017). One factor was student race/ethnicity. The percentage of teachers leaving Texas was higher in schools that had a higher percentage of Black students (positive correlation significant in five of five years) and of Hispanic students (positive correlation significant in four of five years). Further, the percentage of teachers leaving the state was lower in schools that had a higher percentage of White students (negative correlation significant in five of five years).

Additionally, the proportion of teachers leaving teaching was higher for schools with a higher proportion of English language learners (positive and significant correlations in five of five years), schools with a higher proportion of students eligible for the federal school lunch program (positive and significant correlations in five of five years), and schools with a lower proportion of gifted/talented students (negative and significant correlations in five of five years) (Sullivan et al, 2017).

There was some evidence for a relationship with student proficiency. The proportion of teachers leaving teaching was higher for schools with a lower percentage of students passing all state assessments (negative and significant correlation in three of five years) (Sullivan et al, 2017).

In summary, previous research suggests that the following school factors are related to leaving the profession of teaching:

- Student race/ethnicity
- Proportion of English language learners
- Proportion of students eligible for Free and Reduced-Price Meals System (FARMS) services
- Proportion of gifted/talented students
- Student proficiency on state assessments

Factors Related to Moves to Other Schools

This section of the literature review summarizes studies related to questions 2 and 3 of this study, on teacher movement between schools in the same district or state.

Teacher factors

The percentage of teachers who moved within the state was higher for males than females in each of the five years studied, in the study of Texas teachers described above (Sullivan et al, 2017). Similarly, in a study of teacher mobility in the Midwest over five years (2006–2007 through 2010–2011), male teachers were significantly more likely than female teachers to move to another school in their state, based on multinomial, multivariate logistic regressions for two states (Iowa and Wisconsin) (Podgursky, Ehlert, Lindsay, & Wan 2016). However, this relationship was only significant for five-year mobility (i.e., moving versus staying in the same school from 2006–2007 to 2011–2012), not annual mobility.

The percentage of movers within the state was highest for Black teachers compared to other racial/ethnic groups (i.e., Hispanic, White, Other) in each of the five years studied in the Texas study (Sullivan et al, 2017). But in the Midwest study, the likelihood of moving to another school did not vary significantly with a teacher's racial/ethnic status (defined as non-Hispanic White vs. all others) in the two states analyzed (Podgursky et al, 2016).

Teachers with less experience were significantly more likely to move to another school in their state, based on multinomial, multivariate logistic regression of annual mobility and five-year mobility; these results were the same for each of three states in the Midwest study (Podgursky et al, 2016). Likewise, in the study of Texas teachers, the percentage of movers was highest for teachers with 0-2 years of experience, and declined as experience increased (Sullivan et al, 2017). The Philadelphia study examined teachers who moved from a school in Philadelphia to another school within the district or within the state; teachers with 1-10 years of experience had disproportionately high rates of moving to another school (Steinberg et al, 2018). Note that the latter two studies did not report tests of significance.

The Texas study was the only one that examined educational attainment and moving; the percentage of movers was very similar (within two percentage points) for both teachers with advanced degrees and those with a bachelors (Sullivan et al, 2017).

The Midwest study analyzed elementary teachers who moved to a different school in their state and found statistically significant differences (based on ANOVA) in the annual and five-year mobility rates by focus area for each of the three states analyzed; the percentage of movers was highest for special education teachers, lowest for general elementary teachers, and in between for other elementary school teachers (Podgursky et al, 2016). However, the differences in the percentages of movers across 12 areas of certification were relatively small in the Texas study of K-12 teachers, ranging from 8.4% for English language arts to 12.2% for physical education (Sullivan et al, 2017). Note that the latter study did not report tests of significance.

In summary, previous research suggests that the following teacher factors are related to moving from one school to another:

- Gender
- Race/ethnicity
- Years of teaching
- Teaching focus for elementary school teachers

School factors

Characteristics of the student body. The Philadelphia study examined teachers who moved from a school in Philadelphia to another school within the district or within Pennsylvania; across six years of data, teachers moved out of schools with higher percentages of Black or Hispanic/Latino students than the average for Philadelphia (Steinberg et al, 2018). Similarly, the Texas study found that the percentage of teachers who moved to another school within their district was greater in schools with a higher percentage of Hispanic students (positive correlation significant in five of five years) (Sullivan et al, 2017). Further, this study found that the percentage of teachers moving within the state was higher among schools that had a lower percentage of White students (negative correlation significant in five of five years) or a lower percentage of Other (i.e., not Asian, Black, Hispanic or White) students (negative correlation significant in five of five years).

The study of teachers in Texas examined the relationship between other student characteristics and the likelihood that teachers moved to another school in their district (Sullivan et al, 2017). Using the school-level mobility rate, these researchers found that the proportion of teachers moving out of a school was higher for schools with a higher proportion of English language learners (positive and significant correlations in five of five years), with a higher proportion of gifted/talented students (positive and significant correlations in five of five years), with a lower percentage of students in special education programs (negative and significant correlations in five of five years), and with a higher proportion of economically disadvantaged students (positive and significant correlations in four of five years).

The Midwest study also found a relationship with student poverty. Among teachers who moved between schools in the Midwest study, teachers were significantly more likely to leave schools with more economically disadvantaged students, based on multivariate logistic regression (Podgursky, Ehlert, Lindsay, & Wan, 2016).

The last student characteristic to consider is academic achievement. Among teachers who moved between schools in the Midwest study, teachers were significantly less likely to leave schools with higher percentages of academically proficient students, based on multivariate logistic regression (Podgursky et al, 2016). The latter study defined proficiency as meeting the state standard for both math and reading/language arts. Similarly, among Philadelphia teachers who transferred to another school within their district or within Pennsylvania, the schools they exited had lower percentages of proficient students than the average for the Philadelphia district (Steinberg et al, 2018); this study did not report significance testing. However, in the study of Texas teachers, student proficiency on all state assessments was related to the percentage of teachers transferring within their district (significant correlations in four of five years) but not in a consistent way (i.e., positive in two years and negative in two years) (Sullivan et al, 2017).

Other school factors. The Midwest study examined teachers who moved to another school in their state for three different states; based on multivariate logit regressions, teachers were significantly more likely

to leave schools in an urban area than in a nonurban location and also significantly less likely to leave schools with larger student bodies (Podgursky, Ehlert, Lindsay, & Wan, 2016).

The study of Texas teachers found that the proportion of teachers moving within their state was higher in schools with higher student-teacher ratios (positive and significant correlations in five of five years) (Sullivan et al, 2017).

The final factor of interest is the principal's gender, from a study of teacher turnover at all grade levels in New York State over 38 years (Husain, Matsa, & Miller, 2018). Specifically, male teachers were significantly more likely to move from a female principal and to request transfer to a male principal, based on multivariate logistic regression.

Summary. Findings from past research studies suggest that the following school factors are related to moving from one school to another:

- Student race/ethnicity
- Proportion of English language learners
- Proportion of gifted/talented students
- Proportion of students in special education programs
- Proportion of economically disadvantaged students
- Student proficiency on state assessments or standards
- Location (urban vs. nonurban)
- Size of student body
- Student-teacher ratios
- Principal's gender

Methodology

Study Samples

The study focused on the turnover of classroom teachers and therefore excluded special education teachers, teachers of English for Speakers of Other Languages (ESOL), and elementary teachers in specialized areas (e.g., art, music, physical education). In addition, teachers who retired or moved to an administrative position within MCPS were removed from the sample.

The samples to address the three research questions are described below.

The sample for Research Question 1, concerning teacher attrition, was all classroom teachers at any level (i.e., kindergarten through Grade 12) who taught in MCPS during FY 2010 through FY 2018. The sample included elementary classroom teachers (as defined above) and secondary level teachers who taught core subjects, such as math, English, or science, as well as those in specialized areas such as art, music, or physical education. Teacher attrition was defined as resignations and terminations. Three time frames were examined: attrition over the course of two years (FY 2016 - FY 2018); attrition over five years (FY 2013 - FY 2018); and attrition over eight years (FY 2010 - FY 2018).

The sample for Research Question 2, concerning mobility of elementary teachers, was all elementary classroom teachers (as defined above) who taught in MCPS during FY 2010 through FY 2018. Mobility was examined for each of the eight years by analyzing whether teachers stayed in the same school or moved to a different school in a consecutive year.

The sample for Research Question 3 was the same as for Research Question 2.

Teacher and School Factors

Individual level teacher data. The Department of Employee and Retiree Services (ERSC) provided records for MCPS teachers for each year of the study. These records, in combination with OSA records, were used to identify the following variables for each teacher:

a. Demographic characteristics (i.e., gender, race/ethnicity, age)
b. Whether the teacher's residence was in Montgomery County
c. Start date as a teacher in MCPS
d. Highest level of education
e. Type of certification
f. School where the teacher worked
g. Whether the teacher left due to termination or resignation
h. Number of years teaching in MCPS (calculated by using MCPS teacher start date and last year active)
i. Subject area taught as of their last year in MCPS for middle and high school teachers

MCPS school-level data. MCPS school-level data were accessed in OSA records for each of the years in the study to identify the following variables:

a. Percentage of students identified as Black or African American
b. Percentage of students identified as Hispanic/Latino
c. Percentage of students who are currently receiving ESOL services
d. Percentage of students who are currently receiving Free and Reduced-Price Meals System (FARMS) services
e. Percentage of students who currently have an Individualized Education Program (IEP)
f. Total student enrollment (school size)
g. Mean years of experience of teachers in school (derivation described below)
h. Change in principal (derivation described below)

To include a school-level variable about the experience of teaching staff within the school, the mean years of experience of teachers in the school was calculated. Also, a variable related to school administrators was considered as a factor to predict teachers' moves. Specifically, change of principal/school leadership was calculated for each of the years of the analysis by using staff data provided by ERSC. This variable was dichotomous and had a value of 1 when a school had a new principal in a particular year (or an acting principal for a longer period, defined as more than one month in a particular year) and a value of 0, otherwise.

MCPS school complexity index. The complexity index is a composite measure or index of school level demographic characteristics that represents the differences and similarities among schools. Factor analysis was used to develop factor scores using school level proportions of:

a. Ever FARMS: students who previously or currently are receiving FARMS services
b. ESOL: students who currently are receiving ESOL services
c. Special Education: students who currently have an IEP
d. Combined total percent of students identified as Hispanic/Latino and students identified as Black or African American

Using the factor scores from the principal component that explained the most variance in scores as weights, a normal score variable was constructed for each school. From the normal score, a school rank, a percentile rank, and complexity grouping based on percentile (quintile) were computed for each school. Schools in the first quintile (level 1) represent the least complex schools whereas the schools in the fifth quintile (level 5) represent the most complex ones.

MCPS Students' focus groups. According to MCPS Equity Accountability Model, there are five focus groups of students: (1) Non-FARMS Black or African American; (2) Non-FARMS Hispanic/Latino; (3) FARMS White/Asian/All Other Student Groups; (4) FARMS Black or African American; and (5) FARMS Hispanic/Latino.

Analytical Methods

To address the first two research questions, multilevel binary logistic regression was used to test the relationships of teacher and school-level characteristics with the likelihood of: a) teachers leaving MCPS; or b) teachers moving to a different school.

This study followed the analytical procedures suggested by Sommet and Morselli (2017). First, all school-level variables were school-centered in order to facilitate the interpretation of the effect of teacher-level predictors *in a given school* on the likelihood of leaving MCPS (question 1) or moving to a different school (question 2). Then, an empty model was tested to determine the percentage of variance attributable to differences among schools and to determine the intraclass correlation coefficient (ICC). Teacher- and school-level variables were added or removed in subsequent models until the best fit was achieved. Teacher- and school-level variables were examined for multicollinearity and redundancy, and some school-level predictors (for example, percentage of students receiving ESOL services, and percentage of students identified as Black or African American, or Hispanic/Latino) were dropped from the analysis due to their high correlation with the percentage of students receiving FARMS services.

The final model that examined the likelihood of teacher attrition included the following predictors: gender, race/ethnicity, years of experience in MCPS, education, residence in Montgomery County, percentage of students receiving FARMS services in the school, school enrollment size, and mean years of teaching experience in the school (in the elementary and middle school analyses). Additionally, this model incorporated subjects taught for the analysis of teacher attrition in middle and high schools only. The final model that examined the likelihood of elementary teachers moving to a different school included: gender, race/ethnicity, education, years of experience in MCPS, percentage of students receiving FARMS services in the school, school enrollment size, mean years of teaching experience in the school, and if the school experienced a change of principal or not. Interaction terms were included

as appropriate in both models; however, the number of schools was not large enough to include interactions in the middle and high school models for question 1.

