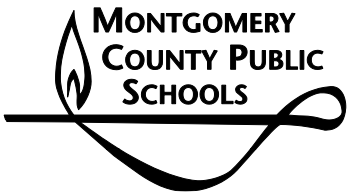

Study of Teacher Workforce in Montgomery County Public Schools

Office of Shared Accountability

2018

Juan Carlos Davila Valencia, M.S., Julie Wade, M.S., and Natalie Wolanin, M.Ed.

OFFICE OF SHARED ACCOUNTABILITY

850 Hungerford Drive
Rockville, Maryland 20850

Dr. Jack R. Smith
Superintendent of Schools

Dr. Janet S. Wilson
Associate Superintendent

Highlights: Study of Teacher Workforce in Montgomery County Public Schools

Juan Carlos Davila Valencia, M.S., Julie Wade, M.S., Natalie Wolanin, M.Ed.

Purpose of Study

This study, conducted by the Office of Shared Accountability (OSA) in Montgomery County Public Schools (MCPS), aims to describe the characteristics of the teaching staff in MCPS, as well as to examine differences across levels and types of schools. The analysis is mainly descriptive and intends ultimately to inform policies and practices that will support successful teacher staffing in the district. The Employee and Retiree Service Center (ERSC) and the Office of Human Resources and Development (OHRD) provided MCPS teacher data, and other reliable sources were consulted to compare district findings with state and national trends. The following questions guided the study, and selected findings are summarized below.

Highlights of Study Findings

1) **What are the characteristics (demographic, education, experience) of current teachers and newly-hired teachers in MCPS?**
   - MCPS teachers are experienced and highly qualified. In FY 2018, 42% of MCPS teachers had more than 15 years of experience compared to 31% in Maryland; and 87% of MCPS teachers hold a master's equivalent or higher degree, larger than Maryland (57%) and the U.S. (57%).
   - The newly-hired teaching staff has become more diverse. The percentage of new teachers who were Black or African American increased from 11% in FY 2014 to 14% in FY 2018, and the percentage of teachers who were Hispanic/Latino rose from 7% in FY 2014 to 10% in FY 2018 (See Figure below).
2) **Do the characteristics of current and newly-hired teachers differ among MCPS schools with different levels of poverty, complexity, and school climate?**
   - In FY 2018, schools with a high poverty rate or low climate perception had teachers with, on average, fewer years of teaching experience, and a more heavy representation of Hispanic/Latino and Black or African American teachers.
3) **What were the MCPS teaching position vacancies at the start of the school year and did they vary among schools with different characteristics? What does the candidate pool look like?**
   - There is little evidence of a teacher shortage in MCPS including positions that have been reported elsewhere as harder to fill (i.e. English for Speakers of Other Languages ([ESOL] or special education). The total number of first-day vacancies decreased from 89 (0.8% of all teaching positions) in the 2017 school year to only 20 (0.2% of all teaching positions) in the 2018 school year; vacancies in elementary positions do not vary by schools' characteristics.
   - College enrollment in teacher preparation programs in Maryland has decreased by 43% during FY 2012-2016. Completion of education programs during those years declined by 14%.
4) **What is the rate of teacher attrition in MCPS and does it differ by teacher and school characteristics?**
   - An increase of teacher turnover rate was observed in MCPS from 6.0% in FY 2014 to 6.9% in FY 2017, which was mainly explained by the rise in the number of teachers' resignations and terminations from 3.2% in FY 2014 to 4.2% in FY 2017. However, on average, 71% of teachers who join MCPS stay employed as teachers in the district for at least five years.
   - Teacher attrition in MCPS is, on average, 2.8 percentage points lower than Maryland based on data from FY 2013 to 2017.
   - Using data from the last 10 years, MCPS schools with a high poverty rate, high complexity, or low climate perception tend to experience a higher number of teachers' resignations and terminations.

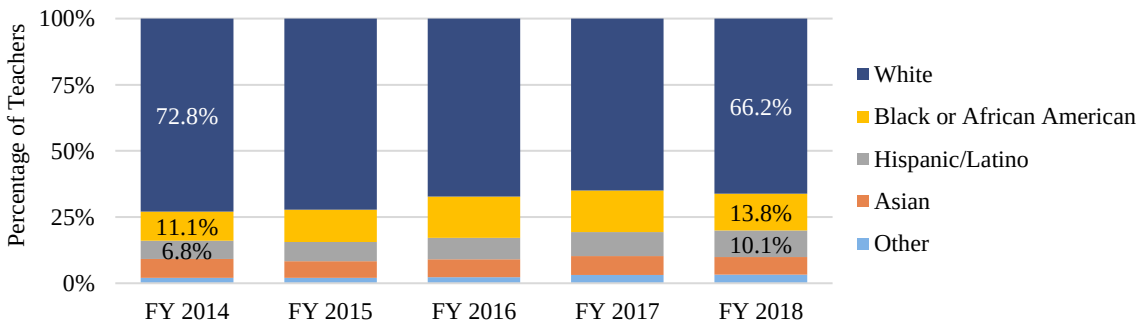

Figure. Distribution of newly-hired MCPS teachers by race/ethnicity (FY 2014-2018)

Table of Contents

List of Tables

List of Figures

Executive Summary

At the request of the Office of the Superintendent of Schools, the Office of Shared Accountability in Montgomery County Public Schools (MCPS) is conducting a study of the teacher workforce in MCPS. This report examined: (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) the status and trends observed for MCPS compared with those of Maryland and the nation to provide a wider context for the findings.

Summary of Methodology

Using data from the Office of Human Resources and Development and the Department of Employee and Retiree Service Center, this report describes the characteristics of current (2017–2018 school year) teachers, including newly-hired teachers (teachers hired on or after July 1, 2017). Specifically, the study reports their gender, age, race/ethnicity, number of years teaching, their degrees, and certifications. Moreover, the study uses percent analyses and bivariate statistics (where appropriate) to examine characteristics of these teachers by school level (elementary, middle or high school), and by schools with different levels of poverty, complexity (index combining percentage of students receiving Free and Reduced-price Meals System, English for Speakers of Other Languages, and special education services; and underrepresented minority students), and school climate perception.

In addition, this study reports the number of unfilled teaching positions for five years; and analyzes the potential candidate pool for MCPS teaching positions, using the numbers of students graduating from education programs.

Finally, this study provides the number and percent of teachers who left MCPS (resigned, were terminated, or retired) across four years, and the percent of teachers who remained in teaching positions for at least five years. Teacher attrition is also reported for different types of schools across 10 years and teacher characteristics across 3 years. A comparison of MCPS data with those of the state of Maryland and national data are provided (when data were available).

Summary of Key Findings

Research Question 1: What are the characteristics (demographic, education, experience) of current teachers and newly-hired teachers in MCPS?

- The gender and age makeup of MCPS teachers are similar to those in Maryland and the U.S. in FY 2018; however, the percentage of Black or African American teachers in MCPS is higher than the nation but lower than the state of Maryland.
- MCPS teacher workforce is slightly more diverse in FY 2018 compared to previous years; the percentage of White teachers has decreased from 76% in FY 2015 to 74% in FY 2018 whereas the percentage of Black or African American and

Hispanic/Latino teachers has increased from 11% to 12% and from 6% to 7%, respectively.

- Newly-hired teachers in MCPS are more diverse than the teacher workforce as a whole. Among teachers hired in each of the last four years, the percent who were Black or African American increased from 11% in Fiscal Year (FY) 2014 to 14% in FY 2018, with a high of 16% in 2017, and the percentage who were Hispanic/Latino rose from 7% in FY 2014 to 10% in FY 2018.
- About half of teachers hired for the 2017–2018 school year had no previous teaching experience before joining MCPS.
- Twenty-nine percent of new teachers hired in FY 2018 completed high school in MCPS, and 45% of all the education institutions where new teachers declared having a degree from or attended are Maryland institutions.
- In FY 2018, approximately 42% of MCPS teachers have more than 15 years of experience compared to the 31% observed in Maryland; and 87% of MCPS teachers hold a master's equivalent or a higher degree, larger than the percentage in Maryland and the U.S. (approximately 57%).

Research Question 2: Do the characteristics of current and newly-hired teachers differ among MCPS schools with different levels of poverty, complexity, and school climate?

- There are more Hispanic/Latino and Black or African American teachers in high-poverty elementary, middle, and high schools, compared to low-poverty schools in FY 2018. This difference is significant for current teachers at all levels, and for newly-hired teachers only in elementary schools.
- Teachers in high-poverty schools in MCPS have fewer years of experience than teachers in low-poverty schools in FY 2018. The difference was significant for all current teachers, but not for the subset of newly-hired teachers due to dissimilarities across school levels. Teachers in high-poverty schools in MCPS tend to have fewer years of experience than teachers in high-poverty schools nationally.
- In FY 2018, teachers in schools where staff perceive school climate more positively tend to have slightly more years of experience than teachers in other schools with a lower perception of climate. This difference was significant for all current teachers but not for the subset of newly-hired teachers.

Research Question 3. What were the MCPS teaching position vacancies at the start of the school year and did they vary among schools with different characteristics? What does the candidate pool look like?

- The total number of first-day vacancies decreased from 89 (0.8% of all teaching positions) in the 2016–2017 school year to 20 (0.2% of all teaching positions) in the 2017–2018 school year; vacancies in elementary positions do not vary by schools' characteristics.
- The number of college students enrolled in teacher preparation programs in Maryland has decreased from FY 2012 to 2016 by 43% but completion of education programs during those years declined by 14%.

- The number of U.S. bachelor's degrees in education declined by 17% from FY 2012 to 2016, and similar trends are observed in the number of master's degrees conferred in education in the U.S. (19% decline).

Research Question 4: What is the rate of teacher attrition in MCPS and does it differ by teacher and school characteristics?

- Retirements, promotions, and transfers remained relatively steady from FY 2014 to 2017. The increase in the teacher turnover rate in MCPS from 6.0% in FY 2014 to 6.9% in FY 2017 is mainly explained by the rise in the number of teachers' resignation and terminations from 3.2% in FY 2014 to 4.2% in FY 2017.
- On average, 71% of teachers who join MCPS stay employed as teachers in the district for at least five years.
- Teacher attrition in MCPS is on average 2.8 percentage points lower than the teacher attrition rate in Maryland based on data from FY 2013 to 2017; and higher differences are observed for teachers who have less than 10 years of experience.
- Schools with high levels of poverty, complexity, or with a low perception of school climate experience a higher number of teachers' resignations and terminations compared to schools with low levels of poverty, complexity, or with a high perception of school climate based on 10 years of analysis.

Conclusion

Overall, the MCPS teacher workforce is well-qualified. Findings for this report demonstrate that the teaching staff in MCPS is highly educated and experienced. Compared with teachers across Maryland and the U.S., MCPS teachers are more likely to hold a master's degree or equivalent. MCPS teachers have more years of experience on average than teachers across Maryland. The demographic makeup of MCPS teachers is similar, overall, to teaching staff in Maryland and the U.S., although the percentage of Black or African American teachers in MCPS is higher than in the U.S. and lower than Maryland. It is important to recognize that data for the state of Maryland are heavily weighted by the largest districts, like Prince George's County and Baltimore City, where the numbers and percentages of Black or African American teachers are higher than other Maryland districts. Indeed, the racial/ethnic makeup of the MCPS teaching staff is strikingly different from the racial/ethnic composition of the student population, a difference observed in many districts across the U.S. Examining the racial/ethnic composition of the teaching staff over a number of years, and examining the racial/ethnic composition of the newly-hired teachers provides some evidence that the MCPS teaching staff is making gains in racial/ethnic diversity. Building a solidly diverse teaching staff, however, will require intentional efforts to address the imbalance.

Finally, since teacher turnover is costly to school budgets, and more importantly, to student learning, it is critical to address it from all fronts. Based on the literature, providing support for new teachers—such as mentoring, coaching, feedback from experienced teachers, opportunities to observe expert teachers, extended professional learning opportunities, reduced workloads, and extra classroom assistance—can strengthen their development as educators and, therefore, increase retention. And to better inform efforts to retain teachers, it is important to understand why they

leave. The Learning Policy Institute (2016) reports that exit surveys can be a "high-leverage" recruitment and retention strategy; indeed, exit surveys or interviews may provide MCPS with information that can help build systems to better develop and support its teachers.

Study of Teacher Workforce in Montgomery County Public Schools

Juan Carlos Davila Valencia, Julie Wade, and Natalie Wolanin

At the request of the Office of the Superintendent of Schools, the Office of Shared Accountability (OSA) in Montgomery County Public Schools (MCPS) is conducting a study of the teacher workforce in MCPS. This report examines: (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. Ultimately, this report aims to inform policies and practices that will support successful teacher staffing in MCPS.

Scope and Research Questions

This study is descriptive in nature. The objectives of this report are: (a) to describe the characteristics—including demographics, education, and experience—of the teaching staff in MCPS; and (b) to examine differences across different levels and types of schools. The MCPS findings are examined within the context of the teaching workforce in the state of Maryland and in the U.S. (when data is available).

The following research questions were developed to address he objectives of the study:

1. What are the characteristics (demographic, education, experience) of all current teachers, including newly-hired teachers, in MCPS?
2. Do the characteristics of current and newly-hired teachers differ among schools with different levels of poverty, complexity, and school climate?
3. What were the MCPS teaching position vacancies at the start of the school year and did they vary among schools with different characteristics? What does the candidate pool for MCPS look like?
4. What is the teacher attrition rate in MCPS and does it differ by teacher and school characteristics?

Additional research questions—including an examination of characteristics of teachers who stay in the profession and an analysis of the movement of teachers between schools—will be addressed in an upcoming report.

Review of Selected Literature

A growing body of research addresses a host of issues related to the teaching workforce, including projected shortages, turnover, and the makeup of the teaching staff. Along with school systems across the country, MCPS is focused on the projected trends in teacher supply and the changing composition and needs of the student population. In support of this look ahead, and to provide context for MCPS data included in this report, relevant studies related to teacher shortage, teacher staffing in Maryland, teacher turnover, and teaching workforce diversity are summarized here.

Teacher Shortage

An abundance of literature conveys the message that there is a teacher shortage in the United States. A recent report by Hanover Research (2017) states "The teacher pipeline is narrowing, as fewer candidates are enrolling in and completing teacher preparation programs." (p. 4). The researchers point out that data based on the Integrated Postsecondary Education Data System (IPEDS), show a decline in the number of bachelor's and master's degrees in education since 2009. However, the report also points out that teacher shortages vary by geography and subject. For example, New York is producing too many teachers while other states like Arizona, California, Oklahoma, Indiana, and Kansas are having difficulty finding teachers. Additionally, rural and urban schools are more likely to have difficulty hiring teachers. A report of the National Center for Analysis of Longitudinal Data in Education Research, CALDER, (Cowan et al., 2016) argues that although there has been a recent decline in national teacher production, the number of newly prepared teachers has grown since the mid-1980's, and only about half of the recent graduates have been hired in public school systems in a given year. They point out that the evidence shows staffing difficulties with specific subjects and types of schools. That is, Science, Technology, Engineering, and Math (STEM) and special education areas, and urban, rural or schools serving many underrepresented minority students have had greater difficulty filling vacancies. The authors stress the need for targeted policies to address specific teacher shortage areas, rather than the adoption of universal policies such as across the board loan forgiveness programs or overall changes to teacher credential requirements (Cowan et al., 2016).

Similarly, a press release from the National Council on Teacher Quality (NCTQ, 2017) argues that there is not a deficit of trained teachers, but instead specific shortages. It points to hiring difficulties for struggling districts, including rural and those with challenging populations, and shortages in certain subjects such as special education and STEM. The NCTQ statement asserts that knowing about shortages in specific locales and subjects affects how we solve the problem. "Instead of a national teacher shortage, districts face a mismatch between teacher graduates and schools' hiring needs. America's teacher training programs prepare too many teachers in fields with a surplus of teachers, such as elementary education, while the numbers trained is too few in the fields where schools most desperately need teachers, such as math, science, and ESL." (NCTQ, 2017, p. 3). Indeed, CALDER has shown that demand for STEM and special education has been greater than elementary, English, and Social Studies for several years now (Cowan et al., 2016). A report from the U. S. Department of Education (Malkus, Hoyer, & Sparks, 2015) pointed out that the percentage of public high schools that reported difficulty staffing mathematics was higher than in almost every other subject. Other subjects with high levels of staffing difficulties were special education, followed by physical sciences and foreign languages. Although these subjects

presented persistent staffing challenges, the report stated that the percentage of high schools that reported difficult-to-staff teaching positions actually declined during the years from 1999–2000 to 2011–2012 for nearly every subject area. For example, the percentage of high schools reporting difficulty staffing mathematics positions decreased from 24 percent in 1999–2000 to 9 percent in 2011–2012.

Teacher Staffing Status in Maryland

The Maryland Teacher Staffing Report analyzes and publishes data collected from local school systems throughout Maryland. In its most recent report (Maryland State Department of Education [MSDE], 2016), the projected areas of critical shortage for the 2017–2018 school year in Maryland were identified. Content areas included: art; dance; family and consumer sciences; computer science; business education; English; English for Speakers of Other Languages (ESOL); mathematics; French, Spanish; science areas; and special education areas. All Maryland local school systems were designated as areas of geographic shortage, based on their responses to an MSDE survey indicating that their system had experienced a shortage in any of the critical shortage areas.

In 2017, the University of Maryland College of Education released a *Policy Brief: Is There a Teacher Shortage in Maryland? Examining Trends in Supply and Demand* (Janulis, 2017). Janulis points out that MSDE estimates shortages by content areas using the number of teachers hired in a given year compared to the number of teachers produced by Maryland colleges. However, more than half of new hires in Maryland schools are from out of state; therefore the reported shortages are inflated (Janulis, 2017).