The multilevel binary logistic regression yielded a regression coefficient, statistical significance, and the odds ratios for each of the predictors. Cohen's *d* effect sizes were used to determine if the odds ratios were large enough to be of practical significance. The following formula was used to calculate the effect size (*d*) from the odds ratio:

$$d = \frac{\ln(OR)}{pi/\sqrt{3}}$$

For positive relationships between predictors and outcomes, a Cohen's *d* effect size of .20 (or an odds ratio of 1.44) is considered small, a Cohen's *d* of .50 (or an odds ratio of 2.47) is considered medium, and a Cohen's *d* of .80 (or an odds ratio of 4.25) is considered large. For example, an odds ratio of 2.0, equivalent to a Cohen's *d* of .38, reflects a positive relationship of small magnitude. For negative relationships, a Cohen's *d* effect size of -.20 (or an odds ratio of .70) is considered small, a Cohen's *d* of -.50 (or an odds ratio of .41) is considered medium, and a Cohen's *d* of -.80 (or an odds ratio of .24) is considered large. As an example, an odds ratio of .30, equivalent to a Cohen's *d* of -.67, reflects a negative relationship of medium magnitude. These thresholds were used to describe the magnitude of the relationship, indicating whether it is of practical significance to educators.

Research Question 1. Multilevel binary logistic regression analysis was conducted at each school level (i.e., elementary, middle, and high) to test the relationship of teacher-level and school-level factors with leaving by attrition (1) versus staying as a teacher in MCPS (0). Teachers who stayed as a teacher in MCPS included those who stayed in the same school as well as those who moved to a different MCPS school. Logistic regression analysis requires a large sample; however, relatively few teachers leave by attrition each year. Therefore, analyses were conducted for multiple years, specifically over two years (FY 2016 to FY 2018), five years (FY 2013 to FY 2018), and eight years (FY 2010 to FY 2018). As an example, using the two-year analysis, the analytic sample was teachers working in FY 2016 and the outcome variable was whether they left due to attrition (i.e., resignation or termination) or were still teaching in FY 2018.

Research Question 2. The mobility rate of elementary teachers for each year was calculated by dividing the number of elementary teachers who moved to another school in the following year by the total number of elementary school teachers in the year of analysis. As an example, the mobility rate for FY 2010 represents the percentage of teachers who moved to another school in FY 2011 among the total number of elementary teachers in FY 2010.

Multilevel binary logistic regression analysis was conducted at the elementary level to test the relationship of teacher-level and school-level factors with moving to another school in MCPS (1) versus staying at the same school (0). For each of the eight years of mobility, there were enough movers to conduct the regression analysis and eight regression models were analyzed to observe if these relationships had any pattern over time. Random school- and teacher-level variations were added or removed in the models for some of the years of analysis when appropriate.

In cases where interactions between variables revealed statistically significant relationships, odds ratios were manually recalculated and only those adjusted odds ratios are reported by the study. Sommet and Morselli (2017) recommend this approach because the odds ratios associated with an interaction term that are produced by standard statistical packages are likely to be biased.

Research Question 3. First, complexity levels for each elementary school for each year were computed. Then, complexity levels of origin and destination schools for those teachers who moved were compared. The change of school complexity levels (direction and magnitude) were reported for each of the years of analysis, as well as the percentage of elementary moves by complexity level. To further examine the composition of schools at different levels of complexity, analysis of students' focus groups and school complexity levels was conducted for three years (FY 2012, 2015, and 2018) to observe any relationship between them.

Strengths and Limitations of the Methodology

Strengths. One of the strengths of this study is the multivariate analysis approach to address teacher attrition and mobility in MCPS. Several teacher and school-level characteristics were incorporated in the analyses, and in some cases additional variables were calculated by the authors to predict as accurately as possible the likelihood of leaving MCPS or moving to a different school. Also, the use of a multilevel binary logistic regression method ensured that the assumption of independence of the residuals was met. Because teachers located in the same school were more likely to behave in the same way than teachers located in different schools, predicting the likelihood of leaving or moving via a standard logistic regression would have violated the assumption that observations are not interdependent. Multilevel binary logistic regression allowed the authors to disentangle the within-school effects from the between-school effects, and as a result, to predict more accurately the likelihood of leaving MCPS or moving within MCPS.

Another strength of this study was the use of multiple years of data and, as a result, inclusion of a large sample of teachers in the analytical models. For example, Research Question 1 addressed the likelihood of teachers leaving versus staying in MCPS in three time frames: two years (FY 2016 to FY 2018), five years (FY 2013 to FY 2018), and eight years (FY 2010 to FY 2018). The sample for each time frame ranged from 900 to more than 2,600 teachers. Research Question 2 analyzed the likelihood of elementary teachers moving to a different school in each of eight years: from FY 2010 to FY 2017 with samples for each year of more than 2,700 teachers. The incorporation of multiple years allowed for the possibility that certain teacher and school-level characteristics were associated with the decision of teachers to leave MCPS or to move to a different school for some specific periods or time frames, rather than consistently over time.

Limitations. Because the sample excluded certain types of teachers (e.g., ESOL, elementary teachers of specialized subjects), the findings cannot be generalized to these groups of teachers.

Certain teacher and school-level characteristics that previous research showed were related to teacher turnover were not available for the current analysis. An example is student proficiency as a school-level variable; a standard variable measuring student proficiency in MCPS for all the years of analysis was not available. Also, some specific events associated with a particular school, in a specific year, or across the school system might have occurred and affected the decision of some teachers to leave or move to a different school. For example, a change in the number of positions allocated to a school or a change of

curriculum might have forced some teachers to leave or move. Similarly, the implementation of pilot programs in certain schools might have influenced their decision to leave or move as well.

Findings

Question 1. What teacher and school characteristics are related to teacher attrition (i.e., leaving due to resignation or termination) in MCPS?

Description of analytic sample

The analytic sample for this question comprised teachers at all levels—elementary, middle, and high school—who taught in MCPS during the school years from 2009–2010 through 2017–2018. Teachers who resigned or were terminated were categorized as teachers who "left" and teachers who remained in their teaching position through the period of study were categorized as teachers who "stayed."

At each school level, the analysis was conducted to examine teacher attrition over three time frames. Table 1 summarizes the number of classroom teachers at each level who were included in the two-year, five-year, and eight-year analyses.

Table 1
Number and Percentages of Teachers who Left MCPS from 2010 to 2018 Over Three Time Frames and School Level

Time Frames	Elementary			Middle			High		
	Total (*N*)	Left MCPS (*n*)	Left (%)	Total (*N*)	Left MCPS (*n*)	Left (%)	Total (*N*)	Left MCPS (*n*)	Left (%)
2-year (2016-2018)	2,662	260	9.8	1,248	117	9.4	1,936	142	7.3
5-year (2013-2018)	2,167	316	14.6	1,032	151	14.6	1,716	205	11.9
8-year (2010-2018)	1,727	310	17.9	903	156	17.3	1,529	249	16.3

Attrition among Elementary Teachers

Teacher characteristics. Table 2 shows the odds ratios for each characteristic in relation to attrition of elementary teachers during each of the three time frames. Descriptive statistics and additional logistic regression results can be found in Appendix A (Tables A1-A3). An odds ratio greater than 1.00 indicates the characteristic is related to a *greater* likelihood of leaving; an odds ratio less than 1.00 indicates the characteristic is related to a *lower* likelihood of leaving.

Teachers with more years of experience in MCPS were less likely to resign or be terminated than teachers with less experience (Table 2). Also, teachers holding a master's degree equivalent or higher and teachers living in Montgomery County were less likely to resign or be terminated than teachers without these characteristics. In the five- and eight-year analyses, all three of these characteristics showed a statistically significant relationship with attrition. In the two-year analysis, years of teaching in MCPS and living in Montgomery County were statistically significant but having a master's degree was not. In the five- and eight-year analyses, the odds ratios for master's degree and living in Montgomery County

were practically significant; having a master's degree showed an odds ratio of small and medium magnitude whereas living in Montgomery County only had odds ratios of small magnitude.

Table 2
Odds Ratios (OR) of Teacher and School Level Characteristics Associated with Elementary School Teachers Leaving MCPS Over Two, Five, and Eight Years

	FY 2016-FY 2018 (two years)	FY 2013-FY 2018 (five years)	FY 2010-FY 2018 (eight years)
Sample (*N*)	2,662	2,167	1,727
	Odds Ratios (OR)		
Teacher characteristics			
Male [a]	1.08	.93	1.04
Black or African American	**.64**	**.64**	.78
Hispanic/Latino	1.00	.71	.95
Years of teaching experience in MCPS	.90***	.85***	.78***
Master's degree equivalent or higher	.85	**.45*** **	**.27*** **
Lives in Montgomery County	.74*	**.67** **	**.67** **
School characteristics			
% students receiving FARMS	1.00	1.00	1.00
Student enrollment (school size)	1.00	1.00	1.00
Mean years of experience of teachers	.91**	.90***	.90***

*$p < .05$; **$p < .01$; ***$p < .001$. Odds ratio values with magnitudes of practical significance are in **bold** font. Odds ratios less than 1 indicate lower likelihood of leaving, and OR ≤ .70 represents small magnitude and OR ≤ .41 represents medium magnitude.
[a] Female is the reference group.
Note. Odds ratios (OR) are based on the multilevel binary logistic regression model for the time period. The OR indicates how the predictor variable is related to the odds that a teacher left versus stayed in MCPS during the time period. Values greater than 1 indicate that increases in the predictor variable are associated with higher odds that a teacher leaves. Values less than 1 indicate that increases in the predictor variable are associated with lower odds. For example, an elementary teacher with a master's degree is less likely to leave vs stay in MCPS between FY 2010 and FY 2018 (.27 times less likely) than an elementary teacher without a master's degree.

Further, the two- and five-year analyses revealed that Black or African American teachers were less likely to resign or be terminated than non-Black or African American teachers, with odds ratios representing practically significant relationships (small magnitude). Relationships were not statistically significant, however (Table 2).

School characteristics. For each of the three time frames, the odds ratios indicated that in schools where the mean years of experience of all teachers in the school was higher, the likelihood for resignation or termination was lower (Table 2). However, these odds ratios were not practically significant but were statistically. Further, as shown in Table 2, other school characteristics (% of students in FARMS and school size) were not significantly related to elementary teacher attrition.

Attrition among Middle School Teachers

Teacher characteristics. In each of the time frames, teachers with more years of experience in MCPS were less likely to resign or be terminated than teachers with less experience. These odds ratios associated with teaching experience were statistically but not practically significant (Table 3). In the

eight-year analysis, teachers with a master's degree equivalent or higher were less likely than teachers without a master's degree to leave by resignation or termination, with an odds ratio that was statistically and practically significant (medium magnitude). Descriptive statistics and additional logistic regression results can be found in Appendix A (Tables A4-A6).

Table 3
Odds Ratios (OR) of Teacher and School Level Characteristics Associated with Middle School Teachers Leaving MCPS Over Two, Five, and Eight Years

	FY 2016-FY 2018 (two years)	FY 2013-FY 2018 (five years)	FY 2010-FY 2018 (eight years)
Sample (*N*)	1,248	1,032	903
	Odds Ratios (OR)		
Teacher characteristics			
Male [a]	1.26	1.18	.85
Black or African American	**.60**	**.62**	**.66**
Hispanic/Latino	**.65**	.87	1.10
Years of teaching experience in MCPS	.89***	.82***	.78***
Master's degree equivalent or higher	.96	.84	**.32***
Lives in Montgomery County	1.01	.73	1.03
Subject taught			
Science	1.21	**1.47**	**2.06***
Mathematics	.82	**1.58**	**1.74**
Foreign Language	1.38	.85	1.04
School characteristics			
% students receiving FARMS	1.01	1.01	1.00
Student enrollment (school size)	1.00	1.00	1.00
Mean years of experience of teachers	.98	.96	.93

*$p < .05$; **$p < .01$; ***$p < .001$. Odds ratio values with magnitudes of practical significance are in **bold** font. Odds ratios less than 1 indicate lower likelihood of leaving, and OR ≤ .70 represents small magnitude and OR ≤ .41 represents medium magnitude. Odds ratios greater than 1 indicate greater likelihood of leaving and OR ≥ 1.44 represents small magnitude.
[a] Female is the reference group.
Note. Odds ratios (OR) are based on the multilevel binary logistic regression model for the time period. The OR indicates how the predictor variable is related to the odds that a teacher left versus stayed in MCPS during the time period. Values greater than 1 indicate that increases in the predictor variable are associated with higher odds that a teacher leaves. Values less than 1 indicate that increases in the predictor variable are associated with lower odds. For example, a middle school teacher with a master's degree is less likely to leave vs stay in MCPS between FY 2010 and FY 2018 (.32 times less likely) than a middle school teacher without a master's degree.

Middle school teachers who were Black or African American (in all the time frames), or Hispanic/Latino (in the two-year analysis only) were less likely to leave MCPS than their non-Black or non-Hispanic peers, respectively, and were practically significant (Table 3). These relationships had odds ratios of small magnitude; however, none of them were statistically significant.

Subjects taught. In the five- and eight-year analyses, teachers who taught science and teachers who taught math had a greater likelihood of resigning or terminating than teachers of other subjects; odds ratios were large enough to be of practical significance (small magnitude). However, none of these relationships were statistically significant, except for science in the eight-year analysis.

School characteristics. Odds ratios indicated that the school characteristics tested were not statistically or practically significant predictors of middle school teacher attrition.

Attrition among High School Teachers

Teacher characteristics. Among high school teachers, years of experience teaching in MCPS and having a master's degree equivalent or higher were statistically significant predictors of attrition. In each of the time frames, teachers with more years of experience in MCPS were less likely to resign or be terminated than teachers with less experience, with odds ratios that were statistically significant but not of a magnitude to be considered practically significant, except for the eight-year analysis (Table 4). Teachers with a master's degree or higher were less likely than teachers without a master's degree to leave by resignation or termination in each of the three time frames. The odds ratios for master's degree were statistically significant for all the time frames, and the magnitude of practical significance varied by the time frame: small magnitude for the two-year analysis, and medium magnitude for the five- and eight-year analyses. In addition, Hispanic/Latino teachers in the eight-year analysis had a lower likelihood of resigning or terminating than non-Hispanic/Latino teachers, with an odds ratio that was practically significant and with a medium magnitude; however, this relationship was not statistically significant. Descriptive statistics and additional logistic regression results can be found in Appendix A (Tables A7-A9).

Table 4
Odds Ratios (OR) of Teacher and School Level Characteristics Associated with High School Teachers Leaving MCPS Over Two, Five, and Eight Years

	FY 2016-FY 2018 (two years)	FY 2013-FY 2018 (five years)	FY 2010-FY 2018 (eight years)
Sample (*N*)	1,936	1,716	1,529
	Odds Ratios (OR)		
Teacher characteristics			
Male [a]	.79	.88	.88
Black or African American	.96	.95	.93
Hispanic/Latino	1.19	.79	**.41**
Years of teaching experience in MCPS	.90***	.81***	**.70*** **
Master's degree equivalent or higher	**.54***	**.32****	**.31***
Lives in Montgomery County	1.00	.86	.93
Subject taught			
Science	1.09	.96	**.47***
Math	.89	.83	.78
Foreign Language	.82	1.07	1.02
School characteristics			
% students receiving FARMS	1.01	1.11	.84**
Student enrollment (school size)	1.00	.98***	.99***

*$p < .05$; **$p < .01$; ***$p < .001$. Odds ratio values with magnitudes of practical significance are in **bold** font. . Odds ratios less than 1 indicate lower likelihood of leaving, and OR ≤ .70 represents small magnitude and OR ≤ .41 represents medium magnitude.
[a] Female is the reference group.
Note. Odds ratios are based on the multilevel binary logistic regression model for the time period. The OR indicates how the predictor variable is related to the odds that a teacher left versus stayed in MCPS during the time period. Values greater than 1 indicate that increases in the predictor variable are associated with higher odds that a teacher leaves. Values less than 1 indicate that increases in the predictor variable are associated with lower odds. For example, a high school teacher with a master's degree is less likely to leave vs stay in MCPS between FY 2016 and FY 2018 (.54 times less likely) than a high school teacher without a master's degree

Subjects taught. In the eight-year analysis, high school teachers who taught science had a statistically and practically significantly (small magnitude) lower likelihood of leaving than teachers of other subjects (Table 4). Other subject areas tested during the three time frames did not yield results of statistical or practical significance.

School characteristics. Odds ratios representing relationships between high school teacher attrition and the school characteristics indicated that student enrollment size was a statistically significant predictor in the five-year and eight-year analyses, and percent of students receiving FARMS services was statistically significant in the eight-year analysis (Table 4). In each case, teachers in larger schools, and teachers in schools with higher percentages of students receiving FARMS services were less likely to resign or be terminated. The magnitudes of the relationships were not large enough to be considered practically significant, however.

Question 2: What is the mobility rate among elementary teachers within MCPS (i.e., movement to another school)? What teacher and school characteristics are related to the mobility of elementary teachers?

Mobility rate of elementary teachers

The mobility rate for each year is represented by the percentage of teachers who moved to another MCPS school in the next consecutive year. Figure 1 shows the annual mobility rate of elementary teachers from FY 2010 to FY 2017. During this period, the mobility rate of elementary teachers increased, with the lowest rate in FY 2010 (4.7%) and the highest rate in FY 2016 (8.9%). The rate went 1.7 percentage points down in FY 2017.

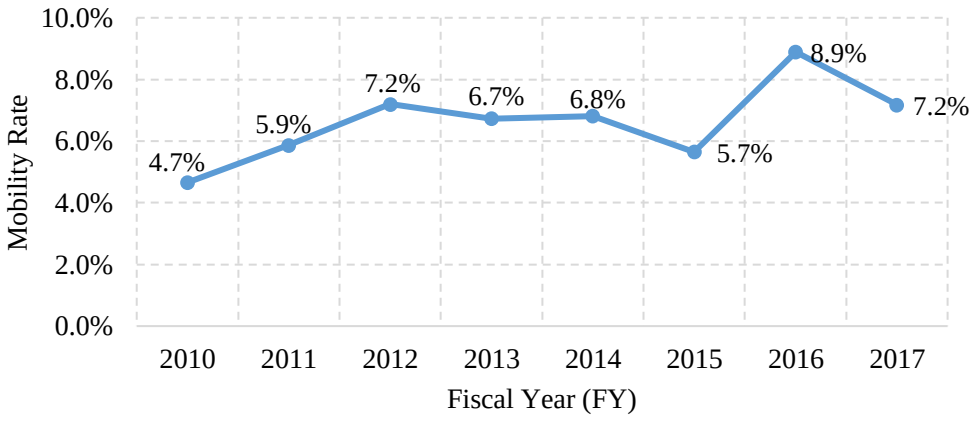

Figure 1. Mobility rate of elementary teachers from FY 2010 to FY 2017.

Across the eight years in the study, on average 87.7% of elementary teachers stayed in the same school from one year to the next (Appendix B, Table B1). Further, 6.6% of elementary teachers on average moved to another MCPS school every year (Appendix B, Table B1). Among the 6.6% of elementary teachers who moved each year (n = 214), 87.3% went to another elementary school, 11.5% went to a middle school, and 1.1% went to a high school (Appendix C, Table C2).

Teacher characteristics. Figures 2 through 4 compare the characteristics of elementary teachers who moved to a different MCPS school (i.e., movers) versus those who stayed in the same school (i.e., stayers). A complete table with characteristics of elementary movers and stayers can be found in Appendix D. According to Figure 2, the proportion of female stayers was slightly higher than the proportion of female movers. Among all the elementary teachers (male and female) who stayed in the same school, between 92% and 93% were female. However, among all the elementary teachers (male and female) who moved to a different school, between 88% and 92% were female (Figure 2).

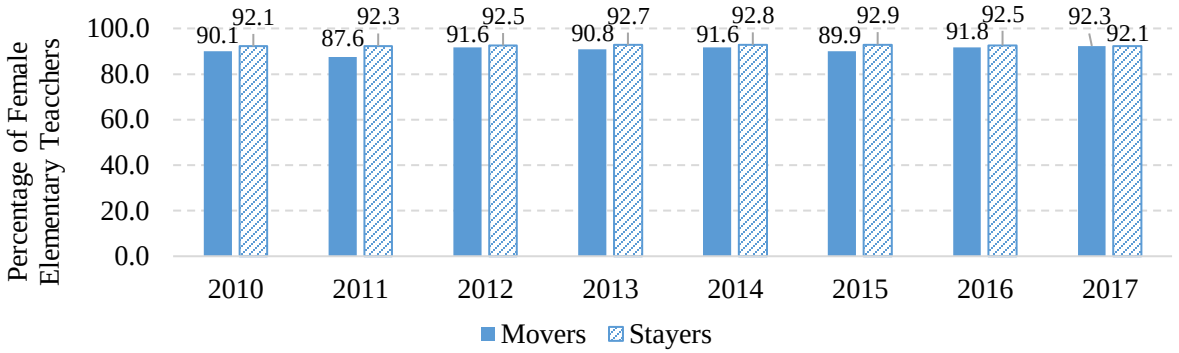

Figure 2. Percentage of Female Elementary Teachers who Moved and Stayed from FY 2010 to FY 2017.

The proportion of Black or African American or Hispanic/Latino elementary movers was higher than the proportion of Black or African American or Hispanic/Latino elementary stayers (Figure 3). Among all the elementary teachers (regardless of their race/ethnicity) who moved to a different school, between 15% and 22% were Black or African American or Hispanic/Latino. However, among all the elementary teachers (regardless of their race/ethnicity) who stayed in the same school, between 14% and 17% were Black or African American or Hispanic/Latino (Figure 3).

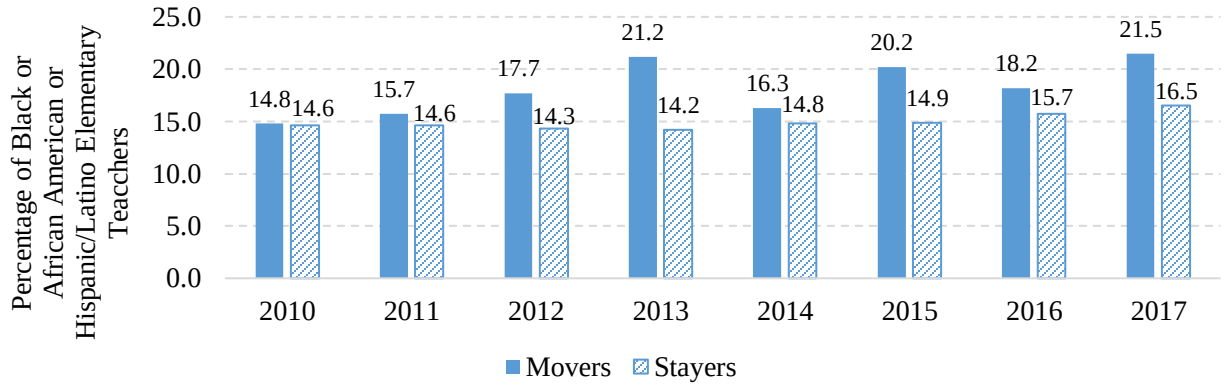

Figure 3. Percentage of Black or African American or Hispanic/Latino Elementary Teachers who Moved and Stayed from FY 2010 to FY 2017.

Between 35% and 63% of elementary teachers who moved to a different school from FY 2010 to FY 2017 had five years or more of teaching experience in MCPS. However, among teachers who stayed in the same school, 59% to 70% had five years or more of teaching experience (Figure 4).

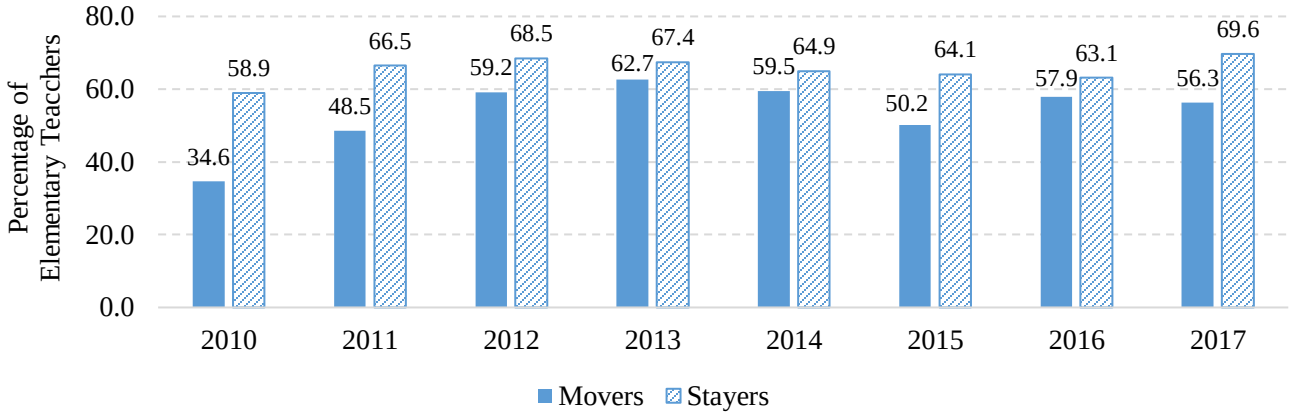

Figure 4. Percentage of Elementary Teachers with Five or More Years of Experience in MCPS who Moved and Stayed from FY 2010 to FY 2017.

The mean proportion of elementary teachers with a master's degree equivalent or higher was very similar for movers and stayers during the eight-year period of analysis (around 75%). However, when the distribution of movers is analyzed by year, the proportion of movers who had a master's degree or higher increased over time from 65.5% in FY 2010 to 80.6% in FY 2017 (Appendix D, Table D1).

School characteristics. Figures 5 and 6 show that the average proportion of students receiving FARMS and ESOL services at destination schools was lower than the average proportion at origin schools in almost all the years of the analysis (the exception was for FY 2010). These differences were statistically significant in five of the years of analysis for FARMS and in six years of analysis for ESOL (Appendix E).