In this highly relevant brief, Janulis (2017) reported that the supply of teachers produced by institutions of higher education in Maryland was relatively constant between 2005 and 2013, but declined in 2014 and 2015. The Maryland Academic Program (MAP) is the primary path to obtain a teaching certificate in Maryland; graduates receive a bachelor's or master's degree and Maryland certification. Most of the MAP graduates are produced by six institutions: Towson University, University of Maryland College Park, Johns Hopkins University, Salisbury University, Notre Dame of Maryland University, and Frostburg University. The number of teachers produced in Maryland has remained fairly steady, averaging 2,622 from 2005 to 2015, but the percentage of MAP graduates hired by Maryland public schools ranged from 55% in 2005 to 13% in 2015. Further, findings from the brief show a steady increase in the number of new out-of-state prepared teachers hired in Maryland public schools between 2010 and 2015; candidates prepared outside the state accounted for 68% of new hires in 2015.

Janulis (2017) reported that across most content areas, the number of Maryland graduates has been static for years, with the exception of special education teachers. The number of special education teachers increased between 2011 and 2013 but dropped to a low in 2014. Across all content shortage areas (math, world languages, ESOL, science, and special education), local school districts hired less than half of the available MAP graduates, although there is considerable variability across content areas and years. Again, this brief attests that the current MSDE tracking system tends to inflate critical area shortages because it does not take into account the supply of teachers from out of state. Finally, this University of Maryland report concludes there is little

evidence of a teacher shortage in Maryland. However, decreased enrollment in teacher preparation programs and increasing enrollment in Maryland public schools suggest that the job market may change. Recommendations from the brief include: monitoring the regional teacher market and looking beyond state borders; improved tracking of critical content areas by taking into account the supply of teachers from out of state; and tracking geographic shortage areas.

Teacher Turnover

A recent report by the Learning Policy Institute (Carver-Thomas, D., & Darling-Hammond, L., 2017) estimates that 90% of open teaching positions are created by teachers who leave. Their analysis, based on nationally representative survey data from the 2012 Schools and Staffing Survey and the 2013 Teacher Follow-up Survey, found that the highest turnover rates in the nation were in the south (16.7%) and the lowest were in the northeast (10.3%). High turnover occurred in Title 1 schools and in highly diverse schools. The study also found that alternatively certified teachers were 25% more likely than traditionally certified teachers to leave. Among teachers who left for reasons other than retirement, influences for leaving included: a lack of administration support, lower salaries, testing and accountability pressures, lack of advancement opportunities and dissatisfaction with working conditions (Carver-Thomas, D., & Darling-Hammond, L., 2017).

Similarly, Richard Ingersoll, who has done extensive research on teacher supply and demand, states that "the problem is not primarily a matter of producing too few new teachers, but is a result of losing too many existing teachers" (Ingersoll, 2016). He argues that the conventional anecdote to the national teacher shortage has been to implement a wide range of initiatives to recruit additional people into the teaching profession but that research reveals that "existing teacher reform efforts will not succeed" in solving the teacher shortage problem. Rather, teaching suffers from high turnover, higher than any other profession; this turnover is referred to as the "Revolving Door." For example in the 2011–2012 school year, there were 343,955 hires nationally at the beginning of the school year and 531,340 who left at the end of the school year. He continues to point out that not all the leaving is bad, but this high turnover profession results in a high cost. Retirement accounts for only about one-fifth of those who leave; however, one-third is due to pursuing another job or career and more than half (56%) were due to dissatisfaction with their teaching job (Ingersoll, 2016).

As stated by R. Ingersoll, teacher turnover is expensive, both in terms of the cost of student achievement (Ronfeldt et al., 2012) and in the consumption of school and district resources. For the 2016–2017 school year, it can be estimated, using a calculator developed by the Learning Policy Institute (2017), that the cost of each teacher leaving MCPS before retirement is about $11,000, yielding a total annual cost of turnover to the district of approximately $6.0 million.

Janulis (2017) reports that Maryland attrition rates between 2006 and 2015 ranged from a high of 7.8% in 2006–2007 to a low of 6% in 2009–2010. The rate of 7.0% in 2015–2016, however, is still below the national average of 7.7%. The distribution of when teachers leave teaching has changed. Maryland has improved the retention of early career teachers (0-5 years of experience) slightly, but attrition has increased among mid-career teachers (5-20 years of experience). Teachers' retirement rates have not changed. Janulis concludes that the improved retention of

teachers early in their career has not had a substantial effect on overall attrition rates because more mid-career teachers are leaving.

Teacher Diversity

In addition to ensuring that schools are fully staffed with qualified teachers, districts around the country have identified workforce diversity as a top priority (Putnam et al., 2016). For several decades, educators and researchers have posited that a diverse teaching workforce is important for reaching all student most effectively, and research evidence bears out the positive impact of a diverse teaching staff (Boser, 2014; Gershenson, Holt, & Papageorge, 2016).

The MCPS Board of Education Policy ACA, *Nondiscrimination, Equity, and Cultural Proficiency*, describes the benefit for all students that diversity in the workforce brings:

> The educational experiences of all students will be enriched by providing exposure to staff from many backgrounds reflecting the pluralistic nature of the community, thereby providing settings for education that promote understanding of diversity and contribute to the quality of the exchange of ideas inherent in the educational setting (MCPS, 2017).

Adding to the benefits brought to the school community as a whole, research has demonstrated measurable gains in academic achievement and college aspirations among students of color, especially those who are economically disadvantaged, when their school experience includes a same-race teacher. In a study of the impact of same-race teachers on the long-term achievement of elementary students, Gershenson and his colleagues found that for Black students, having at least one Black teacher in third, fourth, or fifth grades significantly reduced the probability of dropping out of high school, especially among the most economically disadvantaged students. In addition, having at least one Black teacher in grades 3 through 5 increased the likelihood that persistently low-income boys and girls aspired to attend a four-year college (Gershenson et al., 2017).

The effects of student-teacher demographic match on teacher expectations were examined by Gershenson, Holt, and Papageorge (2016) using data from the Education Longitudinal Study of 2002 (ELS). Their design allowed analysis of data from two teachers per student; this strategy was previously used to demonstrate that students assigned to one demographically mismatched teacher and one same-race or same-sex teacher, were perceived by the demographically mismatched teacher as more likely to be disruptive, inattentive, and less likely to complete homework (Dee, 2005). Similarly, Gershenson, Holt, and Papageorge (2016) found that non-Black teachers of Black high school students had significantly lower expectations than did Black teachers. The effects were larger for Black male students and math teachers.

A recent Brookings Institute report summarizes three theoretical arguments that have been made in support of increasing the representation of minority teachers, particularly for students who share their background (Egalite & Kisida, 2016): (1) providing effective role models; (2) having higher expectations for learning and future achievement; and (3) fewer cultural differences to effectively teach. Further, a 2014 study published by the Center for American Progress noted that teachers of color are more likely to work and remain in high-poverty, hard-to-staff urban schools, and districts

than their White counterparts (Partee, 2014). To achieve a national teacher workforce as diverse as the school communities it serves will require long-term policy goals using multiple strategies to address the college and teaching pathways, hiring, and retention of minority teachers (Putnam et al., 2016).

Methodology

Data Sources

This report is a compilation of information from MCPS—specifically from the Department of Employee and Retiree Service Center (ERSC) and the Office of Human Resources and Development (OHRD)—as well as data from the state of Maryland and the U.S.

Four research questions guided the study and were addressed as follows.

Research questions 1 and 2 were addressed by describing the characteristics of MCPS teachers during the 2017–2018 school year, including newly-hired teachers,—specifically their gender, age, race/ethnicity, number of years teaching and in MCPS, and their degrees and certifications. The study examined the characteristics of teachers by school level (elementary, middle or high school), and by different school characteristics (poverty, complexity, and climate). MCPS data also were reported alongside data from Maryland and the nation in order to view them in the broader context.

Research question 3 addressed unfilled teaching positions and the potential teacher candidate pool. The number of unfilled teaching positions was reported for five years (from FY 2014 to 2018), specifying types of position vacancies reported for each year. Proportions of elementary teaching vacancies[1] were examined among different types of schools (poverty, complexity, climate perception). The potential candidate pool for MCPS teaching positions was examined using the numbers of students graduating from education programs in Maryland.

Research question 4 addressed teacher attrition in MCPS, which is defined in this report as the number of teachers leaving MCPS due to resignations or terminations. The number and percent of teachers leaving MCPS and Maryland were reported across five years (from FY 2013 to 2017), the number and percent of teachers who remained in teaching positions for five years after they were first hired were reported for school years starting in 2008 were reported for MCPS and U.S. Teacher attrition was reported both across MCPS and for different types of schools, as well as by teacher characteristics. Eligibility of teachers for retirement was also reported for the next 10 years and by school level.

[1] Only one category of vacancies—elementary and Kindergarten teachers—was large enough to examine by levels of school categories.

Study Samples

All MCPS teachers for the 2017–2018 school year were included in the study (N = 13,001). Data are presented for the total group of teachers, for subgroups of teachers, such as by level (elementary, middle, and high school), and also for the subgroup of teachers who were newly hired in MCPS in the 2017–2018 school year (N = 987).

Variables of Interest

I. ***Individual level teacher data.*** Records for MCPS teachers were provided by ERSC, which included the 2018 Statistical Staff Profile (data as of October 2017) and a current teacher database. This current teacher database (2017–2018 school year) includes all MCPS teachers as of November 2017, whereas newly-hired teachers comprises the teacher staffing hired from July 1, 2017 to November 2017. This current teacher database was mainly used for the analysis, unless otherwise noted. Files were kept in a restricted area of a secure server used exclusively by the Program Evaluation Unit of OSA. Variables included:

a. Demographic characteristics (gender, race/ethnicity, age)
b. Years of experience teaching and years in MCPS
c. Level of education
d. Type of certification

Teacher data regarding resignation and termination was also provided by the ERSC as of March 2018, as well as teacher retirement eligibility as of May 2018. These termination, resignation, and retirement eligibility data were mainly used for the analysis, unless otherwise noted.

II. ***Aggregated teacher data.*** OHRD provided data aggregated for FY 2018 newly-hired teachers regarding which percentage of them were MCPS graduates, and what type of institution (Maryland or out-of-state) they hold a degree from or attended to. This information is based on what new hires entered in their applications (MCPS Career Profile).

MCPS staff position data, also provided by OHRD, were used to report the number of unfilled teaching positions as of the first day of school, for the current school year (FY 2018) and previous four years (from FY 2014 to 2017).

III. ***MCPS school-level data.*** Data files containing characteristics of MCPS schools were used to group schools by various characteristics, such as level of poverty, level of complexity, and school climate. MCPS school-level data were accessed in OSA records. Data were used to group schools as follows.

a. *Levels of poverty* in each school were estimated by using the percentage of students receiving Free and Reduced-Price Meals System (FARMS) services during the 2017–2018 school year. Schools were grouped into four categories of poverty, using the

same percentages as reported by the U.S. Department of Education, National Center for Education Statistics (NCES) in "Public School Teacher Data File," 2015–16 (Taie & Goldring, 2017). Analysis is presented by school level separately (elementary, middle, and high school) so that differences by school level are not confounded with differences by poverty level.

b. *School complexity* used an index that classifies schools based on their level of complexity. Four factors were used to compute this index: (a) the combined percentage of students identified as Hispanic/Latino, and Black or African American; (b) the percentage of students who previously received or are currently receiving FARMS services; (c) the percentage of students who previously received or are currently receiving English for Speakers of Other Languages (ESOL) services; and (d) the percentage of students who have ever had or currently have an Individualized Education Program (IEP). The weight for these four factors was not equally the same, but a factor analysis was used to determine the weights associated to each of them. The output from this factor analysis provided a list of factor scores or weights for each variable, where a variable with a positive factor score is associated with a higher impact. Later, a normal score variable was constructed for each school using the factor scores calculated previously. This new variable or complexity index can be regarded as the school impact score, where the higher the school impact score, the higher the implied impact of those four factors on that particular school. For this report, and for each school level, schools are divided into quintiles as arbitrary cut-off points.

c. *School climate* was measured by using the Staff Climate Survey administered to school staff during the 2016–2017 school year (MCPS, 2017b). At the end of every school year, MCPS conducts this survey, which measures staff perceptions about their school's environment, administration, safety, respect, and recognition. Staff, including teachers, evaluates their schools' climate by indicating their level of agreement to 17 positive statements (from strongly agree to strongly disagree). For this report, only the statements concerning to teachers were used (16 of the 17). For each statement, the percentage of staff answering "strongly agree" or "agree" was combined for each of the 203 schools with data and, later, an average of these percentages was calculated for each school. This new variable represents the average percentage of agreement to the 16 statements; the higher the average, the higher the perception of the school climate by the staff. For this report, and for each school level, schools are divided into quintiles as arbitrary cut-off points. It is important to note that the average response rates to the Staff Climate Survey were 58% among elementary school staff, 52% among middle school staff, and 49% among high school staff.

IV. State and national data. Data from Maryland, from other districts in Maryland, and from the U.S. were presented alongside MCPS data to provide a broader context. Sources are indicated below.

a. *Maryland teacher and teacher attrition* data were obtained from the MSDE dashboard (MSDE, 2018) and from the report "Professional Staff by Assignment, Race/Ethnicity and Gender, Maryland Public Schools," published by the Maryland State Department

of Education (MSDE) in October 2017. For Maryland teacher attrition, five academic years (from 2013 to 2017) were retrieved on April 2018.

b. *U.S. teacher data* were obtained from the "Public School Teacher Data File," published by the U.S. Department of Education, National Center for Education Statistics, from the National Teacher and Principal Survey (NTPS), 2015–2016; and "Public School Teacher Attrition and Mobility in the First Five Years: Results from the First Through Fifth Waves of the 2007–2008 Beginning Teacher Longitudinal Study," published by the Institute of Education Sciences, National Center for Education Statistics, U.S. Department of Education, April 2015.

c. *Candidate pool data* were represented by the numbers of graduates from teaching programs in Maryland and the U.S. from 2012 through 2016. Numbers of graduates from Maryland and Pennsylvania teacher preparation programs were drawn from the 2017 Title II Reports: National Teacher Preparation Data (U.S. Dept. of Education, 2018); the number of U.S. bachelor's degrees and master's degrees conferred in education were obtained from U.S. Department of Education, National Center for Education Statistics, Higher Education General Information Survey.

Analysis of Data

Research Questions 1 and 2. Descriptive statistics were used to report characteristics of all current teachers, and also of a subgroup of teachers who were newly hired; the analysis included their gender, age, race/ethnicity, number of years teaching and in MCPS, their degrees and certifications. Also included were the characteristics of teachers by school level (elementary, middle or high school), and by different school characteristics (poverty, complexity, and climate perception). Characteristics of teachers in different groups of schools were compared with Chi-square tests or Fisher Exact tests (for categorical data, such as degree or race/ethnicity) or Analysis of Variance (ANOVA; for continuous data, such as years of experience).

Research Question 3. The number of unfilled teaching positions was reported descriptively for five years (from FY 2014 to 2019), with the types of position vacancies reported for each year. Proportions of position vacancies were examined for elementary and Kindergarten teachers among different types of schools (poverty, complexity, climate perception). The numbers of students graduating from education programs were reported in an examination of the potential candidate pool for MCPS teaching positions.

Research Question 4. The number and percent of teachers who left MCPS (resigned, were terminated, or retired) was reported across four years (from FY 2014 to 2017), and the number and percent of teachers who remained in teaching positions for five years was reported for school years starting in 2008. Teacher attrition was reported both across MCPS and for different types of schools, as well as by teacher characteristics. Relationships between teacher attrition and teacher and school characteristics were tested with Chi-square tests or Fisher Exact tests (for categorical data) or ANOVA (for continuous data). MCPS data were compared with those of the state of Maryland as well as with national data. Eligibility of MCPS teachers for retirement was also reported for the next 10 years and by school level.

Strengths and Limitations of the Methodology

A strength of these methods is the presentation of multiple analyses of teacher staffing in MCPS. Numbers and percentages of teachers are reported across MCPS, but also by school level, and by different types of schools. Teacher characteristics (e.g., experience) are examined by school characteristics (e.g., poverty) in an effort to more fully understand staffing trends.

Limitations of these methods pertain to the nature and availability of the data. For example, staff data are not static; people move in and out of positions, so the numbers are changing continually. The base data for this report were retrieved from the MCPS system in November 2017. However, when the report is submitted, the actual "current" staff data will not be exactly the same as they were in November, 2017, as presented in the report. The same concern applies to newly-hired teachers. Newly-hired teachers only include individuals starting from July 1, 2017 until the data were retrieved in November 2017. New teachers joining MCPS after November 2017 are not included in the analysis.

It was important to include information for Maryland and the nation in order to provide context for MCPS data. However, many data points of interest in this study were not available for Maryland or the U.S., so not all MCPS data can be presented within the context of the state or country. In addition, some data from Maryland or the nation are not available for the same year, or are not defined by precisely the same criteria as MCPS data; for instances where data were available, the authors strived to provide the most accurate descriptions of the data definitions and sources.

Finally, data were presented for schools categorized by perceptions of school climate, and average response rates for the Staff Climate Survey ranged from 49% (for high schools) to 58% (for elementary schools), so perceptions of climate may not represent all teachers in the school.

Findings

Research Question 1: What are the characteristics (demographics, education, experience) of current teachers and newly-hired teachers in MCPS?

Demographic characteristics of MCPS teachers.

Tables 1 through 4 show the number and percentage of all MCPS teachers and newly-hired teachers by gender, race/ethnicity, and age. Table 1 shows the gender, race/ethnicity, and age of current MCPS teachers in the school years from 2014–2015 (FY 2015) through 2017–2018 (FY 2018).