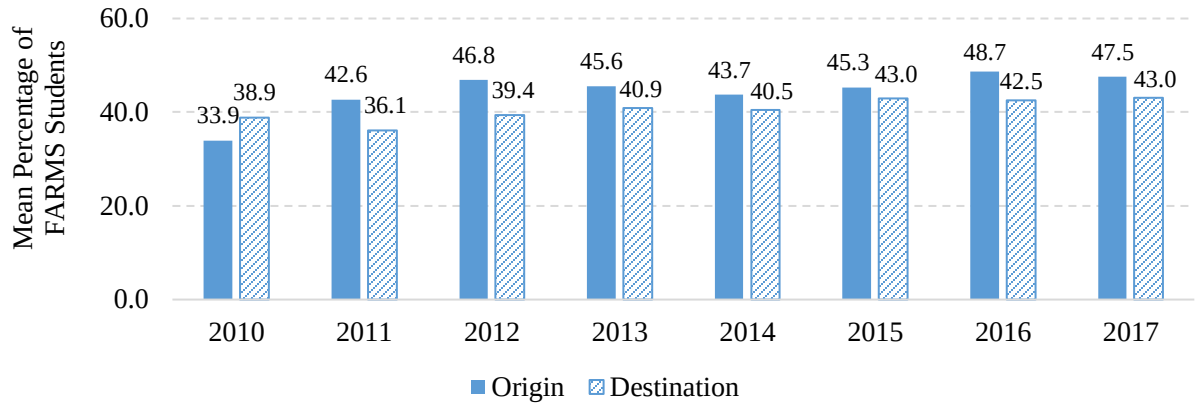

Figure 5. Mean Percentages of Students Receiving FARMS services at Origin and Destination Schools from FY 2010 to FY 2017.

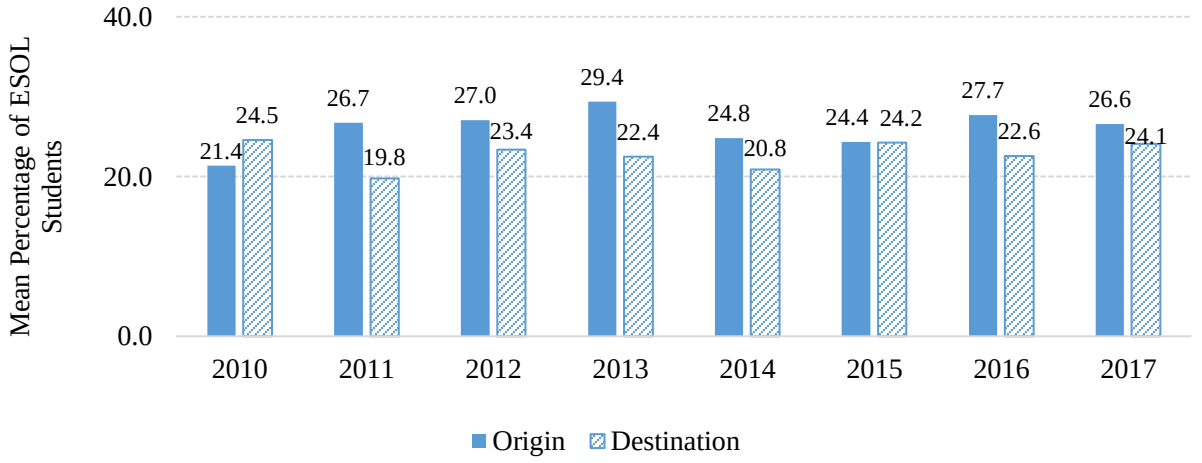

Figure 6. Mean Percentages of Students Receiving ESOL services at Origin and Destination Schools from FY 2010 to FY 2017.

Similarly, the average proportion of Black or African American and Hispanic/Latino students at destination schools was lower than the average proportion reported at origin schools for most years, but the magnitude of these differences varied depending on the year of analysis (Figure 7 and 8). Also, these differences were only statistically significant in few years of analysis (Appendix E, Table E1).

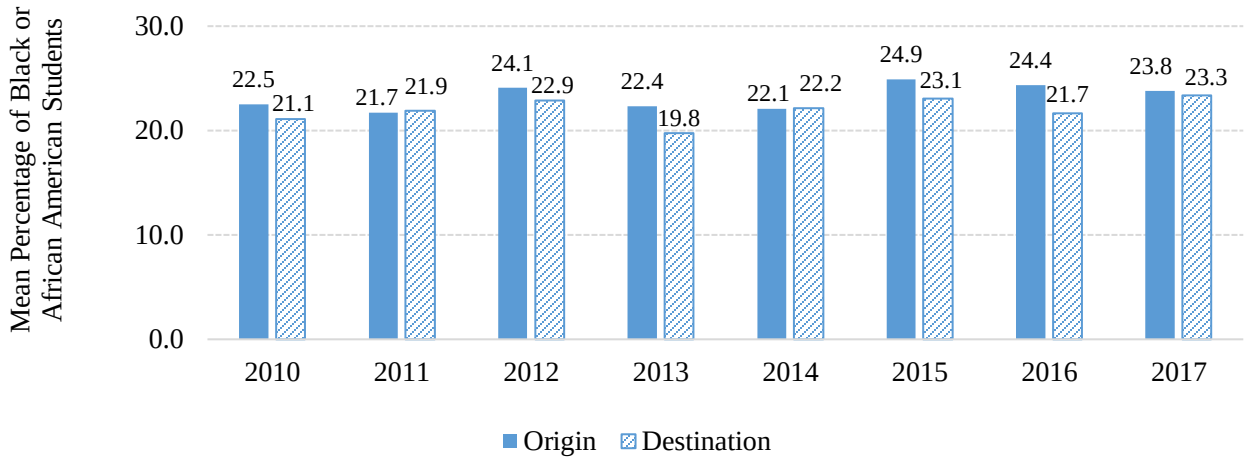

Figure 7. Mean Percentages of Students identified as Black or African American at Origin and Destination Schools from FY 2010 to FY 2017.

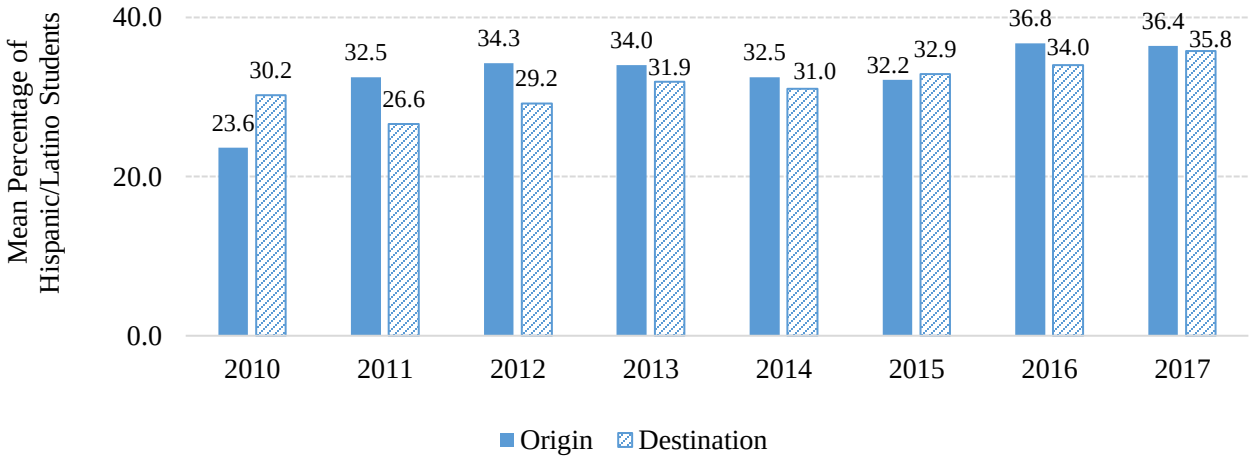

Figure 8. Mean Percentages of Students identified as Hispanic/Latino at Origin and Destination Schools from FY 2010 to FY 2017.

In the case of students receiving special education, the average proportion of students receiving this type of service did not differ much between origin and destination schools; the difference between origin and destination schools were for less than one percentage point in all of the years of analysis and none of them were statistically significant (Appendix E, Table E1).

Teacher and school characteristics related to the mobility of elementary teachers

Table 5 summarizes the relationship (via odds ratios) of mobility of elementary teachers among teacher and school characteristics during the eight-year period of analysis (FY 2010 - FY 2017). Descriptive statistics and additional logistic regression results can be found in Appendix F (Tables F1-F8) for each

of the years of analysis. This analysis is restricted to moves to another elementary school for two reasons: 1) moves from the elementary to the secondary level might have involved different reasons than moves within the elementary level and 2) the total number of moves by elementary teachers to other school levels was small in each of the year of the analysis (Appendix C, Table C1).

Table 5
Odds Ratios (OR) of Teacher and School Level Characteristics Associated with Elementary Teachers Moving to Another MCPS Elementary School From FY 2010 to FY 2017

	Fiscal Year (FY)							
Predictors	2010	2011	2012	2013	2014	2015	2016	2017
Sample (*N*)	2,772	2,733	2,877	2,979	3,057	3,083	3,025	2,776
	Odds Ratios (OR)							
Teacher characteristic								
Male [a]	1.04	1.35	.92	.78	1.20	**1.69**	.92	.72
Black or African American	1.05	.95	1.09	1.22	.73	1.07	1.01	1.31
Hispanic/Latino	**.53**	.83	.87	.97	.81	**1.49**	.86	.99
Master's degree equivalent or higher	1.13	1.23	1.18	**1.79****	1.09	**1.87****	**1.64****	1.43
Years of teaching experience in MCPS	.86***	.96**	.94***	.97*	.94***	.90***	.97**	.96**
School characteristic								
% of students receiving FARMS	.99	1.00	1.01*	1.00	1.01	1.00	1.01*	1.01*
Student enrollment (school size)	.99	.99	1.00	.99*	1.00	1.00	.99	.99
Mean years of experience of teachers	.85**	.92*	.86**	.90***	.95	.83***	.90***	.90**
Change of principal/school leadership	1.15	1.28	**2.34****	1.09	.91	**1.44**	1.21	1.13
Interactions								
Teacher and school-level interactions (years of teaching experience in MCPS & FARMS)	--	--	--	--	1.02**	1.01*	--	--

* $p < .05$, ** $p < .01$, *** $p < .001$. Odds ratio values with magnitudes of practical significance are in **bold** font. Odds ratios less than 1 indicate lower likelihood of moving and OR ≤ .70 represents small magnitude. Odds ratios greater than 1 indicate greater likelihood of moving and OR ≥ 1.44 represents small magnitude.
(--) Interactions were included in some years of analysis when appropriate. Only statistically significant and recalculated interactions are shown.
[a] Female is the reference group.
Note. Odds ratios (OR) are based on the multilevel binary logistic regression model for each of the years of analysis. The OR indicates how the predictor variable is related to the odds that an elementary teacher moved versus stayed in the same school in the following year. Values greater than 1 indicate that increases in the predictor variable are associated with higher odds that a teacher moves. Values less than 1 indicate that increases in the predictor variable are associated with lower odds. For example, for an elementary teacher with a master's equivalent, master's, or higher degree, the odds of moving vs staying in the same school in FY 2016 are 1.64 times the odds for an elementary teacher without those credentials.
Descriptive statistics and additional logistic regression results can be found in Appendix F (Tables F1-F8).

Teacher characteristics. In FY 2015, elementary male teachers had a higher likelihood of moving to another elementary school than female teachers, with an odds ratio that was small and practically significant; however, this relationship was not statistically significant (Table 5). Hispanic/Latino elementary teachers in FY 2010 were less likely to move to a different elementary school than teachers of other races/ethnicities, whereas in FY 2015 they were more likely to move than their peers of other races/ethnicities. Each of these two relationships was practically significant (small magnitude) but not statistically significant. In FY 2013, 2015, and 2016, elementary teachers with a master's equivalent or higher degree were more likely to move to a different elementary school than their counterparts with bachelor's degrees. The odds ratios for level of education were practically significant (small magnitude) as well as statistically significant. Elementary teachers with more years of teaching experience in MCPS were less likely to move to another elementary school than teachers with less experience in all of the eight years of analysis. The odds ratios associated with this predictor were statistically significant for all the years but not practically significant.

School characteristics. Elementary teachers were slightly more likely to move from schools with higher percentage of students receiving FARMS services in FY 2012, 2016, and 2017 (Table 5). The odds ratios for this school characteristic were statistically significant for these three fiscal years, although not practically significant. School size was not a factor associated with elementary teachers moving to other elementary schools, except for FY 2013, when this relationship was statistically but not practically significant; the likelihood for moving was slightly lower in schools with more students compared to schools with less students. Elementary teachers were less likely to move from schools with an experienced teacher body than from schools with less experienced teachers. This relationship was statistically but not practically significant in almost all years of analysis. A change of leadership or principal was also associated with elementary teachers moving. Teachers were more likely to move from schools that had a change of leadership or principal in FY 2012 and 2015. This relationship was statistically and practically significant in FY 2012 with an odds ratio of small magnitude whereas, in FY 2015, the odds ratio was exclusively practically significant and of small magnitude.

Interactions. Interactions between teacher- and school-level variables, specifically between years of teaching experience in MCPS and schools' percentage of students receiving FARMS services, were statistically significantly associated with moving in FY 2014 and 2015 (Table 5). For these two years, among the teachers located in high FARMS schools, experienced teachers were more likely to move to a different school than their less experienced peers. Even though these associations were statistically significant, they were not practically significant. For the other years of analysis, interactions either were not appropriate or were not significant.

Question 3: Among the elementary teachers who moved to another MCPS school from FY 2010 to FY 2017, what proportion of teachers moved to a school with a higher, lower, or same level of complexity?

The move of elementary teachers from one school to another by school complexity (computed using the percentages of students who were ever FARMS, ESOL, special education, Black or African American and Hispanic/Latino) was examined. Figure 9 illustrates the change of school complexity levels (direction and magnitude) for those who moved to another MCPS school from FY 2010 to 2017. During this period, the largest number of elementary teachers who moved to different schools went to MCPS schools with similar complexity levels (same level, +1, or -1 complexity level).

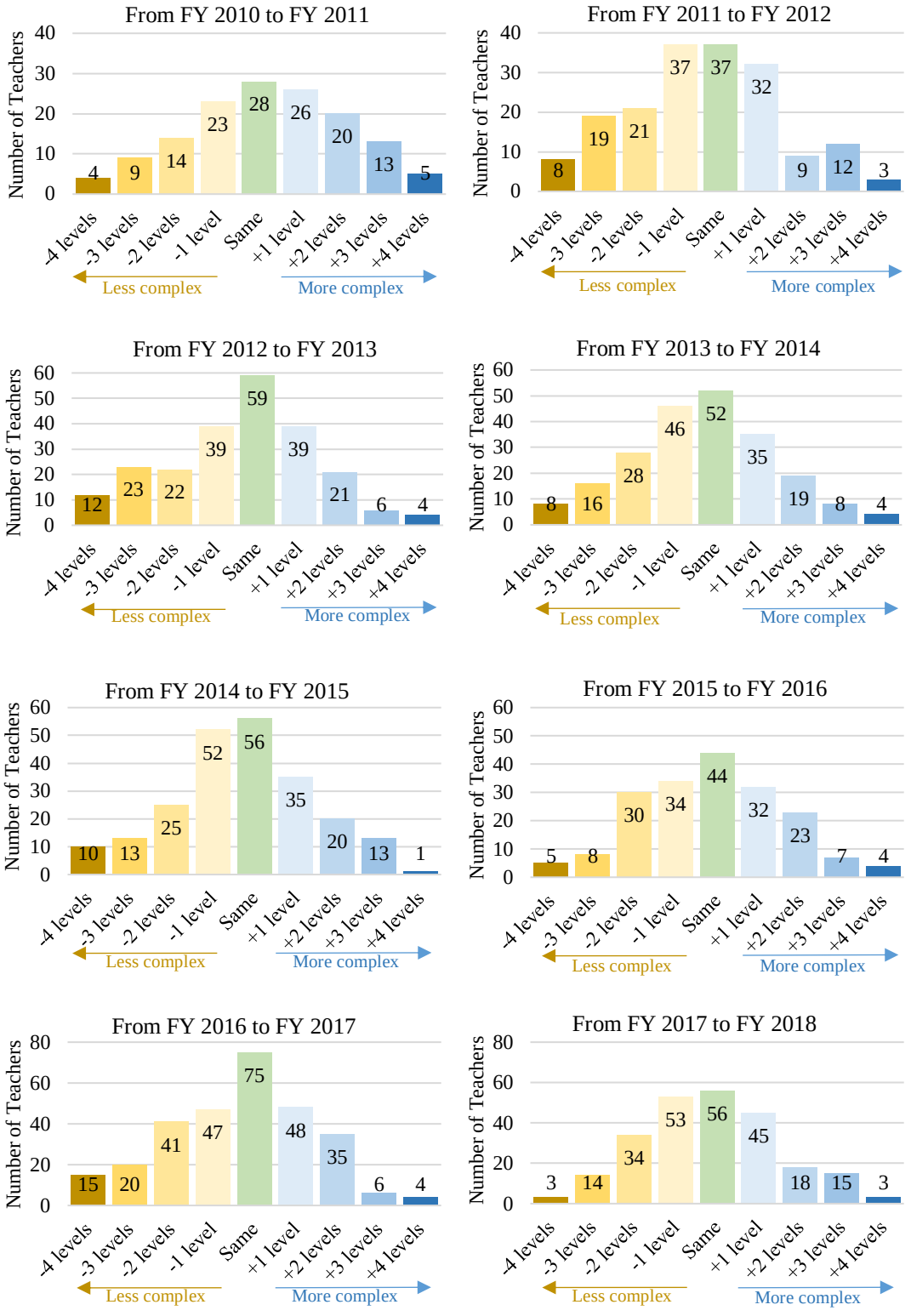

Figure 9. Direction and Magnitude of Change of School Complexity Levels of Elementary Teachers who Moved from FY 2010 to FY 2017.

However, when elementary mobility was examined across years, close to one half of elementary teachers who changed schools moved to less complex schools, whereas about a third of them moved to more complex schools, except for FY 2010 (Figure 10).

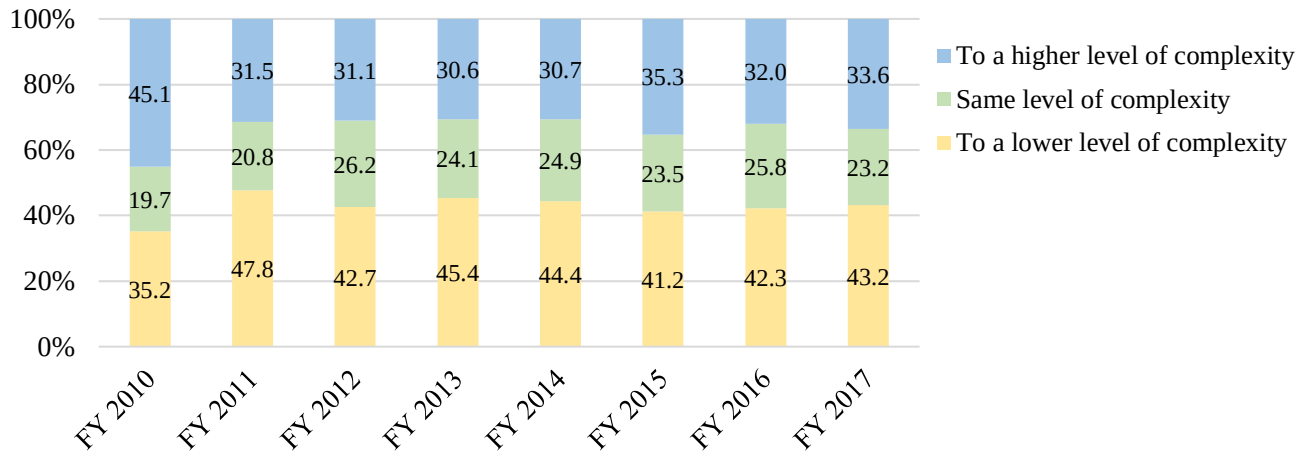

Figure 10. Percentages of Elementary Moves by School Complexity (Higher, Same, or Lower).

Students' Focus Groups in Elementary. To further describe the demographic characteristics of schools by their complexity levels, analysis of students' focus groups and school complexity was conducted for FY 2012, FY 2015, and FY 2018. In these three years, elementary schools with high levels of complexity (levels 4 or 5) were schools with large proportion of FARMS Black or African American and FARMS Hispanic/Latino students. Conversely, elementary schools with low levels of complexity (levels 1 or 2) were schools with large proportion of non-FARMS White/Asian/All Other Student Groups students (Appendix G, Tables G1-G3).

Summary of Findings

Advanced statistical analysis allowed the authors to identify the factors, among teacher and school characteristics, that were related to teacher attrition and elementary teacher mobility.

Teacher Attrition

Among elementary, middle, and high school teachers, those with more years of experience and those with a master's degree or equivalent were less likely to leave MCPS. Among elementary teachers, those living in Montgomery County were less likely to leave; however, this was not a significant predictor for middle or high school teachers. Teacher race/ethnicity was not a significant predictor for leaving MCPS; however, some odds ratios with magnitudes of practical significance were found, especially in middle school, indicating that Black or African American and Hispanic/Latino teachers were less likely to leave than teachers of other races/ethnicities.

The association between school factors and teacher attrition varied across school level. In elementary, teachers in schools with an experienced teacher body were less likely to leave, reporting statistically significant odds ratios in all the time frames of analysis. In middle schools, no school factors tested were statistically or practically significant in predicting teacher attrition; however, science teachers had a greater likelihood of leaving than non-science teachers in some of the time frames analyzed. In high schools, teachers in schools with higher percentages of FARMS or with larger student populations were less likely to leave, with odds ratios statistically significant in some of the time frames of analysis. Contrary to science teachers in middle schools, science teachers in high schools had a lower likelihood of leaving than their non-science peers.

Teacher Mobility

The mobility rate for elementary teachers varied over the years of the study, from a low of 4.7% in 2010 to a high of 8.9% in 2016.

Both teacher's years of experience and the average years of experience of teachers in the school were statistically significantly related to teacher mobility in almost all of the years of analysis; the likelihood of moving to a different elementary school was lower with more teaching experience or in schools with a more experienced teacher body. Some other teacher and school level factors were also associated to the likelihood of moving but for few years only. For example, elementary teachers with a master's degree equivalent or higher were more likely to move, as well as elementary teachers in schools with a high percentage of students receiving FARMS services or in schools that experienced a change of principal.

Finally, during the period FY 2011 – FY 2017, the percentage of elementary teachers who moved to schools with lower levels of complexity was greater than the percentage of elementary teachers who moved to schools with higher levels of complexity (close to one half and about a third, respectively).

Discussion

The higher rate of attrition and mobility among teachers with less experience is not unique to MCPS based on literature review. Research consistently reports that teachers in the early years of their career are more likely to leave their teaching positions or change schools. However, this study's finding that elementary teachers in schools with higher average years of experience are less likely to leave MCPS or move to a different school suggests that working in a school with more experienced staff may offer benefits that support teachers' retention. Further, the findings point to the importance of initiatives such as Teacher Induction, Retention, and Advancement (TIRA) in MCPS, designed to support teachers in their first years with the goal of offsetting some of the risks for attrition and mobility that beginning teachers bring.

As discussed in the first report, MCPS has strived to recruit, support, and retain a diverse teaching staff, and some gains in the racial/ethnic diversity of the teaching staff have been observed in the last five years (see Davila Valencia, Wade, and Wolanin, 2018 for details). Although studies from other districts have found that Black or African American or Hispanic/Latino teachers are more likely to leave their teaching positions, it was not the finding in the current MCPS study. In fact, the results of these analyses trended in the opposite direction—Black or African American and Hispanic/Latino teachers were less likely to leave than other teachers. Efforts in place in MCPS such as the Teacher Workforce Diversity

Strategic Plan (MCPS, 2014) and the Building our Network of Diversity (BOND) Project (MCPS, 2018) may be having a positive impact not only on increasing the diversity of the teaching staff, but on sustaining it as well, by expanding support networks within schools and across the district.

Further, studies of teachers in Texas and in North Carolina found that having a graduate degree was associated with an increased likelihood of leaving. In MCPS, however, among elementary teachers and high school teachers, and in the eight-year study of middle school teachers, a master's degree or equivalent was associated with a lower likelihood of leaving. Personnel policies and practices, financial support of graduate education, and a supportive professional learning community may influence the relationship between teachers' education level and attrition in a positive way in MCPS.

This study examined teacher attrition and mobility over the years, considering variables important to teacher and school success. It is recognized that some factors not available for this study (e.g., changes in position allocations, implementation of programs within schools) may influence teacher attrition and mobility in a particular school, in a specific year, or across the school system. However, the current findings provide information about teacher and school characteristics related to teacher movement, and results of the study indicate where the needs are the greatest, particularly in terms of promoting retention and supporting early-career teachers in their schools.

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Appendix A

Table A1
Descriptive Statistics and Logistic Regression Results of Elementary Teachers Leaving or Not Leaving MCPS During Two Years: FY 2016 through FY 2018

	Descriptive Statistics by Group						Logistic Regression Results			
	Left MCPS (*N* = 260)			Did Not Leave (*N* = 2,402)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	260	17	6.5	2,402	138	7.5	.07 (.25)	1.08	.66	1.77
Black of African American	260	18	6.9	2,402	238	9.9	-.45 (.24)	**.64**	.40	1.03
Hispanic/Latino	260	22	8.5	2,402	165	6.9	.00 (.23)	1.00	.63	1.58
Master's degree equivalent or higher	260	168	64.6	2,402	2,034	84.7	-.16 (.15)	.85	.63	1.15
Lives in Montgomery County	260	153	58.8	2,402	1,612	67.1	-.30 (.13)	.74	.57	.96
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	260	5.5	3.9	2,402	11.9	7.3	-.11 (.01)	.90***	.87	.92
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	260	46.8	27.9	2,402	38.8	26.3	.00 (.00)	1.00	.99	1.01
Student enrollment (school size)	260	616.9	147.5	2,402	619.0	169.7	-.00 (.00)	1.00	.99	1.00
Mean years in MCPS of teachers in school	260	7.9	2.4	2,402	9.4	2.9	-.09 (.03)	.91**	.86	.97

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
[a] Female is the reference group.