Table 1
Demographic Characteristics of MCPS Teachers from FY 2015 to FY 2018 by Gender, Race/Ethnicity, and Age

	FY 2015		FY 2016		FY 2017		FY 2018	
	N	%	N	%	N	%	N	%
Gender								
Female	9,961	80.6	9,888	80.4	10,217	80.1	10,388	79.9
Male	2,393	19.4	2,416	19.6	2,536	19.9	2,613	20.1
Race/Ethnicity								
American Indian or Alaskan Native	24	≤ 1.0	22	≤ 1.0	21	≤ 1.0	19	≤ 1.0
Asian	670	5.4	677	5.5	722	5.7	748	5.8
Black or African American	1,397	11.3	1,421	11.5	1,526	12.0	1,578	12.1
Hispanic/Latino	689	5.6	726	5.9	804	6.3	850	6.5
Native Hawaiian and Pacific Islander	≤ 5	≤ 1.0	≤ 5	≤ 1.0	≤ 5	≤ 1.0	6	≤ 1.0
Two or More	162	1.3	171	1.4	189	1.5	203	1.6
White	9,411	76.2	9,286	75.5	9,486	74.4	9,597	73.8
Age								
20 – 29 years	2,223	18.0	2,110	17.1	2,253	17.7	2,276	17.5
30 – 39 years	3,568	28.9	3,611	29.3	3,740	29.3	3,800	29.2
40 – 49 years	3,171	25.7	3,203	26.0	3,358	26.3	3,494	26.9
50 – 59 years	2,314	18.7	2,331	18.9	2,402	18.8	2,453	18.9
60+ years	1,078	8.7	1,049	8.5	1,000	7.8	978	7.5
Total	12,354	100.0	12,304	100.0	12,753	100.0	13,001	100.0

Note. Data provided by the Staff Statistical Profile, ERSC, 2018 (Section 9).

The percentages of male and female teachers in MCPS changed little over the four years reported; about 80% of all teachers were female in each of the four years (Table 1). Small changes toward to a more diverse teacher workforce were noted, as Figure 1 shows below. Gradual increases in the percentages of Black or African American and Hispanic/Latino teachers occurred each year; an overall decrease in the percentage of White teachers was observed, totaling 2.4 percentage points, from 76.2 in FY 2015 to 73.8 in FY 2018.

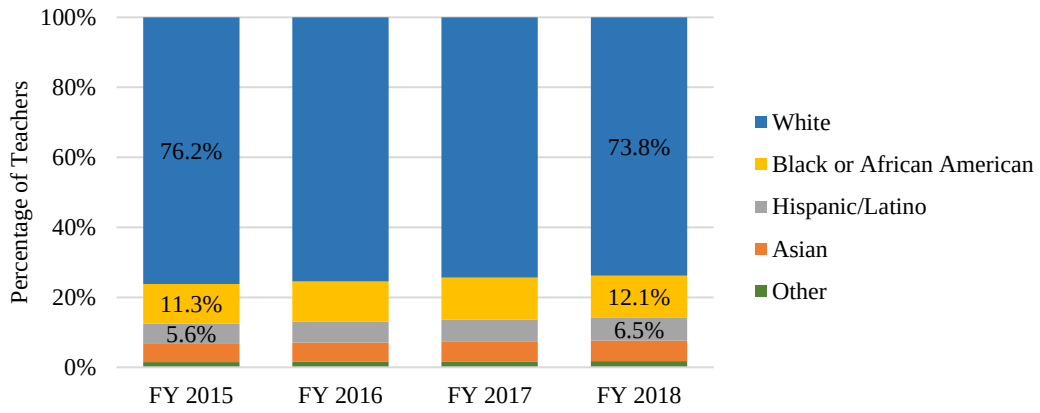

Figure 1. Distribution of MCPS teachers by race/ethnicity from FY 2015 to FY 2018

Note. Data provided by the Staff Statistical Profile, ERSC, 2018 (Section 9).

Table 2 shows the gender, race/ethnicity, and age of all current MCPS teachers by school level as of November 2017.

Table 2
Demographic Characteristics of Teachers by Gender, Race/Ethnicity, and Age as of November 2017 by School Level

	Elementary		Middle		High	
	N	%	N	%	N	%
Gender						
Female	5,581	91.1	2,024	73.2	2,158	63.2
Male	545	8.9	742	26.8	1,254	36.8
Race/Ethnicity						
American Indian or Alaskan Native	≤ 5	≤ 1.0	≤ 5	≤ 1.0	10	≤ 1.0
Asian	358	5.8	166	6.0	192	5.6
Black or African American	598	9.8	427	15.4	461	13.5
Hispanic/Latino	390	6.4	184	6.7	243	7.1
Native Hawaiian and Pacific Islander	≤ 5	≤ 1.0	≤ 5	≤ 1.0	≤ 5	≤ 1.0
Two or More	94	1.5	52	1.9	50	1.5
White	4,677	76.3	1,932	69.8	2,455	72.0
Age						
20 – 29 years	1,390	22.7	452	16.3	375	11.0
30 – 39 years	1,794	29.3	832	30.1	976	28.6
40 – 49 years	1,476	24.1	814	29.4	983	28.8
50 – 59 years	1,066	17.4	475	17.2	756	22.2
60+ years	400	6.5	193	7.0	322	9.4
Total	6,126	100.0	2,766	100.0	3,412	100.0

There are more male teachers at the secondary level than in elementary schools; more than 35% of high school teachers and more than 25% of middle school teachers are men compared with the 9% in elementary schools (Table 2). Similarly, the percentage of Black or African American teachers is lower in elementary compared with middle and high school. On the other hand, a higher percentage of elementary teachers are in the youngest age group (20 – 29 years). The other racial/ethnic and age distribution subgroups are similar across school levels (Table 2).

Table 3 shows the gender, race/ethnicity, and age of newly-hired MCPS teachers from FY 2015 through FY 2018. Considering only the FY 2018, newly-hired teachers represented around 7.7% of all current teachers as of November 2017.

Table 3
Demographic Characteristics of Newly-Hired MCPS Teachers from FY 2015 to FY 2018 by Gender, Race/Ethnicity, and Age

	FY 2015		FY 2016		FY 2017		FY 2018	
	N	%	N	%	N	%	N	%
Gender								
Female	738	81.4	546	78.9	957	78.5	778	78.8
Male	169	18.6	146	21.1	262	21.5	209	21.2
Race/Ethnicity								
American Indian or Alaskan Native	≤ 5	≤ 1.0	0	0.0	≤ 5	≤ 1.0	0	0.0
Asian	55	6.1	45	6.5	86	7.1	67	6.8
Black or African American	106	11.7	104	15.0	195	16.0	136	13.8
Hispanic/Latino	67	7.4	57	8.2	117	9.6	100	10.1
Native Hawaiian and Pacific Islander	0	0.0	0	0.0	≤ 5	≤ 1.0	0	0.0
Two or More	19	2.1	18	2.6	31	2.5	32	3.2
White	659	72.7	468	67.6	783	64.2	652	66.1
Age								
20 – 29 years	513	56.6	351	50.7	605	49.6	498	50.5
30 – 39 years	200	22.1	177	25.6	341	28.0	255	25.8
40 – 49 years	138	15.2	116	16.8	179	14.7	143	14.5
50 – 59 years	46	5.1	44	6.4	81	6.6	77	7.8
60+ years	10	1.1	≤ 5	≤ 1.0	13	1.1	14	1.4
Total	907	100.0	692	100.0	1,219	100.0	987	100.0

Note. Data provided by the Staff Statistical Profile, ERSC, 2018 (Section 8).

The gender and age makeup of newly-hired teachers has not varied much in the last four years reported; on average, almost 80% of newly-hired teachers each year are women (Table 3), and about half of newly-hired teachers are between 20 and 29 years old. However, in the last four years, there has been a decrease of new White teachers and an increase in new Hispanic/Latino

and Black or African American teachers (Figure 2), which may have contributed to a more diverse teacher workforce in MCPS, as mentioned earlier.

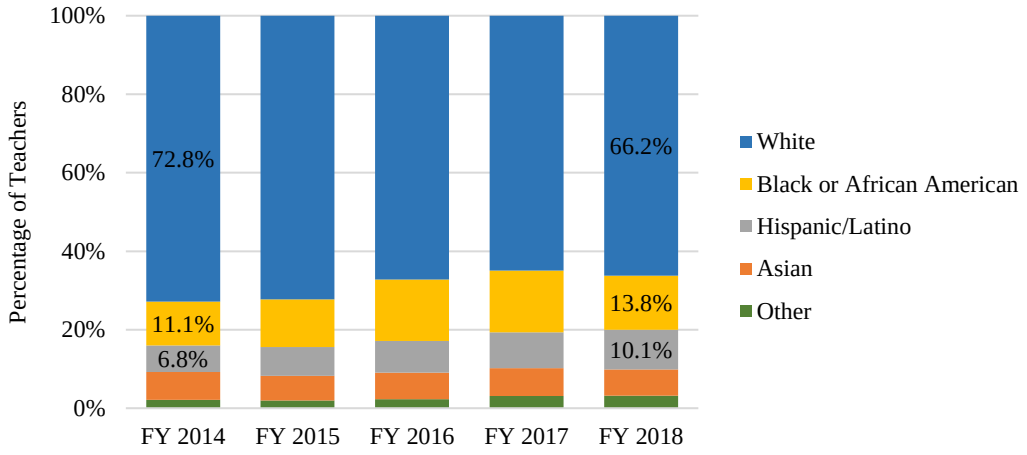

Figure 2. Distribution of newly-hired MCPS teachers by race/ethnicity from FY 2014 to FY 2018

Note. Data provided by the Staff Statistical Profile, ERSC, 2018 (Section 9).

The gender, race/ethnicity, and age of newly-hired MCPS teachers by school level is shown in Table A1, Appendix A. The gender and racial/ethnic makeup of newly-hired teachers follows the same pattern as those observed in Table 2 but with minor differences; the percentage of non-White teachers across all school levels tend to be higher among newly-hired teachers than among all teachers.

How does the teacher profile compare to the student profile?

Notably, according to Figure 3 below, the racial/ethnic makeup of the teaching staff differs from the racial/ethnic makeup of the student population across all MCPS schools. Hispanic/Latino (30%) and White (29%) students are almost equally represented, followed by Black or African American (21%) and Asian (15%). However, even though a gradual increase of Black or African American and Hispanic/Latino teachers has been observed in the last years, still nearly three quarters of all MCPS teachers are White (74%).

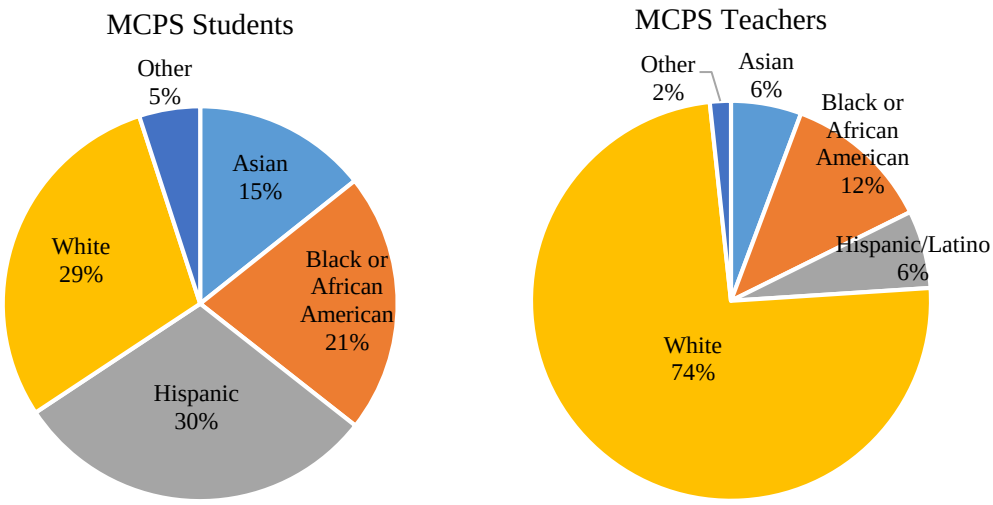

Figure 3. Distribution of MCPS students and teachers by race/ethnicity in FY 2017.

Note. Other includes American Indian or Alaskan Native, Native Hawaiian and Pacific Islander, and individuals with two or more races.

Demographic characteristics of MCPS teachers compared with the State of Maryland and U.S. teachers[2]

Table 4 shows the gender, race/ethnicity, and age of teachers in MCPS, Maryland, and the U.S. The data for MCPS and Maryland is from FY 2017 and data for U.S. teachers is from FY 2016, collected via teachers' surveys.

[2] The National Center for Education Statistics (NCES) reports a total of 3.8 million teachers in all public schools across the United States.

Table 4
Demographic Characteristics of Teachers in MCPS, State of Maryland, and the U.S.

	MCPS, FY 2017[a] *N = 12,753*	Maryland, Oct. 2016 *N = 60,306*	U. S., 2015–2016 *N = 3,827,100*
	%	%	%
Gender			
Female	80.1	78.2	76.6
Male	19.9	21.8	23.4
Race/Ethnicity			
Black or African American	12.0	17.3	6.7
White	74.4	74.4	80.1
Hispanic/Latino	6.3	8.3	8.8
Asian	5.7		2.3
Other[b]	1.7		2.0
Age			
Under 30 years	17.7	*Not available*	15.0
30 – 39 years	29.3		55.9
40 – 49 years	26.3		
50 – 59 years	18.8		29.0
60+ years	7.8		
Total	100.0	100.0	100.0

[a] Source: Data provided by the Staff Statistical Profile, ERSC, 2018 (Section 9).
[b] Race/ethnicity category "Other" includes American Indian, Pacific Islander/Native Hawaiian, and two or more races.

The gender distribution of teachers in MCPS is similar to the state of Maryland and the nation; approximately 80% of teachers are female (Table 4). White teachers have the largest representation in the teachers' makeup in MCPS, Maryland, and the U.S., however, the percentage of Black or African American teachers in MCPS is larger than in the nation but slightly lower than the state of Maryland. It is important to recognize that data for the state of Maryland are heavily weighted by the largest districts, like Prince George's County and Baltimore City, where the numbers and percentages of Black or African American teachers are higher than other Maryland districts. Montgomery County, at 11% Black or African American teachers, has the fourth highest percentage of Black or African American teachers in Maryland. Regarding the age of teachers, the proportion of MCPS teachers in specified age categories is very similar to those reported for the U.S.

Experience and education of MCPS teachers

Tables 5 and 6 show the number and percentage of all MCPS teachers (Table 5) and newly-hired teachers only (Table 6) by experience, education, and certification by school level as of November 2017.

Table 5
Years in MCPS, Years of Teaching Experience, Degree Attained, and Level of Certification for MCPS Teachers by School Level

	Total *N* = 12,304		Elementary *N* = 6,126		Middle *N* = 2,766		High *N* = 3,412	
	N	%	*N*	%	*N*	%	*N*	%
Years in MCPS								
0.0 – 1.0	1,044	8.5	499	8.1	297	10.7	248	7.3
1.1 – 5.0	2,999	24.4	1,557	25.4	720	26.0	722	21.2
5.1 – 10.0	2,157	17.5	1,163	19.0	413	14.9	581	17.0
10.1 – 15.0	2,364	19.2	1,130	18.4	515	18.6	719	21.1
15.1 – 20.0	2,029	16.5	947	15.5	444	16.1	638	18.7
20.1 +	1,711	13.9	830	13.5	377	13.6	504	14.8
Years of Teaching Experience								
0.0 – 1.0	534	4.4	289	4.7	131	4.8	114	3.4
1.1 – 5.0	1,994	16.3	1,111	18.2	474	17.3	409	12.0
5.1 – 10.0	2,211	18.1	1,164	19.1	477	17.4	570	16.8
10.1 – 15.0	2,422	19.8	1,170	19.2	536	19.5	716	21.1
15.1 – 20.0	2,139	17.5	997	16.3	475	17.3	667	19.6
20.1 +	2,940	24.0	1,368	22.4	652	23.8	920	27.1
Degree Attained								
Lower than a Bachelor's	≤ 5	≤ 1.0	≤ 5	≤ 1.0	≤ 5	≤ 1.0	≤ 5	≤ 1.0
Bachelor's	1,475	12.0	980	16.0	284	10.3	211	6.2
Master's equivalent	2,807	22.8	1,403	22.9	615	22.2	789	23.1
Master's	7,842	63.7	3,688	60.2	1,822	65.9	2,332	68.3
Doctorate	109	≤ 1.0	25	≤ 1.0	23	≤ 1.0	61	1.8
Not reported	67	≤ 1.0	29	≤ 1.0	21	≤ 1.0	17	≤ 1.0
Certification								
Standard Professional	2,705	22.0	1,599	26.1	571	20.6	535	15.7
Advanced Professional	8,543	69.4	4,067	66.4	1,878	67.9	2,598	76.1
Maryland Board of Examiners License	190	1.5	151	2.5	22	0.8	17	0.5
Conditional Degree Certificate	161	1.3	43	0.7	57	2.1	61	1.8
Resident Teacher	≤ 5	≤ 1.0	0	0.0	≤ 5	≤ 1.0	≤ 5	≤ 1.0
Other Certificate	32	≤ 1.0	16	≤ 1.0	≤ 5	≤ 1.0	≤ 5	≤ 1.0
Certificate Data not Available or Not Needed	668	5.4	250	4.1	227	8.2	191	5.6
Total	12,304	100.0	6,126	100.0	2,766	100.0	3,412	100.0

Table 5 shows four large groups: (a) almost a quarter of teachers have been in MCPS between one and five years; (b) almost a quarter of MCPS teachers have more than 20 years of teaching

experience; (c) almost two-thirds of MCPS teachers hold a master's degree; and (d) more than two-thirds of MCPS teachers have an advanced professional certification. Also, high school teachers tend to have more years of experience compared to middle and elementary school teachers.