Table A2
Descriptive Statistics and Logistic Regression Results of Elementary Teachers Leaving or Not Leaving MCPS During Five Years: FY 2013 through FY 2018

	Descriptive Statistics by Group						Logistic Regression Results			
	Left MCPS (*N* = 316)			Did Not Leave (*N* = 1,851)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	316	20	6.3	1,851	138	7.5	-.07 (.26)	.93	.57	1.54
Black of African American	316	18	5.7	1,851	176	9.5	-.45 (.26)	**.64**	.39	1.05
Hispanic/Latino	316	16	5.1	1,851	117	6.3	-.34 (.27)	.71	.42	1.42
Master's degree equivalent or higher	316	219	69.3	1,851	1,744	94.2	-.80 (.18)	**.45*** **	.32	.63
Lives in Montgomery County	316	176	55.7	1,851	1,250	67.5	-.40 (.13)	.67**	.52	.87
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	316	6.7	4.3	1,851	9.8	2.9	-.16 (.02)	.85***	.83	.88
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	316	44.7	27.7	1,851	36.7	25.5	.00 (.00)	1.00	.99	1.01
Student enrollment (school size)	316	617.8	146.1	1,851	615.7	172.3	-.00 (.00)	1.00	.99	1.00
Mean years in MCPS of teachers in school	316	8.1	2.5	1,851	9.8	2.9	-.10 (.03)	.90***	.85	.96

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
[a] Female is the reference group.

Table A3
Descriptive Statistics and Logistic Regression Results of Elementary Teachers Leaving or Not Leaving MCPS During Eight Years: FY 2010 through FY 2018

	Descriptive Statistics by Group						Logistic Regression Results			
	Left MCPS (N = 310)			Did Not Leave (N = 1,417)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	310	23	7.4	1,417	121	8.5	.10 (.27)	1.10	.65	1.87
Black of African American	310	27	8.7	1,417	146	10.3	-.25 (.25)	.78	.48	1.26
Hispanic/Latino	310	19	6.1	1,417	77	5.4	-.05 (.32)	.95	.51	1.77
Master's degree equivalent or higher	310	240	77.4	1,417	1,390	98.1	-1.29 (.28)	**.27*****	.16	.48
Lives in Montgomery County	310	175	56.5	1,417	954	67.3	-.40 (.15)	.68**	.50	.89
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	310	7.5	4.3	1,417	16.3	6.1	-.25 (.02)	.78***	.75	.81
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	310	39.0	27.0	1,417	35.1	24.6	-.00 (.00)	1.00	.99	1.00
Student enrollment (school size)	310	595.7	144.4	1,417	609.8	170.9	-.00 (.00)	1.00	.99	1.00
Mean years in MCPS of teachers in school	310	8.4	2.6	1,417	10.11	2.9	-.11 (.03)	.90***	.85	.95

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
[a] Female is the reference group.

Table A4
Descriptive Statistics and Logistic Regression Results of Middle School Teachers Leaving or Not Leaving MCPS During Two Years: FY 2016 through FY 2018

	Descriptive Statistics by Group						Logistic Regression Results			
	Left MCPS (*N* = 117)			Did Not Leave (*N* = 1,131)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	117	29	24.8	1,131	348	30.8	.23 (.22)	1.26	.82	1.93
Black of African American	117	11	9.4	1,131	141	12.5	-.52 (.32)	**.60**	.32	1.12
Hispanic/Latino	117	8	6.8	1,131	77	6.8	-.44 (.40)	**.65**	.29	1.42
Master's degree equivalent or higher	117	93	79.5	1,131	1,030	91.1	.04 (.27)	.96	.57	1.62
Lives in Montgomery County	117	75	64.1	1,131	730	64.5	.01 (.20)	1.01	.68	1.51
Teach Science	117	16	13.7	1,131	131	11.6	.19 (.29)	1.21	.69	2.13
Teach Math	117	10	8.5	1,131	158	14.0	-.20 (.32)	.82	.43	1.54
Teach Foreign Lang.	117	15	12.8	1,131	84	7.4	.33 (.33)	1.38	.72	2.66
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	117	5.6	4.7	1,131	13.2	7.9	-.11 (.02)	.89***	.86	.93
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	117	39.6	22.3	1,131	30.0	20.0	.01 (.01)	1.01	1.00	1.03
Student enrollment (school size)	117	935.3	216.0	1,131	975.4	227.3	-.00 (.00)	1.00	1.00	1.00
Mean years in MCPS of teachers in school	117	8.3	2.6	1,131	9.9	3.2	-.02 (.05)	.98	.88	1.08

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
[a] Female is the reference group.

Table A5
Descriptive Statistics and Logistic Regression Results of Middle School Teachers Leaving or Not Leaving MCPS During Five Years: FY 2013 through FY 2018

	Descriptive Statistics by Group						Logistic Regression Results			
	Left MCPS (*N* = 151)			Did Not Leave (*N* = 881)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	151	42	27.8	881	275	31.2	.16 (.21)	1.18	.78	1.78
Black of African American	151	15	9.9	881	103	11.7	-.48 (.32)	**.62**	.33	1.15
Hispanic/Latino	151	8	5.3	881	53	6.0	-.14 (.43)	.87	.38	2.00
Master's degree equivalent or higher	151	131	86.8	881	850	96.5	.18 (.34)	.84	.43	1.63
Lives in Montgomery County	151	86	57.0	881	577	65.5	-.31 (.20)	.73	.50	1.08
Teach Science	151	24	15.9	881	104	11.8	.38 (.28)	**1.47**	.85	2.53
Teach Math	151	22	14.6	881	120	13.6	.46 (.28)	**1.58**	.90	2.75
Teach Foreign Lang.	151	10	6.6	881	58	6.6	-.16 (.40)	.85	.39	1.88
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	151	7.1	4.8	881	15.8	7.0	-.19 (.02)	.82***	.79	.86
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	151	37.1	21.5	881	28.1	19.4	.01 (.01)	1.01	.99	1.02
Student enrollment (school size)	151	902.1	216.0	881	979.3	225.2	-.00 (.00)	1.00	.99	1.00
Mean years in MCPS of teachers in school	151	8.6	4.8	881	10.3	3.2	-.04 (.05)	.96	.87	1.06

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
[a] Female is the reference group.

Table A6
Descriptive Statistics and Logistic Regression Results of Middle School Teachers Leaving or Not Leaving MCPS During Eight Years: FY 2010 through FY 2018

	Descriptive Statistics by Group						Logistic Regression Results			
	Left MCPS (*N* = 156)			Did Not Leave (*N* = 747)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	156	48	30.8	747	226	30.3	-.16 (.23)	.85	.55	1.33
Black of African American	156	17	10.9	747	90	12.0	-.42 (.33)	**.66**	.34	1.25
Hispanic/Latino	156	6	3.8	747	40	5.4	.10 (.48)	1.10	.43	2.83
Master's degree equivalent or higher	156	134	85.9	747	737	98.7	-1.13 (.49)	**.32***	.73	1.77
Lives in Montgomery County	156	98	62.8	747	474	63.5	.03 (.22)	1.03	.68	1.59
Teach Science	156	27	17.3	747	83	11.1	.72 (.30)	**2.06***	1.14	3.74
Teach Math	156	25	16.0	747	106	14.2	.56 (.30)	**1.74**	.98	3.11
Teach Foreign Lang.	156	14	9.0	747	48	6.4	.04 (.40)	1.04	.48	2.26
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	156	8.3	4.9	747	17.5	6.3	-.25 (.02)	.78***	.75	.82
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	156	34.5	20.5	747	28.1	19.1	-.00 (.01)	1.00	.98	1.01
Student enrollment (school size)	156	884.4	211.2	747	975.1	224.9	-.00 (.00)	1.00	.99	1.00
Mean years in MCPS of teachers in school	156	8.7	2.5	747	10.4	3.3	-.18 (.05)	.93	.84	1.02

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
[a] Female is the reference group.

Table A7
Descriptive Statistics and Logistic Regression Results of High School Teachers Leaving or Not Leaving MCPS During Two Years: FY 2016 through FY 2018

	Descriptive Statistics by Group						Logistic Regression Results			
	Left MCPS (*N* = 142)			Did Not Leave (*N* = 1,794)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	142	64	45.1	1,794	727	40.5	-.23 (.17)	.79	.57	1.10
Black of African American	142	16	11.3	1,794	189	10.5	-.04 (.28)	.96	.56	1.10
Hispanic/Latino	142	12	8.5	1,794	122	6.8	.18 (.34)	1.19	.62	2.31
Master's degree equivalent or higher	142	113	79.6	1,794	1,708	95.2	-.62 (.25)	**.54***	.33	.88
Lives in Montgomery County	142	93	65.5	1,794	1,192	66.4	-.00 (.18)	1.00	.71	1.41
Teach Science	142	19	13.4	1,794	218	12.2	.09 (.25)	1.09	.67	1.79
Teach Math	142	14	9.9	1,794	213	11.9	-.11 (.27)	.89	.52	1.53
Teach Foreign Lang.	142	11	7.7	1,794	150	8.4	-.20 (34)	.82	.42	1.59
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	142	5.9	4.5	1,794	13.7	7.8	-.11 (.02)	.90***	.87	.93
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	142	31.8	14.9	1,794	26.0	15.6	.01 (.01)	1.01	.99	1.02
Student enrollment (school size)	142	1,940	443.8	1,794	2,034	461.7	.00 (.00)	1.00	.99	1.00

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
[a] Female is the reference group.

Table A8
Descriptive Statistics and Logistic Regression Results of High School Teachers Leaving or Not Leaving MCPS During Five Years: FY 2013 through FY 2018

	Descriptive Statistics by Group						Logistic Regression Results			
	Left MCPS (*N* = 205)			Did Not Leave (*N* = 1,511)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	205	81	39.5	1,511	625	41.4	-.13 (.37)	.88	.58	1.35
Black of African American	205	31	15.1	1,511	156	10.3	.05 (.35)	.95	.48	1.90
Hispanic/Latino	205	10	4.9	1,511	100	6.6	-.24 (.53)	.79	.28	2.25
Master's degree equivalent or higher	205	176	85.9	1,511	1,480	97.9	-1.14 (.38)	**.32****	.15	.68
Lives in Montgomery County	205	121	59.0	1,511	1,003	66.4	-.15 (.22)	.86	.56	1.33
Teach Science	205	28	13.7	1,511	182	12.0	-.04 (.32)	.96	.51	1.81
Teach Math	205	24	11.7	1,511	184	12.2	-.19 (.35)	.83	.42	1.64
Teach Foreign Lang.	205	21	10.2	1,511	120	7.9	.07 (.42)	1.07	.47	2.47
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	205	8.1	5.6	1,511	15.6	7.1	-.21 (.02)	.81***	.77	.85
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	205	30.6	15.9	1,511	25.4	15.5	.11 (.10)	1.11	.91	1.35
Student enrollment (school size)	205	1,868	414.5	1,511	2,035	461.3	-.02 (.00)	.98***	.97	.98

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
[a] Female is the reference group.

Table A9
Descriptive Statistics and Logistic Regression Results of High School Teachers Leaving or Not Leaving MCPS During Eight Years: FY 2010 through FY 2018

	Descriptive Statistics by Group						Logistic Regression Results			
	Left MCPS (*N* = 249)			Did Not Leave (*N* = 1,280)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	249	106	42.6	1,280	549	42.9	-.13 (.21)	.88	.58	1.34
Black of African American	249	30	12.0	1,280	139	10.9	-.07 (.33)	.93	.49	1.78
Hispanic/Latino	249	8	3.2	1,280	88	6.9	-.89 (.64)	**.41**	.12	1.45
Master's degree equivalent or higher	249	220	88.4	1,280	1,267	99.0	-1.16 (.50)	**.31***	.12	.84
Lives in Montgomery County	249	159	63.9	1,280	843	63.9	-.08 (.22)	.93	.60	1.44
Teach Science	249	33	13.3	1,280	159	12.6	-.75 (.35)	**.47***	.24	.94
Teach Math	249	32	12.9	1,280	158	12.3	-.25 (.32)	.78	.41	1.46
Teach Foreign Lang.	249	19	7.6	1,280	98	7.7	.02 (.43)	1.02	.44	2.36
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	249	8.6	5.1	1,280	17.2	6.5	-.36 (.03)	**.70*** **	.66	.75
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	249	27.6	15.3	1,280	25.1	15.4	-.14 (.06)	.87*	.77	.97
Student enrollment (school size)	249	1,858	384.3	1,280	2,033	467.0	-.01 (.00)	.99	.98	.99

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
[a] Female is the reference group.

Appendix B

Table B1
Total Numbers and Percentages of Elementary Teachers who Moved, Stayed, or Left their Elementary Teacher Role in MCPS from FY 2010 to FY 2018

	Movers		Stayers		Leavers	
Fiscal Year (FY)	*n*	%	*n*	%	*n*	%
2010	142	4.7%	2,732	89.6%	175	5.7%
2011	176	5.9%	2,650	88.3%	172	5.7%
2012	225	7.2%	2,733	87.5%	166	5.3%
2013	216	6.7%	2,815	87.7%	179	5.6%
2014	225	6.8%	2,901	87.9%	173	5.2%
2015	188	5.7%	2,927	88.0%	210	6.3%
2016	290	8.9%	2,792	85.6%	179	5.5%
2017	246	7.2%	2,976	86.9%	202	5.9%
Eight-year average	214	6.6%	2,816	87.7%	182	5.7%

Appendix C

Table C1
Total Numbers and Percentages of Elementary Teachers who Stayed and Moved to Another Elementary, Middle, or High School from FY 2010 to FY 2017

	Fiscal Year (FY)																	
	2010		2011		2012		2013		2014		2015		2016		2017		Eight-year average	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Stayers	2,732	95.1	2,650	93.7	2,733	92.4	2,815	92.9	2,901	92.8	2,927	94.0	2,792	90.6	2,976	92.4	2,816	93.0
Movers																		
Elem. to Elem.	131	4.6	165	5.8	201	6.8	184	6.1	192	6.1	170	5.5	248	8.0	193	6.0	186	6.1
Elem. to Middle	7	0.2	12	0.4	22	0.7	30	1.0	32	1.0	17	0.5	40	1.3	48	1.5	26	0.8
Elem. to High	4	0.1	1	0.0	2	0.1	2	0.1	1	0.0	0	0.0	3	0.1	5	0.2	2	0.1
Total	2,874	100.0	2,828	100.0	2,958	100.0	3,031	100.0	3,126	100.0	3,114	100.0	3,083	100.0	3,222	100.0	3,030	100.0

Table C2
Eight-Year Average of Number and Percentage of Elementary Teachers who Moved to Another Elementary, Middle, or High School from FY 2010 to FY 2017

	Eight-year average (FY 2010 – FY 2017)	
	n	%
Movers		
Elem. to Elem.	185	87.3
Elem. to Middle	26	11.5
Elem. to High	2	1.1
Total	214	100.0

Note. Only one elementary teacher moved to a special school in one of the years analyzed.

Appendix D

Table D1
Total Numbers and Percentages of Elementary Teachers who Moved by Teachers' Characteristics from FY 2010 to FY 2018

	Fiscal Year (FY)																		
	2010		2011		2012		2013		2014		2015		2016		2017		Eight-Year		
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*Mean*	*SD*	*%*
Total	142	100.0	178	100.0	225	100.0	217	100.0	226	100.0	189	100.0	292	100.0	247	100.0	214	45.6	100.0
Gender																			
Female	128	90.1	156	87.6	206	91.6	197	90.8	207	91.6	170	89.9	267	91.8	228	92.3	195	43.6	90.7
Male	14	9.9	22	12.4	19	8.4	20	9.2	19	8.4	19	10.1	24	8.2	19	7.7	19	2.9	9.3
Race/ethnicity																			
Asian	11	7.7	6	3.4	17	7.6	16	7.4	15	6.6	8	4.2	23	7.9	15	6.1	14	5.4	6.4
Black or African American	15	10.6	20	11.2	28	12.4	31	14.3	22	9.7	19	10.1	32	11.0	34	13.8	25	7.0	11.6
Hispanic/Latino	6	4.2	8	4.5	12	5.3	15	6.9	15	6.6	19	10.1	21	7.2	19	7.7	14	5.4	6.6
Two or More	0	0.0	1	0.6	2	0.9	3	1.4	3	1.3	5	2.6	3	1.0	1	0.4	2	1.6	1.0
White	110	77.5	143	80.3	166	73.8	152	70.0	171	75.7	138	73.0	212	72.9	178	72.1	159	30.7	74.4
Years of Teaching Experience in MCPS at the time of the move																			
0 – 1 years	16	12.3	10	6.0	17	7.8	15	7.0	16	7.5	18	9.5	9	3.1	8	3.5	14	3.8	7.1
1 – 5 years	69	53.1	76	45.5	72	33.0	65	30.2	70	33.0	76	40.2	113	38.8	92	40.2	79	15.9	39.3
5 – 10 years	32	24.6	48	28.7	92	42.2	77	35.8	79	37.3	59	31.2	82	28.2	52	22.7	65	20.5	31.3
10 – 15 years	6	4.6	23	13.8	22	10.1	39	18.1	32	15.1	24	12.7	48	16.5	42	18.3	30	13.5	13.7
15+ years	7	5.4	10	6.0	15	6.9	19	8.8	15	7.1	12	6.3	39	13.4	35	15.3	19	11.7	8.7
Education degree at the time of the move																			
Bachelor's	49	34.5	46	26.0	62	27.9	45	20.9	61	27.1	47	25.0	57	19.9	48	19.4	52	7.0	25.1
Master's or Master's equivalent	93	65.5	131	74.0	160	72.1	170	79.1	163	72.4	140	74.5	228	79.7	199	80.6	161	41.6	74.7
Doctorate	0	0.0	0	0.0	0	0.0	0	0.0	1	0.4	1	0.5	1	0.3	0	0.0	0	0.5	0.2

Note. Few teachers do not report education degree or valid years of teaching experience. SD = Standard Deviation.

Table D2
Total Numbers and Percentages of Elementary Teachers who Stayed by Teachers' Characteristics from FY 2010 to FY 2018

	Fiscal Year (FY)																		
	2010		2011		2012		2013		2014		2015		2016		2017		Eight-Year		
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*	*Mean*	*SD*	*%*
Total	2,730	100.0	2,648	100.0	2,731	100.0	2,813	100.0	2,900	100.0	2,927	100.0	2,792	100.0	2,976	100.0	2,815	112.4	100.0
Gender																			
Female	2,513	92.1	2,445	92.3	2,527	92.5	2,608	92.7	2,692	92.8	2,718	92.8	2,583	92.5	2,741	92.1	2,603	106.5	92.5
Male	217	7.9	203	7.7	205	7.5	205	7.3	208	7.2	209	7.1	209	7.5	235	7.9	211	10.4	7.5
Race/ethnicity																			
Asian	167	6.1	173	6.5	166	6.1	176	6.3	193	6.7	208	7.1	197	7.1	208	7.0	186	17.6	6.6
Black or African American	269	9.9	258	9.7	237	8.7	230	8.2	245	8.4	250	8.5	249	8.9	275	9.2	252	15.2	8.9
Hisp./Latino	128	4.7	131	4.9	154	5.6	168	6.0	186	6.4	188	6.4	190	6.8	216	7.3	170	30.8	6.0
Two or More	2	0.1	0	0.0	28	1.0	28	1.0	35	1.2	32	1.1	33	1.2	41	1.4	25	15.3	0.9
White	2,162	79.2	2,084	78.7	2,145	78.5	2,211	78.6	2,240	77.2	2,246	76.8	2,121	76.0	2,232	75.0	2,180	60.8	77.5
Years of Teaching Experience in MCPS at the time of the move																			
0 – 1 years	187	7.0	99	3.8	241	9.0	269	9.6	289	10.0	230	7.9	155	5.6	29	1.1	187	89.1	6.8
1 – 5 years	904	34.1	764	29.6	605	22.5	649	23.1	722	25.1	820	28.1	873	31.3	766	29.4	763	103.2	27.9
5 – 10 years	735	27.7	803	31.1	828	30.8	842	30.0	809	28.1	738	25.3	579	20.7	577	22.2	739	106.7	27.0
10 – 15 years	349	13.2	474	18.4	566	21.0	571	20.4	530	18.4	565	19.4	559	20.0	551	21.2	521	76.2	19.0
15+ years	478	18.0	439	17.0	450	16.7	473	16.9	530	18.4	565	19.4	626	22.4	681	26.2	530	87.7	19.4
Education degree at the time of the move																			
Bachelor's	731	26.8	627	23.7	610	22.4	735	26.2	732	25.3	723	24.7	669	24.0	770	25.9	700	57.4	24.9
Master's or Master's Equivalent	1,993	73.0	2,017	76.2	2,111	77.4	2,064	73.5	2,158	74.5	2,198	75.1	2,110	75.8	2,193	73.8	2,105	76.7	74.9
Doctorate	5	0.2	4	0.2	5	0.2	6	0.2	4	0.1	4	0.1	4	0.1	8	0.3	5	1.4	0.2

Note. Few teachers do not report race/ethnicity, education degree, or valid years of teaching experience. SD = Standard Deviation.

Appendix E

Table E1

Characteristics of Origin and Destination Schools for Elementary School Movers: Mean Percentages, Standard Deviations, and Mean Percentage Differences from FY 2010 to FY 2017

		Fiscal Year (FY)																	
		2010		2011		2012		2013		2014		2015		2016		2017		Eight-year	
		Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD
% of students receiving FARMS services	Origin	33.9	25.0	42.6	27.9	46.8	26.4	45.6	28.5	43.7	27.9	45.3	27.4	48.7	26.5	47.5	26.7	44.3	4.61
	Destination	38.9	27.7	36.1	25.8	39.4	24.3	40.9	27.4	40.5	26.5	43.0	27.4	42.5	26.8	43.0	25.3	40.5	2.38
	Mean % Diff.	4.9		-6.5*		-7.5**		-4.7*		-3.2		-2.3		-6.2**		-4.5*		-3.8	
% of students receiving ESOL services	Origin	21.4	15.5	26.7	19.2	27.0	17.7	29.4	19.2	24.8	16.4	24.4	15.0	27.7	15.5	26.6	15.5	26.0	2.44
	Destination	24.5	18.6	19.8	15.0	23.4	15.3	22.4	16.8	20.8	15.5	24.2	15.6	22.6	15.6	24.1	15.9	22.7	1.71
	Mean % Diff.	3.2		-6.9***		-3.6*		-6.9***		-4.0**		-0.1		-5.2***		-2.5*		-3.3	
% of students receiving Special Education	Origin	10.5	4.0	9.6	3.1	10.0	3.5	10.4	4.4	10.3	3.7	10.6	4.0	10.9	4.0	11.2	4.1	10.4	0.51
	Destination	10.1	3.6	10.2	4.0	10.6	4.0	10.5	3.9	9.7	4.9	10.4	4.0	11.5	3.9	11.7	4.1	10.6	0.70
	Mean % Diff.	-0.4		0.6		0.6		0.1		-0.6		-0.2		0.6		0.5		0.1	
% of Black or African American students	Origin	22.5	15.1	21.7	14.6	24.1	15.9	22.4	16.7	22.1	15.2	24.9	17.7	24.4	15.4	23.8	14.9	23.2	1.20
	Destination	21.1	14.6	21.9	16.1	22.9	15.6	19.8	13.2	22.2	14.4	23.1	15.1	21.7	13.4	23.3	13.6	22.0	1.17
	Mean % Diff.	-1.4		0.2		-1.2		-2.6*		0.1		-1.8		-2.7*		-0.4		-1.2	
% of Hispanic /Latino students	Origin	23.6	17.6	32.5	21.5	34.3	20.6	34.0	22.2	32.5	21.8	32.2	20.8	36.8	21.9	36.4	21.1	32.8	4.10
	Destination	30.2	20.3	26.6	18.6	29.2	17.6	31.9	21.6	31.0	19.6	32.9	20.3	34.0	21.3	35.8	19.5	31.5	2.87
	Mean % Diff.	6.6**		-5.9**		-5.1**		-2.1		-1.5		0.7		-2.7		-0.7		-1.3	

* $p < .05$, ** $p < .01$, *** $p < .001$. SD = Standard Deviation. *Note.* Mean % differences may be slightly different due to rounding.

Appendix F

Table F1
Descriptive Statistics and Logistic Regression Results of Elementary Teachers who Moved vs. Did Not Move in FY 2010

	Descriptive Statistics by Group						Logistic Regression Results			
	Moved (N = 131)			Did not move (N = 2,732)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	131	10	7.6	2,730	217	7.9	.04 (.36)	1.04	.53	2.16
Black of African American	131	12	9.2	2,730	269	9.9	.05 (.34)	1.05	.55	2.06
Hispanic/Latino	131	5	3.8	2,730	128	4.7	-.63 (.62)	**.53**	.16	1.85
Master's degree equivalent or higher	131	84	64.1	2,729	1,998	73.2	.12 (.23)	1.13	.73	1.77
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	131	4.9	4.6	2,732	9.2	8	-.15 (.03)	.86***	.82	.91
School characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Change of principal/school leadership	131	5	3.8	2,732	99	3.6	.14 (.66)	1.15	.34	4.48
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	131	33.5	24.7	2,732	35.4	25.1	-.00 (.01)	.99	.99	1.01
Student enrollment (school size)	131	520	125	2,732	533	138	-.00 (.00)	.99	.99	1.00
Mean years in MCPS of teachers in school	131	8.6	3.1	2,732	9.0	2.8	-.16 (.06)	.85**	.77	.95

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
Only statistically significant interactions are reported. Interaction (years of teaching experience and FARMS) was added into the model but it was not statistically significant.
[a] Female is the reference group.

Table F2
Descriptive Statistics and Logistic Regression Results of Elementary Teachers who Moved vs. Did Not Move in FY 2011

	Descriptive Statistics by Group						Logistic Regression Results			
	Moved (N = 165)			Did not move (N = 2,650)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	165	19	11.5	2,648	203	7.7	0.3 (.26)	1.35	.81	2.25
Black of African American	165	17	10.3	2,648	258	9.7	-.05 (.26)	.95	.57	1.59
Hispanic/Latino	165	6	3.6	2,648	131	4.9	-.19 (.38)	.83	.39	1.76
Master's degree equivalent or higher	164	119	72.6	2,648	2,021	76.3	.21 (.19)	1.23	.84	1.79
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	165	6.3	4.7	2,650	9.5	7.4	-.04 (.02)	.96**	.93	.99
School characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Change of principal/school leadership	165	39	23.6	2,650	371	14.0	.24 (.20)	1.28	.86	1.90
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	165	43.1	28.3	2,650	36.3	25.7	.00 (.00)	1.00	.99	1.01
Student enrollment (school size)	165	552	121	2,650	554	145	-.00 (.00)	.99	.99	1.00
Mean years in MCPS of teachers in school	165	8.5	3.00	2,650	9.4	2.8	-.09 (.03)	.92*	.86	.98

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
Only statistically significant interactions are reported. No interactions were added into this model.
[a] Female is the reference group.