Table 6 details the teaching experience and education of the teachers who were hired in the 2017–2018 school year.

Table 6
Years of Teaching Experience and Degree Attained of Newly-Hired Teachers For the FY 2018 by School Level

	Total N = 956		Elementary N = 449		Middle N = 274		High N = 233	
	N	%	N	%	N	%	N	%
Years of Teaching Experience								
0.0 – 1.0	482	51.3	259	58.6	119	44.2	104	45.6
1.1 – 5.0	154	16.4	58	13.1	57	21.2	39	17.1
5.1 – 10.0	142	15.1	65	14.7	43	16.0	34	14.9
10.1 – 15.0	109	11.6	42	9.5	37	13.8	30	13.2
15.1 – 20.0	36	3.8	13	2.9	9	3.3	14	6.1
20.1 +	16	1.7	≤ 5	1.1	≤ 5	1.5	7	3.1
Degree Attained								
Lower than a Bachelor's	≤ 5	≤ 1.0	≤ 5	≤ 1.0	≤ 5	≤ 1.0	0	0.0
Bachelor's	389	40.7	237	52.8	88	32.1	64	27.5
Master's equivalent	40	4.2	14	3.1	21	7.7	≤ 5	2.1
Master's	492	51.5	184	41.0	155	56.6	153	65.7
Doctorate	13	1.4	≤ 5	≤ 1.0	≤ 5	1.5	≤ 5	2.1
Not reported	20	2.1	9	2.0	5	1.8	6	2.6
Total	956	100.0	449	100.0	274	100.0	233	100.0

Note. For a few new teachers, years of experience was not available. Certification data were unavailable for more than two-thirds of newly-hired staff so are not included in the table.

More than half of newly-hired teachers for the FY 2018 have limited, or no previous teaching experience (Table 6); the percentage of newly-hired teachers without teaching experience is higher among elementary teachers than among middle or high school teachers. In addition, more than half of the newly-hired elementary teachers hold a bachelor's degree, while more than half of the newly-hired middle and high school teachers have a master's degree (Table 6).

Figure 4 reports the proportion of FY 2018 newly-hired teachers who completed high school in MCPS, and the type of education institution where they hold a degree from or attended based on their educational history.

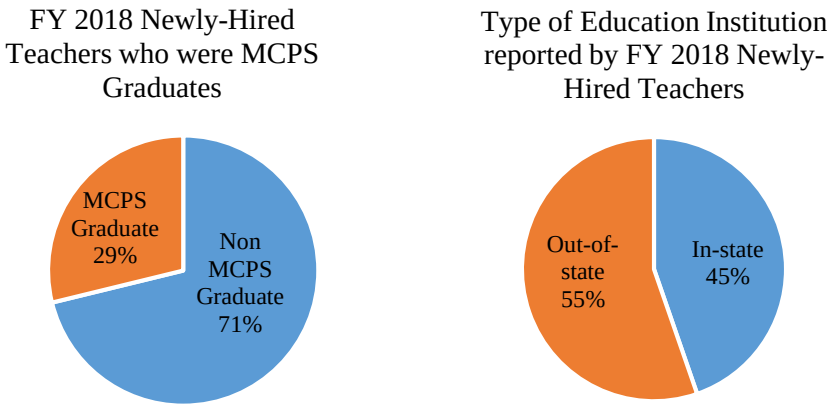

Figure 4. High school education, and in-state and out-of-state education of FY 2018 newly-hired teachers.

Twenty-nine percent of the new teachers hired in the FY 2018 completed high school in MCPS. Among all the education institutions where new teachers reported having a degree from or attended, in-state institutions represented around 45%. The in-state institutions with more mentions by new hires were University of Maryland (36%), followed by Towson University (17%).

Experience and education of MCPS teachers compared with Maryland and U.S. teachers

Table 7 presents data on years of teaching experience, education level, and types of certification held by MCPS teachers, teachers in Maryland, and in the all U.S. Data for MCPS and Maryland teachers are reported for the FY 2017, whereas for all U.S. teachers, data are reported for the FY 2016.

Table 7
Years of Teaching Experience, Degree Attained, and Level of Certification For Teachers in MCPS, State of Maryland, and the U.S.

	MCPS, FY 2017 [a] *N = 12,753*	Maryland, Oct. 2016 *N = 60,306*	U. S., 2015–2016 *N = 3,827,100*
	%	%	%
Years of Teaching Experience			
0.0 – 5.0	20.3	31.2	15.0 [b]
5.1 – 10.0	18.0	19.7	23.2 [b]
10.1 – 15.0	19.6	18.4	19.4 [b]
15.1 – 20.0	18.6	14.2	42.3 [b]
20.1 +	23.5	16.4	
Degree Attained			
Non-degree	≤ 1.0	≤ 1.0	2.4
Associate	0.0		
Bachelor's	13.2	42.3	40.5
Master's equivalent	23.6	57.1	57.0
Master's	62.0		
Doctorate	1.1	0.0	
Certification			
Standard Professional	25.7	25.4	*Not available*
Advanced Professional	69.5	67.9	
Maryland Board of Examiners License	3.6	0.0	
Conditional Degree Certificate	1.1	0.0	
Resident Teacher	≤ 1.0	0.0	
Other Certificate	0.0	0.0	
Certificate Data not Available or Not Needed	≤ 1.0	6.7	
Total	100.0	100.0	100.0

[a] Source: Data provided by the Staff Statistical Profile, ERSC, 2018 (Section 9).
[b] Range of years of experience is reported differently for U.S. data. The first category is less than four years; the second category is 4 to 9 years; the third category is 10 to 14 years; the last category is 15 years or more.

More than 40% of MCPS teachers have at least 15 years of teaching experience, similar to U.S. levels, whereas Maryland reports around 30% of teachers with at least 15 years of teaching experience (Table 7). MCPS stands out by having 87% of teachers with at least a master's equivalent degree compared to 57% reported by Maryland and national data. Regarding teacher certification, MCPS does not differ much from the numbers reported by Maryland; more than 90% of teachers in MCPS and Maryland hold a standard or advanced professional certification.

Summary of Research Question 1: Characteristics of current and newly-hired teachers in MCPS

- Approximately 80% of MCPS teachers in FY 2018 are female, 74% are White, and 56% are between 30 and 49 years of age.
- Ninety-one percent of teachers in elementary schools in FY 2018 are female whereas 63% in high schools are female; White teachers are also predominant regardless of the school level.
- Female teachers are still the majority among the newly-hired teachers for the 2017–2018 school year; however, there has been a slight increase in hiring male teachers in the last four years from 19% to 21%.
- MCPS teacher workforce is slightly more diverse in FY 2018 compared to previous years; the percentage of White teachers has decreased from 76% in FY 2015 to 74% in FY 2018 whereas the percentage of Black or African American teachers and Hispanic/Latino teachers has increased from 11% to 12% and from 6% to 7% respectively.
- Newly-hired teachers in MCPS are more diverse than the teacher workforce as a whole. Among teachers hired in each of the last four years, the percentage who were Black or African American increased from 11% in FY 2014 to 14% in FY 2018, with a high of 16% in 2017, and the percentage who were Hispanic/Latino rose from 7% in FY 2014 to 10% in FY 2018.
- The gender and age makeup of MCPS teachers in FY 2018 are similar to those in Maryland and the U.S.; however, the percentage of Black or African American teachers in MCPS is higher than in the nation but lower than the state of Maryland.
- More than 87% of MCPS teachers in FY 2018 hold a master's equivalent or a higher degree, and more than 90% of MCPS teachers have a standard professional or advanced professional certification.
- Around half of teachers hired for the FY 2018 had no previous teaching experience before joining MCPS.
- Twenty-nine percent of new teachers hired in the FY 2018 completed high school in MCPS, and 45% of all the education institutions where new teachers declared having a degree from or attended are in-state institutions.
- Around 42% of MCPS teachers in FY 2018 have more than 15 years of experience compared to 31% observed in Maryland; and 87% of MCPS teachers hold a

master's equivalent or a higher degree, larger than the percentage in Maryland and the U.S. (approximately 57%).

Research Question 2: Do the characteristics of current and newly-hired teachers differ among schools with different levels of poverty, complexity, and school climate?

Teachers' characteristics by school levels of poverty

Appendix B, Table B1, shows the distribution of teachers by school levels of poverty, which uses the same intervals as reported by the NCES. Each of the four intervals represents the percentage range of students receiving FARMS.

School levels of poverty and teachers' gender. For each school level, the distribution of female and male teachers does not vary much across the school levels of poverty (Appendix B, Figure B1). A test of association corroborates the lack of significant relationship between teachers' gender and poverty level for elementary, middle, and high schools ($p > 0.05$; Appendix B, Table B2). Similar results were observed for newly-hired teachers ($p > 0.05$; Appendix B, Table B2).

When teachers' gender distribution in MCPS high-poverty schools is compared to the distribution in U.S. high-poverty schools, the percentage of male teachers in MCPS high-poverty schools is lower compared to the percentage in the U.S. (Figure 5). This coincides with Table 4 (Research Question 1) which showed that the overall percentage of male teachers in MCPS is lower than in the U.S.

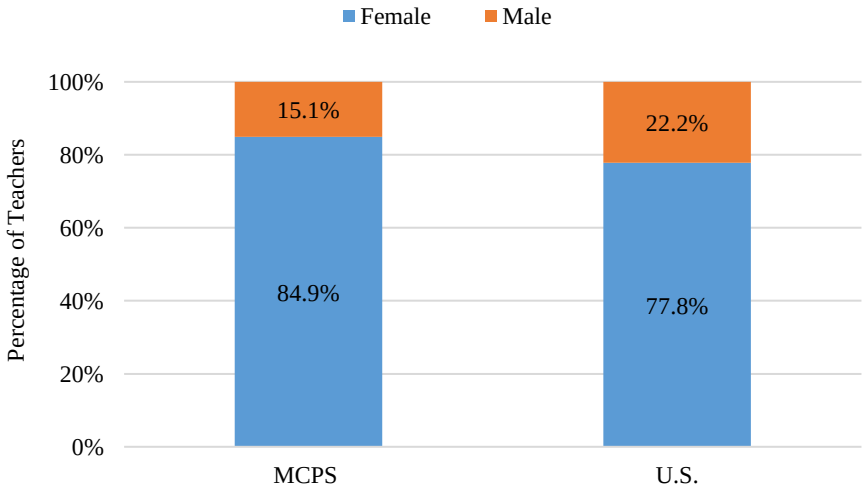

Figure 5. Percentage of MCPS female and male teachers in schools with more than 50% students receiving FARMS compared to U.S.

School levels of poverty and teachers' race/ethnicity. Figure 6 shows the distribution of White, Black or African American, and Hispanic/Latino teachers by school levels of poverty for elementary, middle, and high schools.

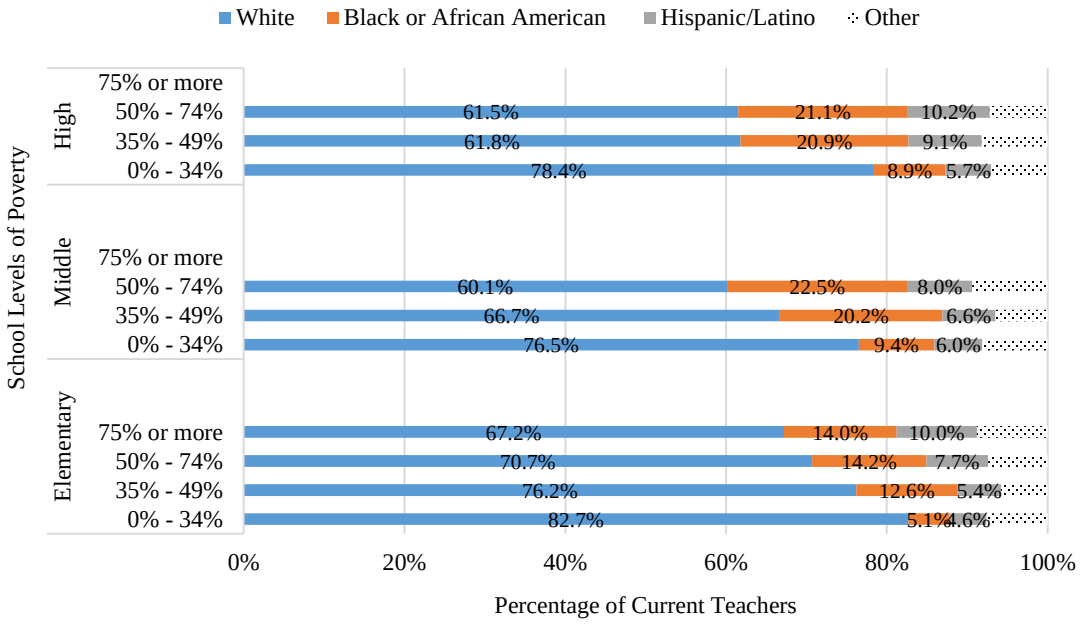

Figure 6. Percentage of White, Black or African American, and Hispanic/Latino teachers by levels of poverty for elementary, middle, and high schools.

In schools with high percentages of students who received FARMS services, there are higher proportions of Hispanic/Latino and Black or African American teachers compared to schools with lower levels of students who received FARMS services, regardless of the school level (Figure 6). Tests of association confirm a statistically significant relationship between school levels of poverty and teachers' race/ethnicity in elementary, middle, and high schools ($p < 0.01$; Appendix B, Table B3). Analysis of newly-hired teachers revealed a significant relationship between teacher's race/ethnicity and school level of poverty only for elementary schools ($p < 0.05$; Appendix B, Table B3).

For schools with more than one half of students receiving FARMS services, the proportion of White teachers is lower in MCPS compared to national data (Figure 7) and the proportion of Black or African American and Hispanic/Latino teachers is higher. This difference is consistent with Table 4 (Research Question 1), which shows that overall MCPS has a more diverse teacher workforce than the U.S.

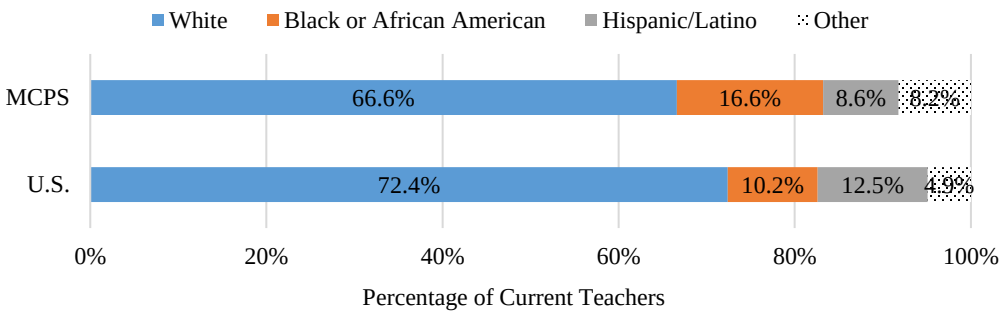

Figure 7. Percentage of White, Black or African American, and Hispanic/Latino teachers in schools with more than 50% students in FARMS. Comparison between MCPS and U.S.

School levels of poverty and teachers' experience. An examination of the average years of teaching experience in schools with different levels of FARMS participation revealed fewer years of experience in high-poverty schools. The pattern was observed in elementary, middle, and high school levels. Figure 8 shows how the average years of experience decreases as the school levels of poverty increases. Tests of association confirm the relationship between teachers' experience and school levels of poverty in elementary, middle, and high schools ($p < 0.01$; Appendix B, Table B4), indicating that high-poverty schools are associated to teachers with fewer years of teaching experience on average.

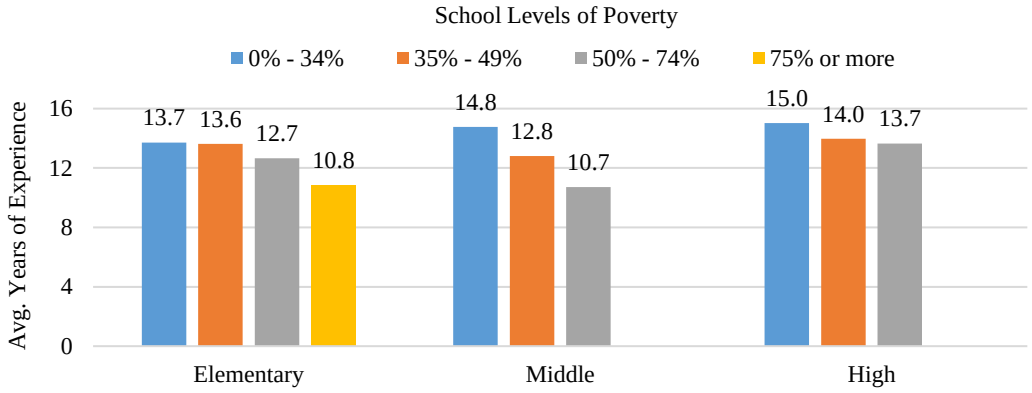

Figure 8. Average years of experience of elementary, middle, and high school teachers across all school levels of poverty.

However, this association is not clear and not significant ($p > 0.05$; Appendix B, Table B4) when the analysis is performed for newly-hired teachers, as shown in Figure 9. In the case of elementary and middle schools, the average years of teaching experience of newly-hired teachers in high-poverty schools is not necessarily lower than low-poverty schools. And in the case of high schools, newly-hired teachers in high-poverty locations have more years teaching experience on average than low-poverty locations.