Table F3
Descriptive Statistics and Logistic Regression Results of Elementary Teachers who Moved vs. Did Not Move in FY 2012

	Descriptive Statistics by Group						Logistic Regression Results			
	Moved (N = 201)			Did not move (N = 2,733)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	201	14	7.0	2,731	204	7.5	-.08 (.33)	.92	.49	1.74
Black of African American	201	23	11.4	2,731	237	8.7	.08 (.26)	1.09	.65	1.81
Hispanic/Latino	201	11	5.5	2,731	154	5.6	-.14 (.36)	.87	.43	1.77
Master's degree equivalent or higher	198	139	70.2	2,726	2,116	77.6	.16 (.20)	1.18	.80	1.73
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	201	7.2	5.6	2,733	9.6	7.5	-.07 (.02)	.94***	.90	.97
School characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Change of principal/school leadership	201	52	25.9	2,733	322	11.8	.85 (.29)	**2.34****	1.34	4.11
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	201	47.6	26.6	2,733	38.0	26.5	.01 (.00)	1.01*	1.00	1.01
Student enrollment (school size)	201	594	148	2,733	571	146	.00 (.00)	1.00	.99	1.00
Mean years in MCPS of teachers in school	201	8.5	2.30	2,733	9.5	2.9	-.15 (.05)	.86**	.79	.94

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
Only statistically significant interactions are reported. Interaction (years of teaching experience and FARMS) was added into the model but it was not statistically significant.
[a] Female is the reference group.

Table F4
Descriptive Statistics and Logistic Regression Results of Elementary Teachers who Moved vs. Did Not Move in FY 2013

	Descriptive Statistics by Group						Logistic Regression Results			
	Moved (N = 184)			Did not move (N = 2,815)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	184	10	5.4	2,813	205	7.3	-.25 (.31)	.78	.42	1.42
Black of African American	184	22	12.0	2,814	230	8.2	.20 (.24)	1.22	.77	1.94
Hispanic/Latino	184	11	6.0	2,814	168	6.0	-.03 (.31)	.97	.53	1.77
Master's degree equivalent or higher	182	142	78.0	2,810	2,070	73.7	.58 (.19)	**1.79****	1.22	2.61
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	184	7.7	5.8	2,815	9.6	7.6	-.03 (.01)	.97*	.95	.99
School characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Change of principal/school leadership	184	22	12.0	2,815	287	10.2	.09 (.23)	1.09	.69	1.73
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	184	46.7	29.3	2,815	38.9	26.3	.00 (.00)	1.00	.99	1.01
Student enrollment (school size)	184	562	135	2,815	585	150	-.00 (.00)	.99*	.99	1.00
Mean years in MCPS of teachers in school	184	8.5	3.0	2,815	9.5	2.9	-.11 (.03)	.90***	.84	.95

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
Only statistically significant interactions are reported. Interaction (mean years in MCPS of teachers in school and FARMS) was added into the model but it was not statistically significant.
[a] Female is the reference group.

Table F5
Descriptive Statistics and Logistic Regression Results of Elementary Teachers who Moved vs. Did Not Move in FY 2014

	Descriptive Statistics by Group						Logistic Regression Results			
	Moved (N = 192)			Did not move (N = 2,901)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	192	14	7.3	2,900	208	7.2	.19 (.30)	1.20	.67	2.15
Black of African American	192	13	6.8	2,900	245	8.4	-.32 (.32)	.73	.39	1.35
Hispanic/Latino	192	12	6.3	2,900	186	6.4	-.21 (.35)	.81	.41	1.61
Master's degree equivalent or higher	191	132	69.1	2,897	2,161	74.6	.08 (.20)	1.09	.74	1.60
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	192	6.9	5.0	2,901	9.5	7.6	-.06 (.02)	.94***	.91	.97
School characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Change of principal/school leadership	192	30	15.6	2,901	476	16.4	-.10 (.28)	.91	.52	1.58
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	192	43.7	28	2,901	40.0	26.8	.01 (.00)	1.01	1.00	1.02
Student enrollment (school size)	192	614	169	2,901	598	151	-.00 (.00)	1.00	.99	1.00
Mean years in MCPS of teachers in school	192	8.8	3.1	2,901	9.4	2.9	-.05 (.04)	.95	.87	1.03
Interactions							β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience & FARMS							.02 (.01)	1.02**	1.01	1.03

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
Only statistically significant interactions are reported.
[a] Female is the reference group.

Table F6
Descriptive Statistics and Logistic Regression Results of Elementary Teachers who Moved vs. Did Not Move in FY 2015

	Descriptive Statistics by Group						Logistic Regression Results			
	Moved (N = 170)			Did not move (N = 2,927)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	170	18	10.6	2,927	209	7.1	.52 (.27)	**1.69**	.99	2.88
Black of African American	170	18	10.6	2,925	250	8.5	.07 (.28)	1.07	.62	1.85
Hispanic/Latino	170	16	9.4	2,925	188	6.4	.40 (.29)	**1.49**	.84	2.64
Master's degree equivalent or higher	169	123	72.8	2,925	2,202	75.3	.62 (.20)	**1.87****	1.25	2.77
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	170	6.0	4.4	2,927	9.6	7.5	-.11 (.02)	.90***	.87	.93
School characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Change of principal/school leadership	170	25	14.7	2,927	288	9.8	.37 (.32)	**1.44**	.78	2.68
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	170	46.4	27.6	2,927	41.0	26.9	.00 (.00)	1.00	.99	1.01
Student enrollment (school size)	170	613	146	2,927	605	150	-.00 (.00)	1.00	.99	1.00
Mean years in MCPS of teachers in school	170	8.4	2.7	2,927	9.4	2.8	-.19 (.05)	.83***	.76	.90
Interactions							β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience & FARMS							.01 (.01)	1.01*	1.00	1.03

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
Only statistically significant interactions are reported.
[a] Female is the reference group.

Table F7
Descriptive Statistics and Logistic Regression Results of Elementary Teachers who Moved vs. Did Not Move in FY 2016

	Descriptive Statistics by Group						Logistic Regression Results			
	Moved (N = 248)			Did not move (N = 2,792)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	248	16	6.5	2,792	209	7.5	-.08 (.26)	.92	.55	1.55
Black of African American	248	27	10.9	2,791	249	8.9	.01 (.22)	1.01	.66	1.54
Hispanic/Latino	248	16	6.5	2,791	190	6.8	-.15 (.27)	.86	.51	1.44
Master's degree equivalent or higher	243	189	77.8	2,783	2,114	76.0	.50 (.18)	**1.64****	1.16	2.31
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	248	8.0	6.0	2,792	10.0	7.5	-.03 (.01)	.97**	.95	.99
School characteristic (categorical variables)	N	*n*	%	N	*n*	SD	β (SE)	Odds Ratio	Lower	Upper
Change of principal/school leadership	248	50	20.2	2,792	426	15.3	.19 (.17)	1.21	.87	1.69
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	248	49.8	26.5	2,792	40.8	26.9	.01 (.00)	1.01*	1.00	1.01
Student enrollment (school size)	248	612	148	2,792	612	156	-.00 (.00)	.99	.99	1.00
Mean years in MCPS of teachers in school	248	8.8	2.80	2,792	9.9	2.9	-.11 (.03)	.90***	.85	.95

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
Only statistically significant interactions are reported. No interactions were added into this model.
[a] Female is the reference group.

Table F8
Descriptive Statistics and Logistic Regression Results of Elementary Teachers who Moved vs. Did Not Move in FY 2017

	Descriptive Statistics by Group						Logistic Regression Results			
	Moved (N = 193)			Did not move (N = 2,976)					95% Conf. Intervals	
Teacher characteristic (categorical variables)	N	*n*	%	N	*n*	%	β (SE)	Odds Ratio	Lower	Upper
Male [a]	193	11	5.7	2,976	235	7.9	-.33 (.33)	.72	.38	1.37
Black of African American	193	27	14.0	2,976	275	9.2	.27 (.22)	1.31	.84	2.02
Hispanic/Latino	193	16	8.3	2,976	216	7.3	-.01 (.29)	.99	.56	1.75
Master's degree equivalent or higher	193	148	76.7	2,971	2,201	74.1	.36 (.20)	1.43	.98	2.11
Teacher characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
Years of teaching experience in MCPS	193	7.5	5.7	2,976	10.9	7.5	-.04 (.01)	.96**	.93	.98
School characteristic (categorical variables)	N	*n*	%	N	*n*	SD	β (SE)	Odds Ratio	Lower	Upper
Change of principal/school leadership	193	41	21.2	2,976	548	18.4	.12 (.18)	1.13	.79	1.62
School characteristic (continuous variables)	N	Mean	SD	N	Mean	SD	β (SE)	Odds Ratio	Lower	Upper
% of students receiving FARMS	193	49.8	26.1	2,976	41.1	27.4	.01 (.00)	1.01*	1.00	1.01
Student enrollment (school size)	193	609	137	2,976	619	164	-.00 (.00)	.99	.99	1.00
Mean years in MCPS of teachers in school	193	9.6	2.6	2,976	10.6	2.8	-.11 (.03)	.90**	.84	.96

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. SD = Standard deviation. SE = Standard error.
Odds ratio values with magnitudes of practical significance are in **bold** font.
Only statistically significant interactions are reported. No interactions were added into this model.
[a] Female is the reference group.

Appendix G

Table G1
Students' Focus Groups and School Complexity Level as of FY 2012

	Lowest complexity		Moderately low complexity		Moderate complexity		Moderately high complexity		Highest complexity	
Focus Groups	N	%	N	%	N	%	N	%	N	%
Non-FARMS All Other Student Groups	11,042	**31.9**	11,597	**33.5**	6,836	19.7	3,300	9.5	1,843	5.3
Non-FARMS Black or African American	451	7	1,353	20.9	1,465	22.6	2,032	31.4	1,170	18.1
Non-FARMS Hispanic/Latino	886	14.3	1,423	23	1,333	21.6	1,276	20.7	1,260	20.4
FARMS All Other Student Groups	276	6.5	803	18.8	911	21.4	1,085	25.4	1,191	27.9
FARMS Black or African American	252	2.7	910	9.7	1,933	20.7	3,486	**37.3**	2,776	**29.7**
FARMS Hispanic/Latino	211	1.4	925	6.2	2,176	14.5	3,754	**25.0**	7,921	**52.9**
Total	13,118	17.3	17,011	22.4	14,654	19.3	14,933	19.7	16,161	21.3

Table G2
Students' Focus Groups and School Complexity Level as of FY 2015

	Lowest complexity		Moderately low complexity		Moderate complexity		Moderately high complexity		Highest complexity	
Focus Groups	N	%	N	%	N	%	N	%	N	%
Non-FARMS All Other Student Groups	11,502	**33.1**	11,000	**31.7**	7,331	21.1	3,133	9	1,737	5
Non-FARMS Black or African American	591	8.5	1,298	18.6	1,782	25.5	2,237	32.1	1,069	15.3
Non-FARMS Hispanic/Latino	1,025	14.8	1,448	20.9	1,587	23	1,455	21	1,398	20.2
FARMS All Other Student Groups	313	7.1	822	18.7	905	20.5	1,195	27.1	1,172	26.6
FARMS Black or African American	300	2.9	964	9.2	2,185	20.9	3,989	**38.1**	3,025	**28.9**
FARMS Hispanic/Latino	255	1.4	1,158	6.6	2,643	15	4,402	**25.0**	9,183	**52.1**
Total	13,986	17.2	16,690	20.6	16,433	20.3	16,411	20.2	17,584	21.7

Table G3
Students' Focus Groups and School Complexity Level as of FY 2018

	Lowest complexity		Moderately low complexity		Moderate complexity		Moderately high complexity		Highest complexity	
Focus Groups	N	%	N	%	N	%	N	%	N	%
Non-FARMS All Other Student Groups	11,650	**34.4**	10,928	**32.3**	6,798	20.1	3,073	9.1	1,432	4.2
Non-FARMS Black or African American	741	9.5	1,604	20.6	2,046	26.3	2,255	28.9	1,148	14.7
Non-FARMS Hispanic/Latino	1,227	15	1,711	20.9	1,877	22.9	1,717	20.9	1,665	20.3
FARMS All Other Student Groups	304	7.2	765	18.2	896	21.3	1,141	27.2	1,096	26.1
FARMS Black or African American	352	3.4	1,159	11.2	2,005	19.4	3,781	**36.7**	3,014	**29.2**
FARMS Hispanic/Latino	303	1.6	1,228	6.6	2,746	14.7	4,691	**25.2**	9,666	**51.9**
Total	14,577	17.6	17,395	21	16,368	19.7	16,658	20.1	18,021	21.7