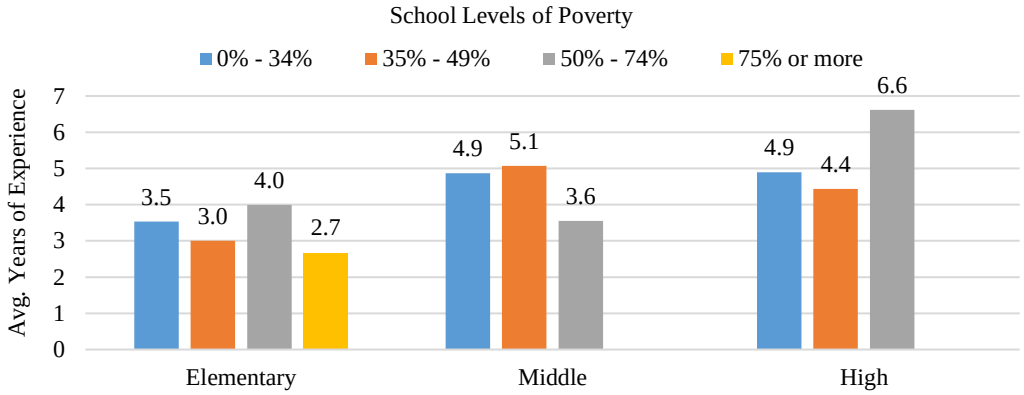

Figure 9. Average years of experience of newly-hired elementary, middle, and high school teachers for each school levels of poverty.

As shown previously in Table 7 (Research Question 1), MCPS teachers' years of experience is similar to U.S. teachers, although MCPS had a higher percent of teachers with five years of experience or less. However, when years of teaching experience is compared among different school levels of poverty, teachers in high-poverty schools in MCPS report having fewer years of teaching experience on average compared to high-poverty schools across the nation (Figure 10).

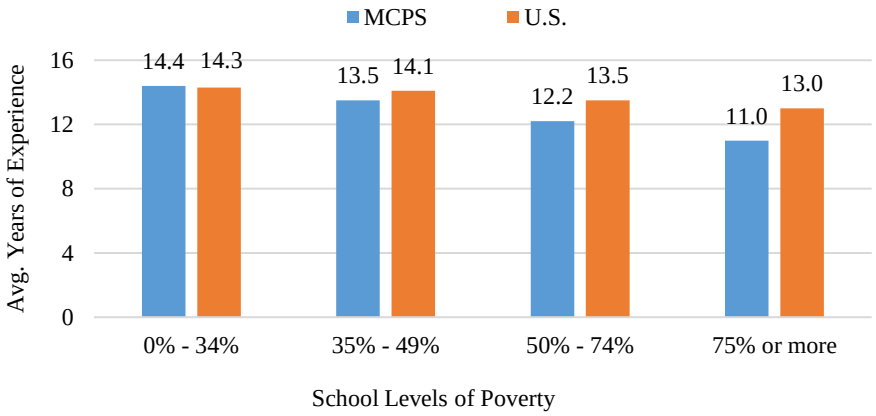

Figure 10. Average years of teaching experience by school levels of poverty, comparison between MCPS and U.S.

School levels of poverty and teachers' degree. Figure 11 displays the distribution of highest degrees held by elementary, middle, and high school teachers by school levels of poverty.

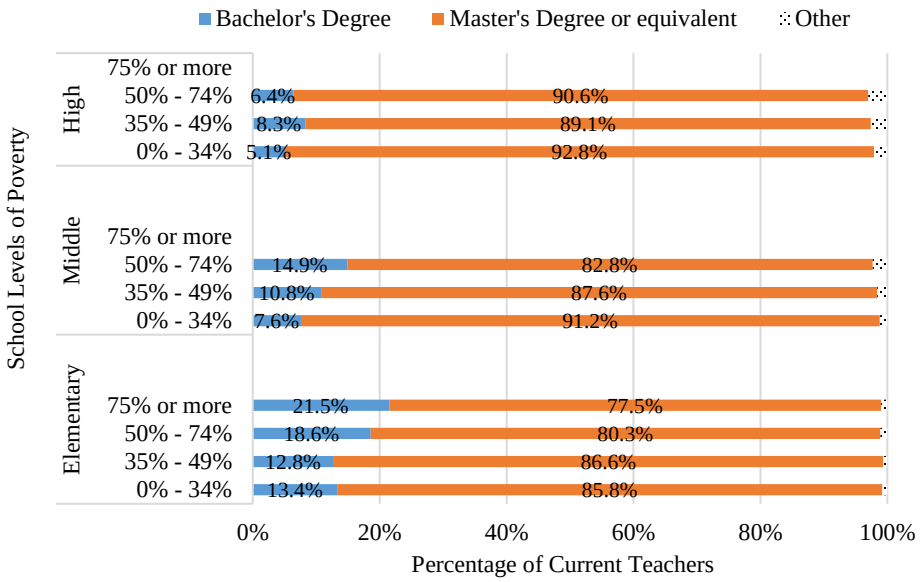

Figure 11. Percentage of highest degree of elementary, middle, and high school teachers by school levels of poverty.

The percentage of teachers with a master's degree or equivalent is higher in schools with lower percentages of student receiving FARMS services than in schools with higher FARMS enrollment; the relationship between FARMS and teachers' degree is statistically significant for all school levels ($p < 0.01$; Appendix B, Table B5) (Figure 11). For newly-hired teachers, no clear association between degree and school levels of poverty is observed (except for high school); tests of independence were not significant ($p > 0.05$; Appendix B, Table B5), indicating that the level of the earned degree of new hires has nothing to do with the level of poverty of the school they teach.

Teachers' characteristics by school levels of complexity

Appendix B, Table B6, shows the distribution of teachers by school levels of complexity, and it uses the complexity index ranking to classify schools into quintiles (see Methodology). For each of the school levels, Table B6 in Appendix B displays only the two lowest and the two highest quintiles of the complexity index.

School levels of complexity and teachers' gender. The makeup of female and male teachers in elementary, middle, and high schools does not differ for each level of school complexity (Appendix B, Figure B2). This lack of association is confirmed by a test of independence where the relationship between teachers' gender and school complexity is not significant ($p > 0.05$; Appendix B, Table B7). The same pattern and lack of significant relationship were observed when the analysis only included newly-hired teachers ($p > 0.05$; Appendix B, Table B7), indicating that high or low-complexity schools are not necessarily associated with a particular gender of new hires.

School levels of complexity and teacher race/ethnicity. Figure 12 shows the percentage of White, Black or African American, and Hispanic/Latino teachers by school levels of complexity.

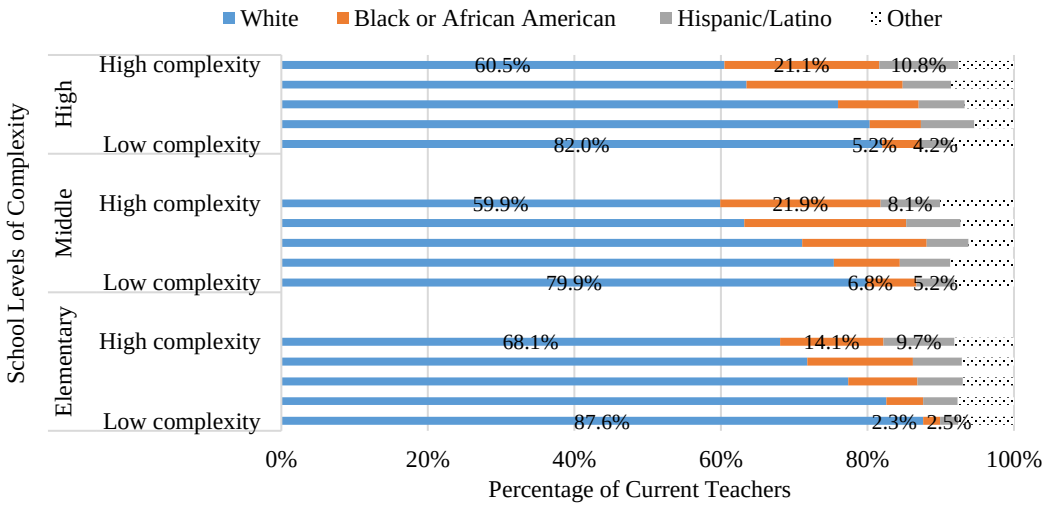

Figure 12. Percentage of White, Black or African American, and Hispanic/Latino teachers by school levels of complexity for elementary, middle, and high schools.

Similar to the findings of school poverty measured by receipt of FARMS, the proportion of White teachers is smaller in high-complexity schools compared to low-complexity schools, and the percentage of Black or African American and Hispanic/Latino teachers increases as the school complexity increases (Figure 12). A test of association confirms a statistically significant relationship between teachers' race/ethnicity and school complexity for all schools levels ($p < 0.01$; Appendix B, Table B8). A similar pattern was observed for newly-hired teachers, although it was not statistically significant for middle and high school levels ($p > 0.05$; Appendix B, Table B8).

School levels of complexity and teachers' experience. Figure 13 displays the average years of experience of elementary, middle, and high school teachers by different levels of school complexity.

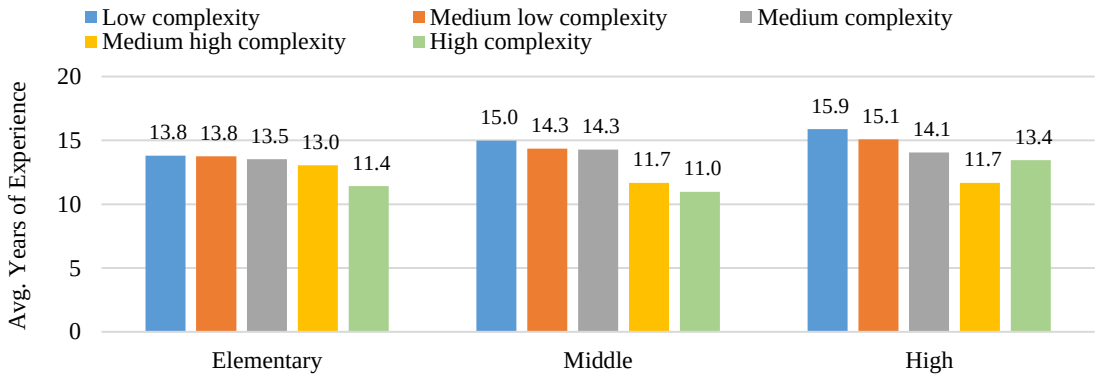

Figure 13. Average years of experience of elementary, middle, and high school teachers by school levels of complexity.

Teachers in high-complexity schools tend to have on average fewer years of experience than teachers in low-complexity schools regardless of the school level (Figure 13). Similar to the findings by school levels of poverty, there is a significant relationship between years of teaching experience and school complexity for elementary, middle, and high schools ($p < 0.01$; Appendix B, Table B9). For newly-hired teachers, however, the relationship between school complexity and teachers' experience was not significant (Appendix B, Table B9) at elementary, middle, and high school levels.

In the case of *novice* teachers (newly-hired teachers with no previous teaching experience), which represent about half of the newly-hired teachers for the school year 2017–2018, Figure 14 shows the proportion of these novice teachers by school level and school levels of complexity.

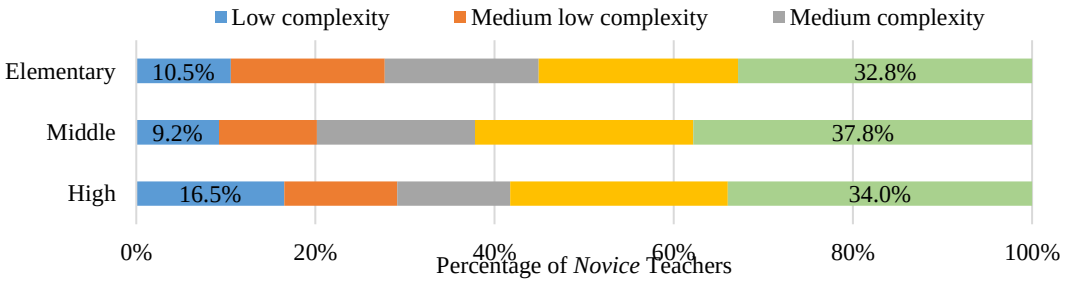

Figure 14. Proportion of novice teachers in schools with different levels of complexity.

The largest proportions of *novice* teachers were in high or medium-high complexity schools compared to low or medium-low complexity schools, for all the school levels (Figure 14).

School levels of complexity and teachers' earned degree. Figure 15 shows the distribution of highest degrees held by elementary, middle, and high school teachers for different levels of school complexity.

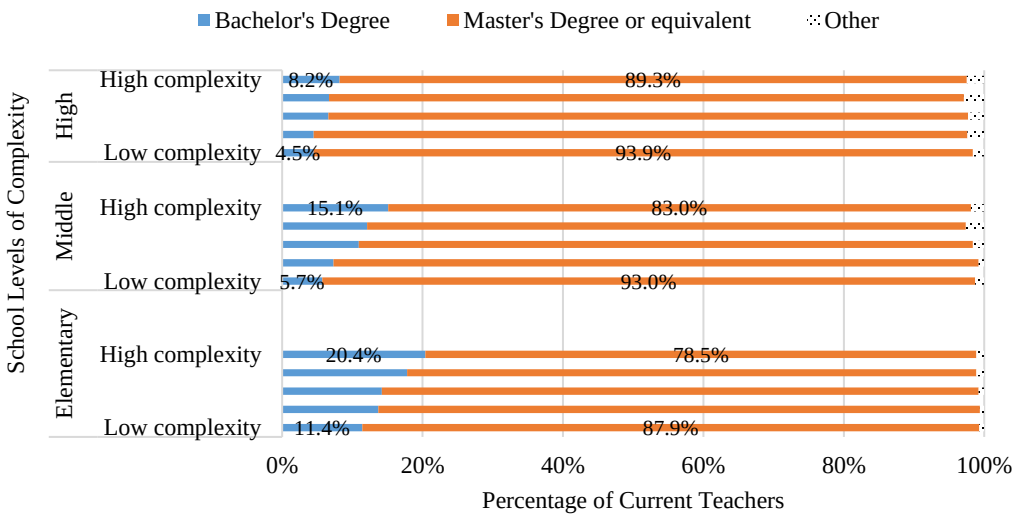

Figure 15. Percentage of highest degree of elementary, middle, and high school teachers by school levels of complexity.

Similar to the findings by school levels of poverty, high-complexity schools have on average more teachers with only bachelor's degree than low-complexity schools, whereas schools with low levels of complexity have more teachers with master's degree compared to high-complexity schools (Figure 15). This relationship is statistically significant at $p < 0.05$ for all school levels in favor of a negative association between school complexity and teachers' education (Appendix B, Table B10). For newly-hired teachers, no significant association between degree and school complexity is observed ($p > 0.05$; Appendix B, Table B10).

Teachers' characteristics by perception of school climate

Appendix B, Table B11, shows the distribution of teachers by different perceptions of school climate. For each of the school levels, Table 11 in Appendix B displays only the extremes of the climate perception distribution (the two lowest and the two highest quintiles).

Perception of school climate and teachers' gender. The distribution of female and male teachers in elementary, middle, and high schools does not vary much across the different perceptions of school climate (Appendix B, Figure B3). This lack of relationship is confirmed by a test of independence where the association between teachers' gender and perception of school climate is not significant ($p > 0.05$; Appendix B, Table B12). The same conclusion was observed when the analysis included only newly-hired teachers ($p > 0.05$; Appendix B, Table B12).

Perception of school climate and teachers' race/ethnicity. Figure 16 shows the proportion of White, Black or African American, and Hispanic/Latino teachers by perception of school climate for each school level.

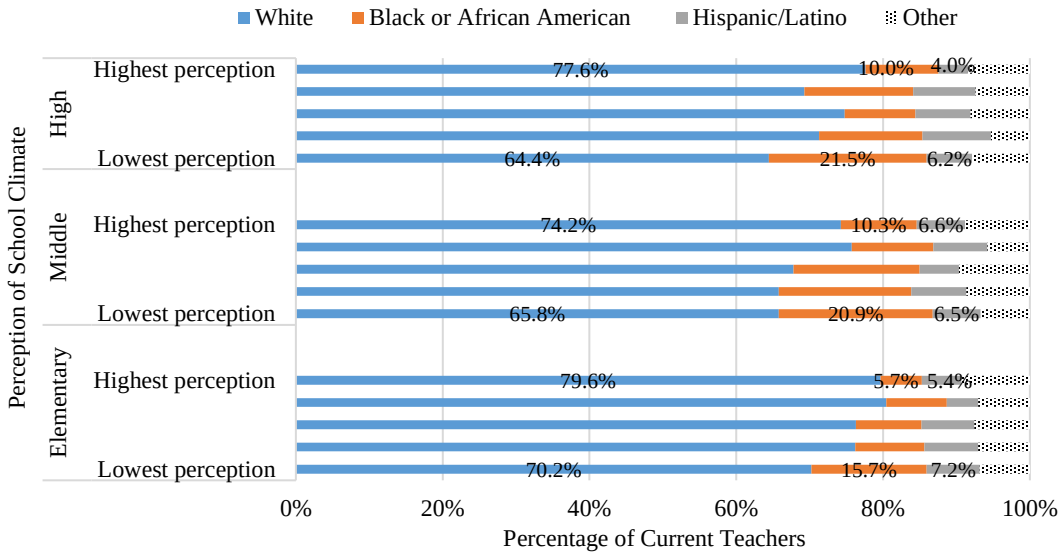

Figure 16. Percentage of White, Black or African American, and Hispanic/Latino teachers by perception of school climate for elementary, middle, and high schools.

According to Figure 16, regardless of the school level, schools with high perception of climate happen to have a greater proportion of teachers with a particular race compared to schools with low perception of climate. Indeed, an analysis of the perception of school climate and the racial/ethnic composition of teaching staff revealed a statistically significant relationship for all school levels ($p < 0.01$; Appendix B, Table B13). For newly-hired teachers, no relationship between teachers' race/ethnicity and perception of school climate was observed for middle and high school levels ($p > 0.05$; Appendix B, Table B13).

Perception of school climate and teachers' experience. Figure 17 displays the years of teaching experience of elementary, middle, and high schools teachers by perception of school climate.

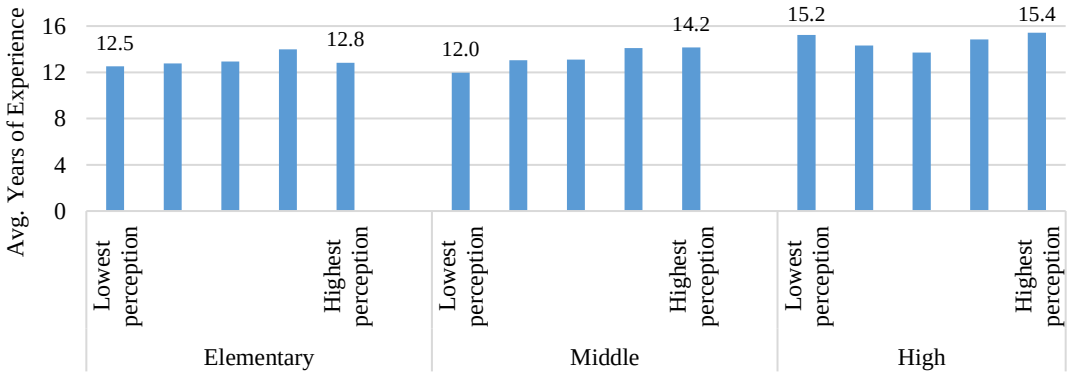

Figure 17. Average years of teaching experience of current elementary, middle, and high school teachers by perception of school climate.

As shown in Figure 17, schools with a better perception of climate tend to have teachers with slightly more years of experience, regardless of the school level. The relationship between experience and perception of school climate for each school level (elementary, middle, and high schools) was statistically significant at $p < 0.05$ (Appendix B, Table B14) in favor of a positive association between school climate perception and teachers' years of experience. For newly-hired teachers, no relationship or association between teachers' years of experience and perception of school climate perception was observed for all school levels ($p > 0.05$; Appendix B, Table B14).

Summary of Research Question 2: Characteristics of current and newly-hired teachers in MCPS by school levels of poverty, complexity, and climate perception

- The gender distribution of MCPS elementary, middle, and high school teachers in the 2018 school year does not differ much across the different school levels of poverty, complexity, or perception of climate. This difference is not significant for all current and newly-hired teachers.
- High-poverty schools in MCPS in FY 2018 have fewer male teachers (15%) compared to the percentage reported nationally (22%), which is consistent with the lower percentage of male teachers in MCPS compared to the U.S.
- There are more Hispanic/Latino and Black or African American teachers in high-poverty elementary, middle, and high schools, compared to low-poverty schools in FY 2018. This difference is significant for current teachers at all levels, and for newly-hired teachers only in elementary schools.
- High-poverty schools in MCPS in FY 2018 report having fewer White teachers (67%) compared to the percentage reported nationally (72%).
- High-poverty schools in MCPS in FY 2018 report having teachers with fewer years of experience than low-poverty schools. The difference is significant for current but not for newly-hired teachers due to dissimilarities across school levels.
- The largest proportion of novice teachers starting in 2017–2018 school year was in high and medium-high complexity schools compared to low or medium-low complexity schools, regardless of the school level.
- Teachers in high-poverty schools in MCPS in FY 2018 tend to have fewer years of experience than the average experience reported nationally.
- High-poverty schools report having fewer teachers with a master's degree or equivalent than their low-poverty counterparts in FY 2018.

- There are more Hispanic/Latino and Black or African American teachers in high-complexity elementary, middle, and high schools compared to low-complexity schools in FY 2018. This difference is significant for current teachers across all school levels but not for newly-hired teachers in middle and high schools.

- Teachers in high-complexity elementary, middle, and high schools tend to have fewer years of experience than teachers in low-complexity schools in FY 2018. This difference is significant for current but not for newly-hired teachers.

- High-complexity schools report having more teachers with only a bachelor's degree than low-complexity schools regardless of the school level in FY 2018. This difference is significant for current teachers, but not for newly-hired teachers.

- A significant association was found between the race/ethnicity of FY 2018 teachers and the perception of school climate for all school levels. In the case of newly-hired teachers, this association is only significant for newly-hired teachers in high schools.

- Teachers in schools where staff perceive school climate more positively tend to have slightly more years of experience than other schools with low perception of climate in FY 2018. This difference is significant for current but not for newly-hired teachers.

Research Question 3. What were the MCPS teaching position vacancies at the start of the school year and did they vary among schools with different characteristics? What does the candidate pool look like?

Teaching position vacancies

To explore teaching position needs and possible hiring challenges, the number and type of positions that were vacant on the first day of school were examined. Figure 18 shows the number of most commonly vacant positions on the first day of school over five years.

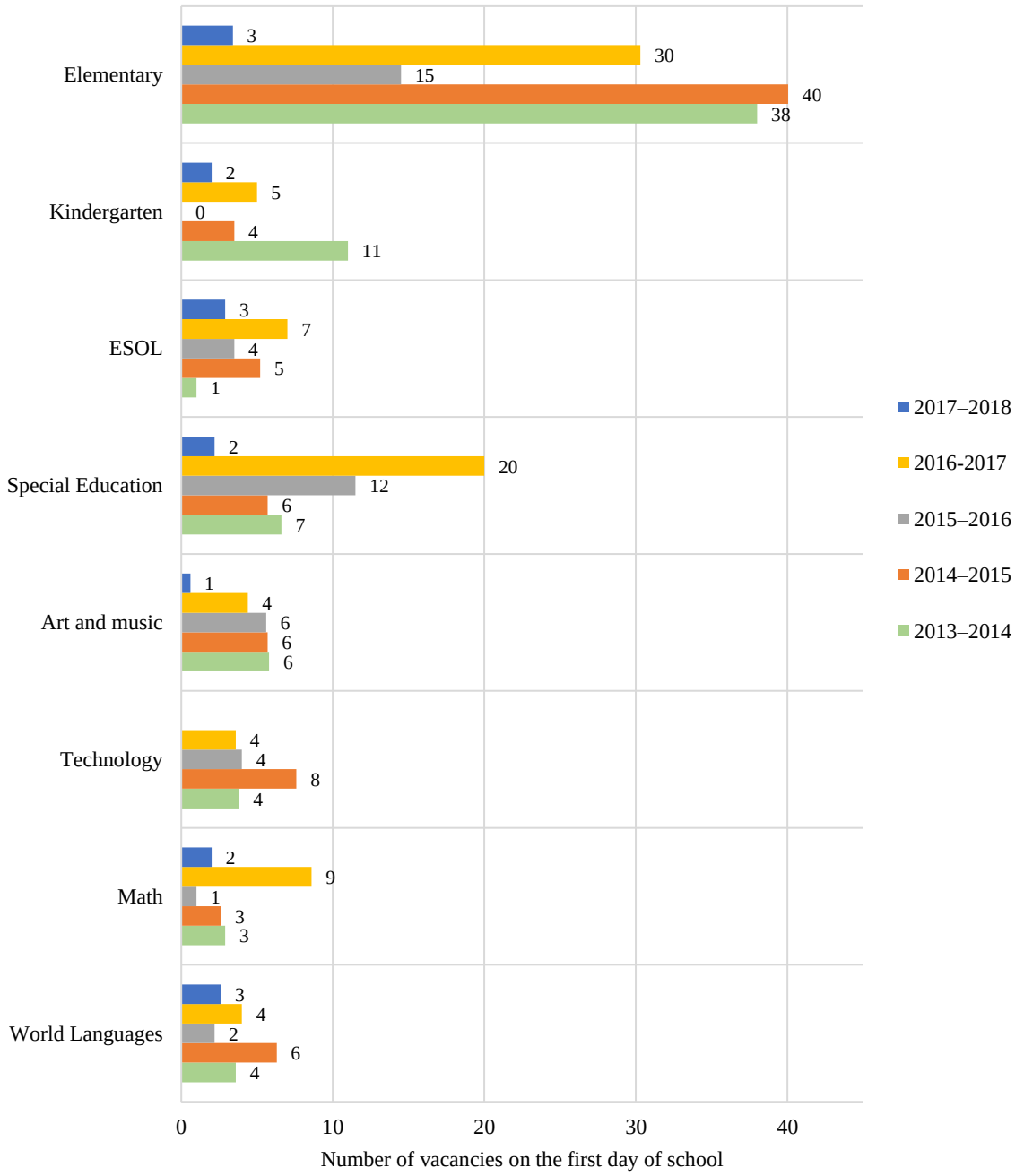

Figure 18. Number of most common teaching position vacancies on the first day of school, FY 2014 to 2018.

The total number of vacancies varied over the five school years, ranging from a low of 20 vacancies (0.2% of all teaching positions) in the 2017–2018 school year to 89 (0.8% of all teaching positions) in the 2016–2017 school year. In each year, the largest number of unfilled positions on the first day of school were elementary teachers; as a category of teachers, elementary teachers also are the largest group reported. The proportion of elementary first-day vacancies, in all years, were less

than or equal to 1% of the number of districtwide elementary classroom teachers. Most other teaching positions that were vacant on the first day of school were in categories of 10 or fewer. An exception was special education teachers; in 2016–2017, 20 special education vacancies (1% of positions) were reported on the first day of school, and in 2015–2016, first-day vacancies of special education teachers were 11.5 (0.6% of positions).

Vacancies in schools with different school-level characteristics. The number of first-day vacancies for kindergarten and elementary classroom teaching positions[3] across the five years was examined in schools with different characteristics to determine whether schools with different levels of poverty, different levels of complexity, or different perceptions of school climate had different numbers of first-day vacancies.

Table 8 shows the number of first-day vacancies occurring over five years in elementary schools at each of the four school levels of poverty. The five-year total and percentage in each poverty level also are shown.

Table 8
Number and Percentage of First-Day Vacancies in Five Years by School Levels of Poverty

	All Elementary Teacher Vacancies 2013–2014 through 2017–2018						
School Levels of Poverty (% FARMS)	2014 *n*	2015 *n*	2016 *n*	2017 *n*	2018 *n*	Total 5 years	% of total
0% – 34%	20	13	12	19	4	68	41.7
35% –49%	5	4	0	4	0	13	8.0
50% – 74%	21	19	5	11	3	59	36.2
75% or more	4	11	0	7	1	23	14.1
Total	50	47	17	41	8	163	100.0

Sixty-eight of the first-day elementary vacancies (42%) across the five years were in schools with FARMS levels of 34% or lower. Within the context of all MCPS elementary teaching positions, 47% are located in schools with the lowest level of FARMS.[4]

Table 9 shows the number of vacancies occurring over five school years in schools at each of five levels of complexity, that is, the aggregated percentage of Black or African American and Hispanic/Latino students, and the percentage of students who ever received FARMS, ESOL, or an IEP. The five-year total and the percentage in each complexity level also are presented in the table.

[3] Only kindergarten and elementary positions were examined in these analysis; numbers of other teaching position vacancies were not large enough to examine by different school groups.
[4] For context, the percentage of elementary teachers in MCPS schools categorized by percent of students receiving services 2018 is: 47% in schools with 0%-34% FARMS; 11% in schools with 35%-49% FARMS; 27% in schools with 50%-74% FARMS; and 16% in schools with 75% or more FARMS.

Table 9
Number and Percentage of First-Day Vacancies in Five Years by School Levels of Complexity

	All Elementary Teacher Vacancies 2013–2014 through 2017–2018						
School Levels of Complexity	2014 *n*	2015 *n*	2016 *n*	2017 *n*	2018 *n*	Total 5 years	% of total
1 Low complexity	8	2	1	6	1	18	11.0
2	8	6	7	7	2	30	18.4
3	6	7	4	10	1	28	17.2
4	17	18	3	8	3	49	30.1
5 High complexity	11	14	2	10	1	38	23.3
Total	50	47	17	41	8	163	100.0

The highest numbers of vacancies across the five years occurred in the two highest complexity groups of schools; schools at the two highest complexity levels had 87, or 53%, of the first-day vacancies over the 5 school years. Within the context of all elementary teaching positions, 46% are located in schools at the two highest complexity levels.[5]

Table 10 shows the number of first-day vacancies occurring over five years in elementary schools at each of the five levels of staff perceptions of school climate. The five-year total and percentage in each level also are shown.

Table 10
Number and Percentage of First-Day Vacancies in Five Years by Perceptions of School Climate

	All Elementary Teacher Vacancies 2013–2014 through 2017–2018						
Staff Perception of School Climate	2014 *n*	2015 *n*	2016 *n*	2017 *n*	2018 *n*	Total 5 years	% of total
5 Highest perception	13	10	2	8	3	36	22.1
4	5	10	2	4	1	22	13.5
3	8	8	6	11	2	35	21.5
2	10	5	3	9	1	28	17.2
1 Lowest perception	14	14	4	9	1	42	25.8
Total	50	47	17	41	8	163	100.0

Examining first-day vacancies for schools with different levels of staff climate perceptions revealed that the largest number of vacancies (42, or 26%) occurred in the quintile of schools with

[5] For context, the percentage of teachers in MCPS elementary schools categorized by levels of complexity in 2018 is: 25% in schools with highest complexity; 21% in schools with moderate-high complexity; 20% in schools with moderate complexity; 19% in schools with moderate-low complexity; and 14% in schools with low complexity.

the lowest perceptions of climate. Among all elementary teaching positions, 21%[6] are located in that group of schools with the lowest climate perceptions.

Potential sources of new teachers in MCPS

In the 2018 school year, around 45% of all the education institutions where new MCPS teachers reported having a degree from or attended are Maryland colleges and universities (Figure 4 in Question 1). Among states neighboring Maryland, Pennsylvania graduates the highest number of teachers from its teaching preparation programs (U.S. Department of Education, 2017). Indeed, Pennsylvania has more than five times the number of teacher preparation programs as Maryland (1,434 in Pennsylvania compared with 239 in Maryland in 2016).[7] Table 11 shows enrollment and completion of teaching preparation programs in Maryland and Pennsylvania, and the number of education bachelor's degrees and master's degrees in the U.S.

Table 11
Teacher Preparation Program Enrollment and Completion in Maryland and Pennsylvania, and Number of U.S. Bachelor's and Master's Degrees in Education

		2011–12	2012–13	2013–14	2014–15	2015–16
Maryland	*N* enrolled	9,134	8,093	6,436	5,490	5,184
	N completed	2,999	2,784	2,687	2,618	2,592
Pennsylvania	*N* enrolled	35,144	23,546	18,630	15,124	14,387
	N completed	11,880	10,372	8,555	6,979	6,375
U.S.	Bachelor's degrees in education	105,656	104,698	98,838	91,596	87,217
U.S.	Master's degrees in education	179,047	164,652	154,636	147,000	145,781

Declining numbers of students enrolling in teacher preparation programs across the U.S. have been widely reported (Hanover, 2017; Janulis, 2017), and indeed, the number of students enrolled in teacher preparation programs in Maryland and Pennsylvania has decreased over the five years examined (Table 11). In Maryland, enrollment decreased by 43% and in Pennsylvania enrollment decreased by 59%. Completion of education programs, however, showed a greater decline in Pennsylvania than in Maryland during the five years examined; the number completing teacher preparation programs in Pennsylvania declined by 46%; the number completing programs in Maryland declined by 14%. The number of U.S. bachelor's degrees in education declined by 17%

[6] For context, the percentage of teachers in MCPS elementary schools categorized by levels of staff climate perceptions in 2018 is: 18% in schools with highest perceptions; 18% in schools with moderate-high perceptions; 21% in schools with moderate perceptions; 22% in schools with moderate-low perceptions; and 21% in schools with lowest perceptions.

[7] Teacher preparation programs include both traditional programs (typically four-year undergraduate programs) and alternative programs (often designed for individuals who already hold a bachelor's degree in a specific content area). In 2013–2014, 89% of those enrolled in teacher preparation programs were in traditional programs (U.S. Dept. of Education, 2015).

during the same five years. Similar trends are observed in the number of master's degrees conferred in education in the U.S., which was reported at 145,781 in 2016, down from 179,047 in 2012, a decline of 19%.

Colleges producing the most teachers in Maryland. In 2015–2016, more than half (*N* = 1,460) of the teachers who completed their preparation in Maryland came from four schools, as shown in Table 12.

Table 12
Maryland Colleges that Prepare the Largest Numbers of Teachers, 2015–2016

College	Number of completers (*N* = 2,592)	Percent of Maryland completers (*N* = 2,592)
Towson University	603	23%
University of Maryland, College Park	330	13%
Notre Dame of Maryland University	287	11%
Salisbury	240	9%
Other 18 Maryland Colleges	1,132	44%

The two Maryland colleges that graduated the largest numbers of teachers—Towson University and University of Maryland, College Park—also were the colleges named by the largest number of teachers who were newly-hired in MCPS in the 2018 school year.

Summary of Research Question 3: MCPS teaching position vacancies and potential sources of new teachers

- The total number of first-day vacancies decreased from 89 (0.8% of all teaching positions) in the 2016–2017 school year to 20 (0.2% of all teaching positions) in the 2017–2018 school year.
- The percentage of elementary teacher vacancies in schools with high levels of poverty (>50% FARMS) does not differ much from their representation in the population of elementary teachers; a similar conclusion was observed in high-complexity schools.
- The number of college students enrolled in teacher preparation programs in Maryland has decreased from FY 2012 to 2016 by 43% but completion of education programs during those years declined by 14%.
- The number of U.S. bachelor's degrees in education declined by 17% from FY 2012 to 2016, and similar trends are observed in the number of master's degrees conferred in education in the U.S. (19% decline).

Research Question 4: What is the teacher attrition rate in MCPS and does it differ by teacher and school characteristics?

Teacher turnover in MCPS

Figure 19 shows the teacher turnover rate in MCPS from FY 2014 to 2017. The turnover rate includes resignations and terminations, retirements, promotions, and transfers.

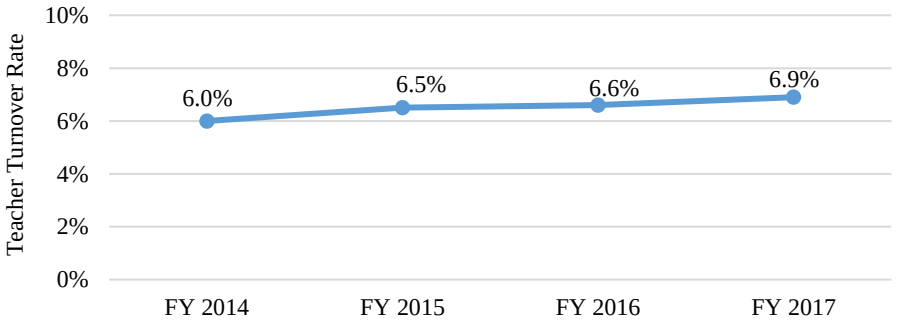

Figure 19. MCPS teacher turnover rate from FY 2014 to 2017

Note. Data provided by the Staff Statistical Report, ERSC, 2018 (Section 9).

In the FY 2017, 6.9% of teachers (903 teachers) left the MCPS teacher workforce, which is an increase of 0.9 percentage points compared to 2014 (Figure 19). This increase is mostly explained by the rise in the number of teachers' resignations and terminations over the last four years, as Figure 20 shows below.

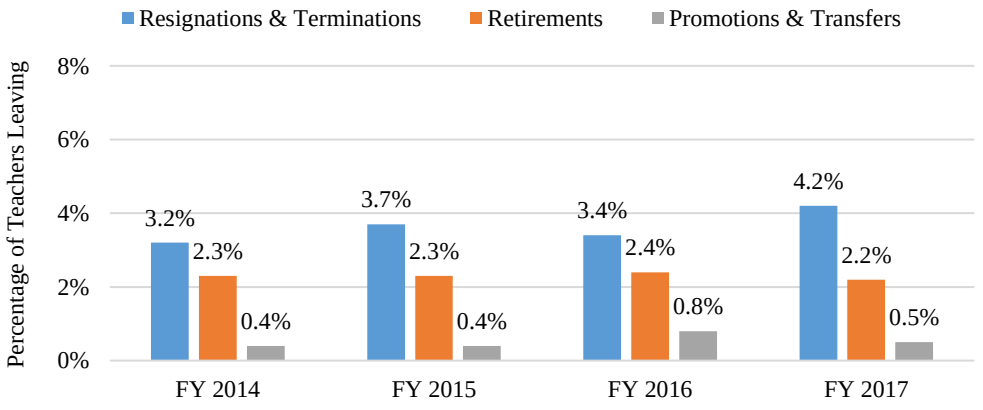

Figure 20. Composition of the MCPS Teacher turnover rate by resignations/terminations, retirements, and promotions and transfers from 2014 to 2017

Note. Data provided by the Staff Statistical Report, ERSC, 2018 (Section 9).

Teacher retention in MCPS

On average, 71.8% of teachers joining the MCPS teacher workforce stay at least five years. Figure 21 shows the percentage of teachers who have stayed as teachers in MCPS during the next five years after they are hired. For example, among the teachers who started in the 2012 school year, 70.0% of them remained as teachers as of 2017.

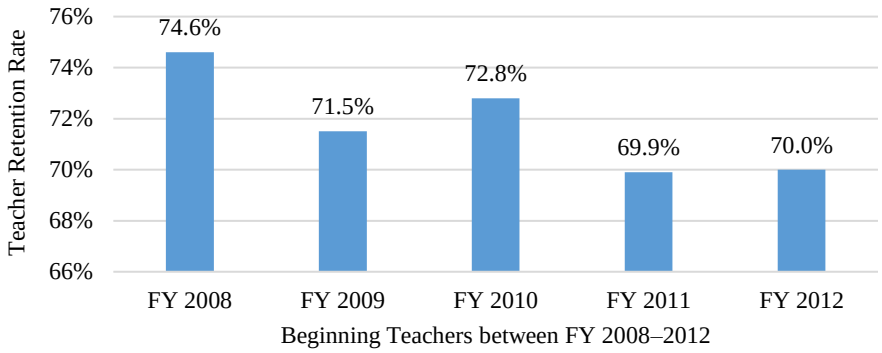

Figure 21. Percentage of beginning teachers between FY 2008–2012 staying as teachers in MCPS during the next 5 years after they are hired

Note. Data provided by the Staff Statistical Report, ERSC, 2018 (Section 9).

The percentage of teachers leaving MCPS after four years is higher than the percentage reported nationally. Table 13 below compares this percentage in MCPS with the one reported in the U.S. for teachers who started in the 2008 school year. In the case of MCPS, around 24% of those teachers left MCPS by 2012 (four years after starting), whereas the percentage of teachers across the U.S. who started in 2008 and left by 2012 was 17% (Table 13).

Table 13
Percentage of FY 2008 Beginning Teachers Leaving MCPS in the Following Four Years Compared with U.S. Rates

	MCPS	**U.S.**
	%	%
FY 2009	13.4	10.0
FY 2010	3.5	2.3
FY 2011	3.8	2.5
FY 2012	3.1	2.5
Total	**23.8**	**17.3**

Note: MCPS data was provided by the Staff Statistical Report, ERSC, 2018 (Section 9).

Teacher attrition in MCPS

Teacher attrition in MCPS—defined as resignations and terminations—is lower than the attrition reported by the state of Maryland. According to the attrition data published by the MSDE, on average, teacher attrition in Maryland is 2.8 percentage points higher than the teacher attrition reported in MCPS over the last five years, as Figure 22 shows below.

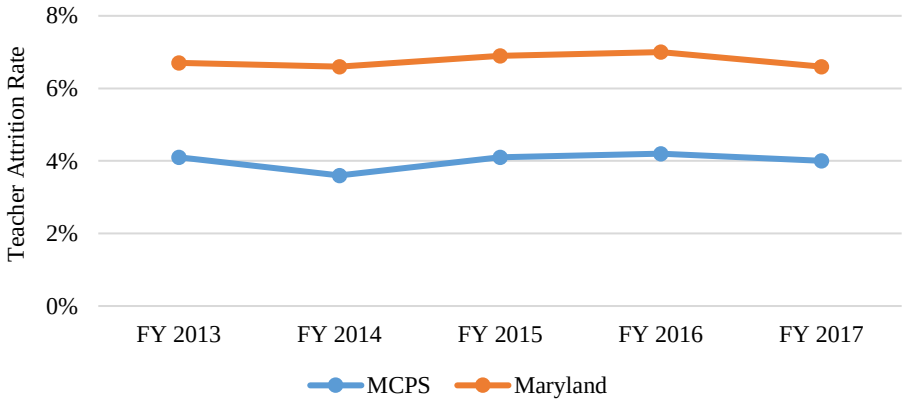

Figure 22. Teacher attrition rate of MCPS and Maryland from 2013 to 2017

Teacher attrition and teachers' characteristics. This report examines whether resignations and terminations in previous years were systematically associated with any teacher or school characteristics. Teachers' data regarding resignations and terminations only include teachers who have left MCPS, and do not include teachers who change schools or school level. Teachers' mobility will be addressed in a future report.

Teacher attrition and teachers' gender and race/ethnicity. The number of teachers' resignations and terminations in MCPS does not differ much by teacher's gender or race/ethnicity. The gender and racial/ethnic makeup of teachers' resignations and terminations are similar to the overall gender and racial/ethnic distribution of teachers in MCPS.[8] Further, the rates of resignation and terminations by gender and race/ethnicity have not changed drastically over the three years of analysis.[9]

[8] Based on 2015–2017 data only. See Appendix C1 for details about the results of tests of significance, and the comparison between gender and race/ethnicity distribution of teachers' resignations/terminations and overall gender and race/ethnicity distribution of teacher in MCPS.

[9] Based on 2015–2017 data only. See Appendix C2 for details about the resignation/termination rate of teachers by gender and race/ethnicity.

Teacher attrition and teachers' experience in MCPS. Figure 23 shows the level of attrition by teachers' years of experience[10] in MCPS, where the largest number of teachers who left MCPS in the last five years have had between one and five years of teaching experience.

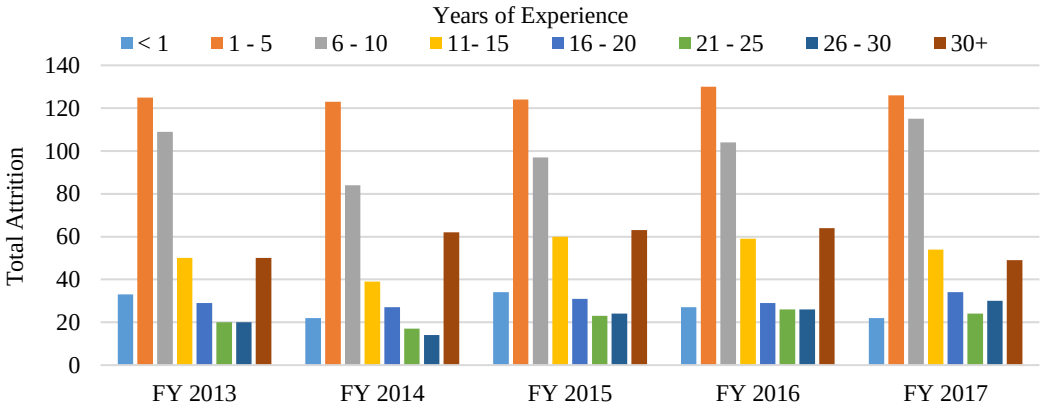

Figure 23. Teacher attrition by years of experience in MCPS from 2013 to 2017

Note: Data provided by the Maryland State Department of Education (MSDE).

When MCPS teacher attrition is compared to Maryland data, MCPS teacher attrition is lower regardless of the years of experience in the local school system. Figure 24 displays how the attrition rate in MCPS is lower than the state attrition rate, especially for teachers who have less than 10 years of experience.

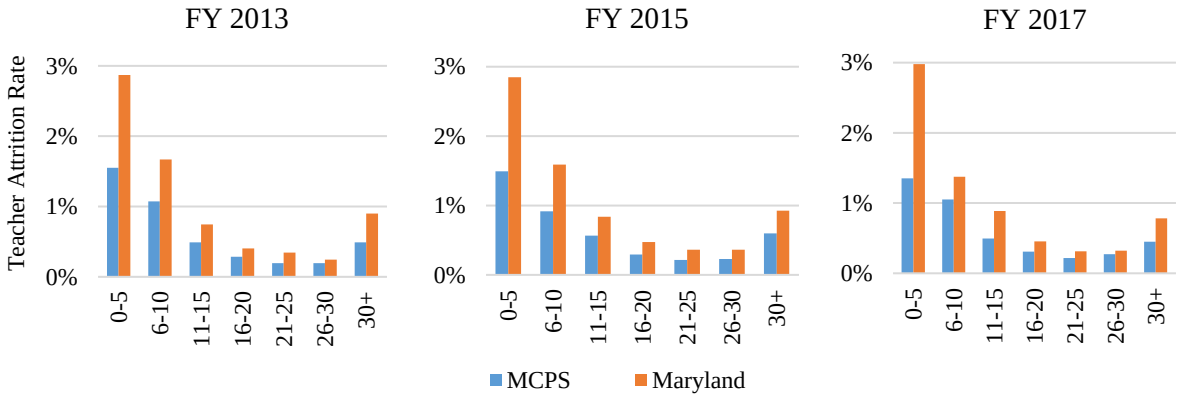

Figure 24. MCPS and Maryland Teacher attrition rate by years of experience in the local school system for FY 2013, 2015, and 2017

Note: Data provided by the Maryland State Department of Education (MSDE).

[10] For this purpose, MSDE defines "years of experience" as the number of years that teachers have taught at the point of leaving their teaching positions. Teacher attrition by years of experience reported by MSDE is not specific about the components included in the attrition calculation (resignations, terminations, retirement, transfers, etc.). However, this report assumes it refers to teachers' resignations and terminations only since the attrition rates reported by MSDE are very similar to MCPS teachers' resignations and terminations reported before (Figure 20 above).

Teacher attrition and schools' characteristics. The rate of teachers' resignations and terminations show a different pattern depending on schools' characteristics.[11]

Teacher attrition and school levels of poverty. The rate of resignations and terminations in schools with high levels of poverty has been different depending on the school level. Figure 25 displays how the rate of teachers' resignations and terminations in elementary schools with high and low levels of poverty has changed from FY 2008 to 2017.[12]

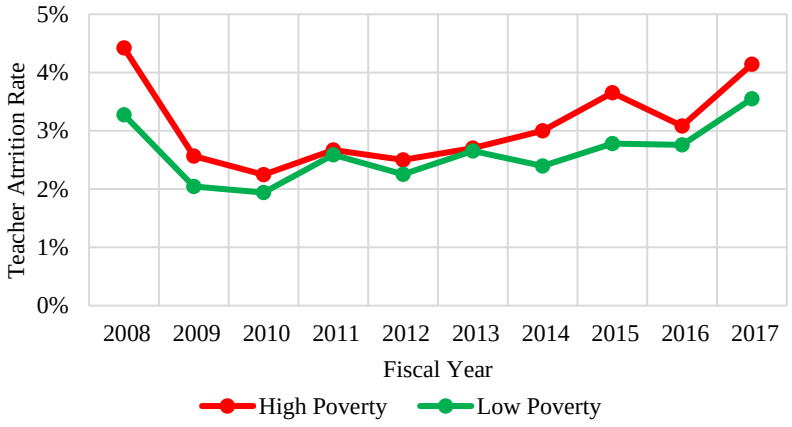

Figure 25. Rate of MCPS teachers' resignations and terminations in elementary schools with low and high levels of poverty

Elementary schools with high levels of poverty had a higher rate of teachers' resignations and terminations over the last 10 years compared to elementary schools with low levels of poverty.[13] Although there was a decrease from FY 2008 to 2010 and this rate was almost the same for all elementary schools between FY 2011 and 2013, an upward trend is observed since FY 2013 (Figure 25).

For middle schools, not only was the rate of teachers' resignations and terminations higher in high-poverty schools over the last 10 years, the gap between schools with high and low levels of poverty has become wider on average, reaching a peak difference of 5.4 percentage points in FY 2017 (Figure 26).[14]

[11] The rate of teachers' resignations and terminations is defined by the number of teachers who resigned or were terminated over the total number of teachers. Since the total number of teachers per school for previous years was not available, Full-time Equivalent teachers reported in *Schools at a Glance* was used as an approximate number instead.
[12] Classification of schools in levels of poverty is based on 2018 school data and an equal number of schools is included in the low and high-poverty categories. This information was used for the 10-year analysis for simplification and it assumes a minimal variation of schools between these two levels across years.
[13] 67 elementary schools are high-poverty schools and 66 are low-poverty schools.
[14] 20 middle schools are high and low-poverty schools.

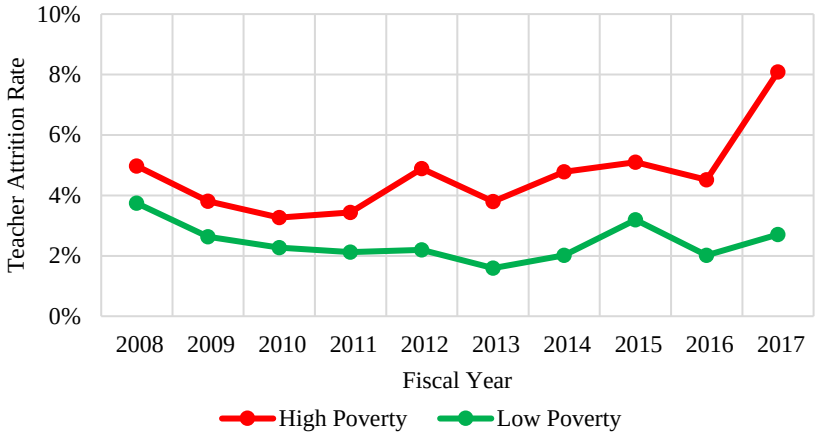

Figure 26. Rate of teachers' resignations and terminations in middle schools with low and high levels of poverty

In the case of high schools, the rate of teachers' resignations and terminations in schools with a higher percentage of students receiving FARMS services is higher across each of the 10 years of analysis, except in FY 2017 when the rates are the same (Figure 27).[15]

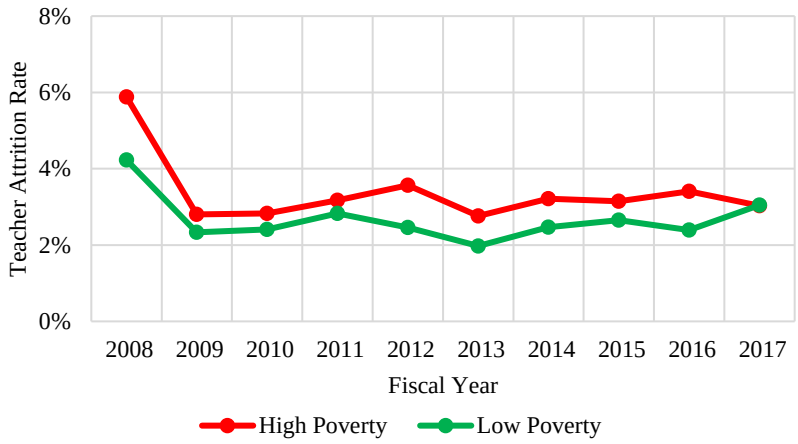

Figure 27. Rate of teachers' resignations and terminations in high schools with low and high levels of poverty

Teacher attrition and school levels of complexity. Similar to the previous analysis based on school poverty, the rate of teachers' resignations and terminations differs depending on the school level.[16]

[15] 13 high schools are high-poverty schools and 12 are low-poverty schools.

[16] For the analysis of attrition and school levels of complexity, schools with high levels of complexity refer to schools in the top 2 quartiles of the school complexity distribution (quartiles 4 & 5), and schools with low levels of complexity in the bottom 2 quartiles (quartiles 1 & 2). The number of schools with high and low levels of complexity are the same. Complexity index is based on 2018 school data, but it is used for the ten-year analysis for simplification. It assumes a minimal variation of schools between these two levels across years.

The rate of teachers' resignations and terminations has been higher in high-complexity elementary schools compared to low-complexity elementary schools. The gap trend differs over time; the difference between teachers' resignations and terminations in elementary schools with high and low levels of complexity has decreased between FY 2008 and 2012 but increased from FY 2013 to 2017 (Figure 28 below).

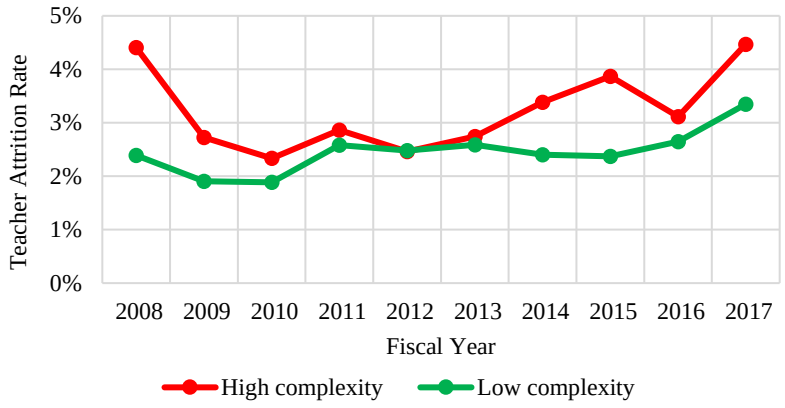

Figure 28. Rate of teachers' resignations and terminations in elementary schools with low and high levels of complexity

The rate of teachers' resignations and terminations has been higher in high-complexity middle and high schools over the last ten years and the gap between high and low-complexity schools has become wider over time in middle schools (Figure 29 and 30).

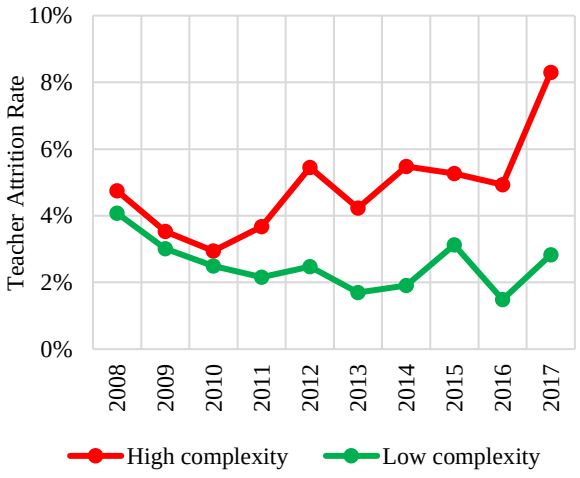

Figure 29. Rate of teachers' resignations and terminations in middle schools with low and high levels of complexity.

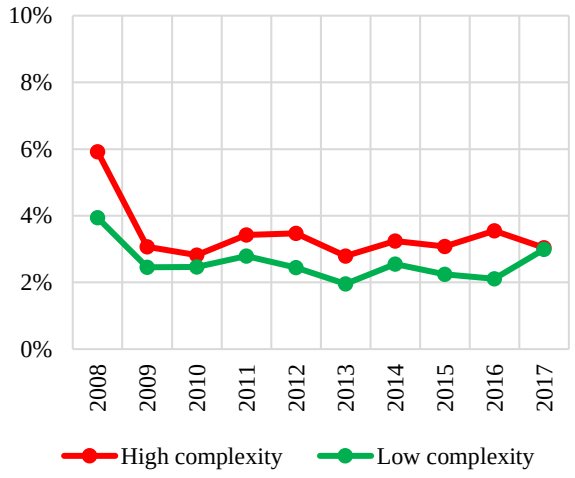

Figure 30. Rate of teachers' resignations and terminations in high schools with low and high levels of complexity.

Teacher attrition and perception of school climate. The difference of teachers' resignations and terminations between schools with low perception and high perception of climate is more visible in middle and high schools than in elementary schools for the last 10 years of analysis.[17]

Among the elementary schools with low and high perception of climate, the rate of teachers' resignations and terminations was very similar during the last 10 years, except for FY 2014 and 2015 when the rate of teachers' resignations and terminations in schools with low perception of climate was higher by 0.9 percentage points (Figure 31 below).

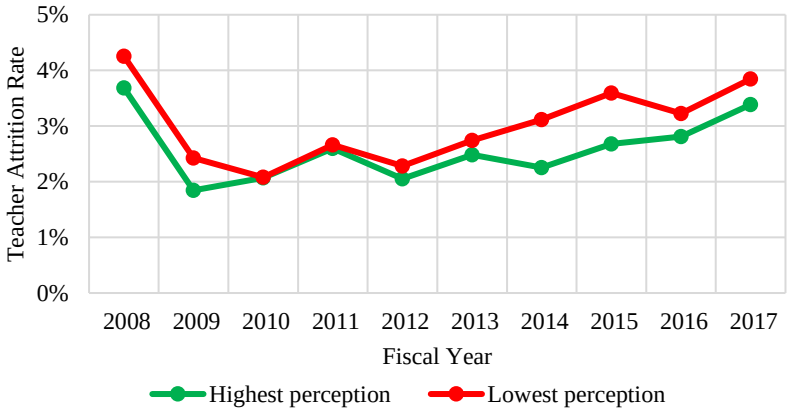

Figure 31. Rate of teachers' resignations and terminations in elementary schools with low and high perception of school climate.

For most of the 10 years analyzed, the rate of teachers' resignations and terminations has been higher in middle and high schools with low perception of school climate (Figure 32 and 33).

[17] For the analysis of attrition and perception of school climate, schools with the highest perception of school climate refer to schools that fall under the top 2 quartiles of the school climate perception distribution (quartiles 4 & 5), and schools with the lowest perception of school climate refer to schools in the bottom 2 quartiles of the school climate perception distribution (quartiles 1 & 2). For all school levels, the number of schools with the highest and lowest perceptions are the same. The ranking of the perception of school climate is based on the 2017 Staff Climate Survey (MCPS, 2017b), and it was used for the ten-year analysis for simplification. It assumes a minimal variation of schools between these two levels across years.

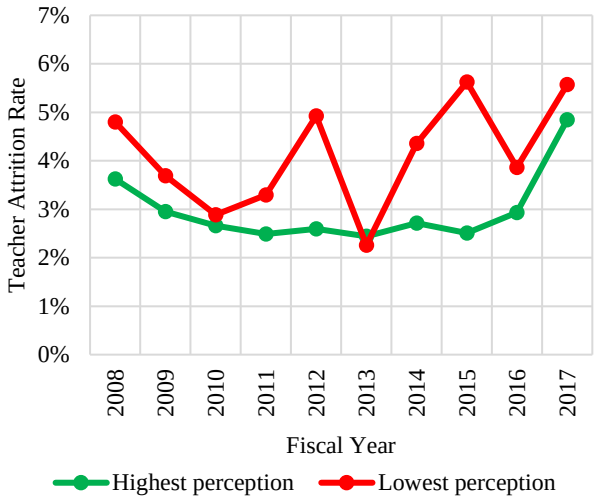

Figure 32. Rate of teachers' resignations and terminations in middle schools with low and high perception of school climate.

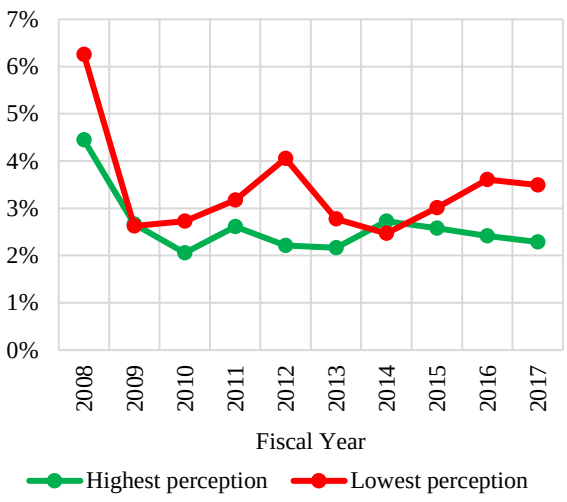

Figure 33. Rate of teachers' resignations and terminations in high schools with low and high perception of school climate.

Retirement Eligibility of MCPS teachers

Figure 34 shows the number of teachers who are eligible to retire in the next 10 years. The number of teachers for FY 2018 is higher than the following years because it includes teachers who become eligible to retire in the 2018 school year plus the number of teachers who were eligible to retire in previous years. Excluding FY 2018, around 2.2% of teachers become eligible to retire every year on average.

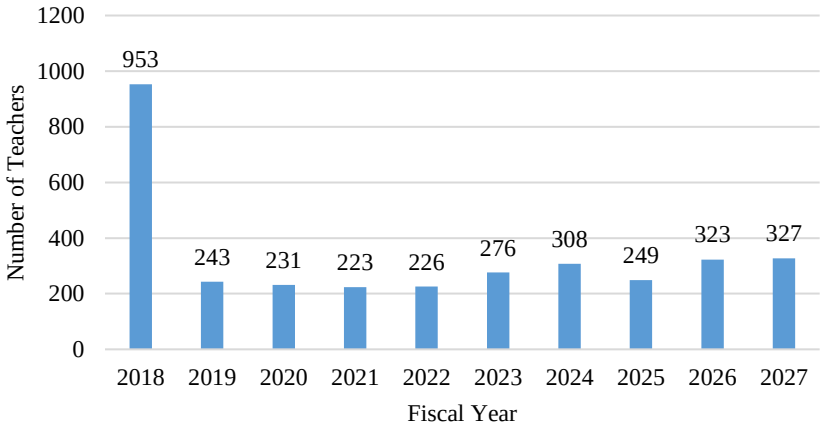

Figure 34. Number of MCPS teachers eligible to retire in the next 10 years.

Retirements and school level. The percentage of teachers who will be eligible for retirement in the next 10 years is slightly higher in high schools compared to elementary and middle schools, as Figure 35 shows below.

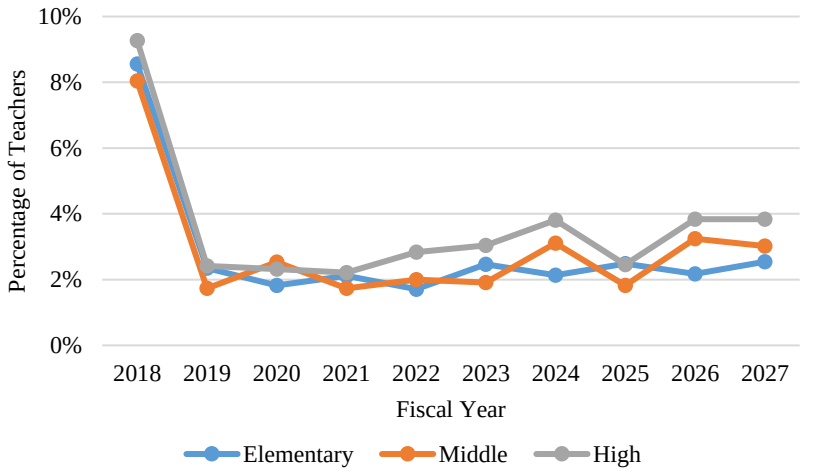

Figure 35. Percentage of teachers eligible to retire in elementary, middle, and high schools, FY 2018–2027.

In each of the examined years, except for FY 2018, which includes teachers who are eligible for retirement but are still teaching, the percentage of elementary, middle, and high school teachers who are eligible to retire is between two and four percent.

Summary of Research Question 4: Teacher attrition in MCPS by teacher and school characteristics

- Teacher turnover rate in MCPS increased from 6.0% in 2014 to 6.9% in 2017.
- The increase in the teacher turnover rate in MCPS is mainly explained by the rise in the number of teachers' resignation and terminations from 3.2% in 2014 to 4.2% in 2017. Retirements, promotions, and transfers remained relatively steady from 2014 to 2017.
- On average, 72% of teachers who join MCPS stay employed as teachers for at least five years. The retention rate in MCPS is higher than Maryland but lower than the rate reported nationally.
- Teachers' resignations and terminations do not differ by teacher's gender or race/ethnicity, and the level of resignations and terminations by teachers' gender or race/ethnicity has not fluctuated much over the last 10 years.

- A large portion of teachers who left MCPS due to resignations or terminations in the last 10 years were in their late 20s or early 30s and had between 1 and 5 years of experience in MCPS.
- Teacher attrition in MCPS is lower than the teacher attrition rate in Maryland for FY 2013, 2015 and 2017, especially for teachers who have less than 10 years of experience.
- Across the last 10 years of analysis, schools with high levels of poverty, complexity, or with a low perception of climate experience a higher number of teachers' resignations and terminations compared to schools with low levels of poverty, complexity, or with a high perception of climate.
- On average, 2.2% of teachers become eligible to retire every year; however, not every eligible teacher decides to do so. More than two-thirds of teachers reported by the ERSC to be eligible to retire in 2018 were eligible to retire in previous years.
- The percentage of teachers eligible to retire in the next 10 years does not differ much by school level; this percentage fluctuates from 2% to 4% and the percentage of high school teachers to be eligible to retire is slightly higher than elementary and middle school teachers.

Discussion

Who are MCPS teachers? Findings for this report demonstrate that the teaching staff in MCPS is highly educated and experienced. Compared with teachers across Maryland and the U.S., MCPS teachers are more likely to hold a master's degree or equivalent. MCPS teachers have more years of experience on average than teachers across Maryland. The demographic makeup of MCPS teachers is similar, overall, to teaching staff in Maryland and the U.S., although the percentage of African American teachers in MCPS is higher than in the U.S. and lower than in Maryland.

Staff diversity. The racial/ethnic makeup of the MCPS teaching staff is strikingly different from the racial/ethnic composition of the student population (see Figure 1), a difference observed in many districts across the U.S. Examining the racial/ethnic composition of the teaching staff over a number of years, and examining the racial/ethnic composition of the newly-hired teachers provides some evidence that the MCPS teaching staff is making gains in racial/ethnic diversity. However, at the rate of progress observed, combined with the demographic trends in the student population, building a teaching staff that is similar to the students they teach requires intentional efforts to address the imbalance. MCPS has strived to promote the recruitment, support, and retention of a diverse teaching staff. The Teacher Workforce Diversity Strategic Plan (MCPS, 2014) outlines a series of initiatives aimed at attracting highly effective teachers with diverse backgrounds and expanding support networks and mentoring within schools and across the district. The plan also seeks to increase opportunities for promising talent among the ranks of MCPS

paraeducators and support services staff to pursue teaching certification, and to develop a teaching career pathway for MCPS high school students, focusing on students with backgrounds and experiences that have been underrepresented in the MCPS teacher workforce.

An effort developed locally to support a diverse teaching staff is the BOND Project, which was founded in 2013 when a group of educators in MCPS saw the need to connect and support male educators of color. The BOND Project, which stands for Building Our Network of Diversity, is focused on the recruitment, retention, and development of male educators of color. The project's work includes the BOND Academy and ongoing efforts to support staff diversity in MCPS (MCPS, 2017).

Teacher shortage? This study found little evidence of a teacher shortage in MCPS. The rate of vacancies at the start of the last five school years has been under 1% of the teaching staff, and the start of the 2017–2018 school year saw only 20 teacher vacancies, or 0.2% of teacher positions. Even positions that have been reported elsewhere (NCTQ, 2017; Cowan, 2016) as harder to fill, such as ESOL and special education teachers, have had beginning-of-the-year vacancy rates of 1% or lower.

Declining enrollment in teacher preparation programs nationally and in the state of Maryland also has been a concern, with fears that it will contribute to a teacher shortage. Enrollment in Maryland teacher programs has decreased by 46% over five years, but *completion* of teacher preparation programs in Maryland has declined 16%; completion of bachelor's programs in teaching has declined 17% nationally. Prior to that, the number of graduates from education programs had held steady since approximately 1980.

An increasing number of retirements, too, has been suggested as a factor in a teacher shortage nationally. In MCPS, the number and percentage of teachers who retired has been steady over the last five years, and, except for the bubble of teachers eligible for retirement from previous years, the projected rate holds steady for the next five years, at between two and three percent. Ingersoll, Merrill, and Stuckey (2014) submit that nationally, the surge of retirements among veteran teachers has reached its end.

There appeared to be slightly more unfilled teacher positions at the start of the school year in elementary schools with high levels of poverty or complexity. Further, rates of resignation or termination are slightly higher in schools with high levels of poverty and complexity, and the average number of years of teaching experience is lower in high-poverty and high-complexity schools at all levels. Teacher movement among schools, particularly moving out of high-complexity schools to other MCPS schools, likely contributes, along with higher turnover, to the difference in teachers' years of teaching experience. Movement between schools will be analyzed in a second report on teacher staffing.

Overall, MCPS is meeting district needs for a well-qualified teaching staff. Projected changes in student populations, needs for support, and increased achievement goals, however, necessitate close monitoring of staffing to ensure that each school is staffed with the best possible assemblage of teachers. The critical importance of a diverse teaching staff has been well-established by research (Gershenson, Holt, & Papageorge, 2016; Gershenson et al., 2017).

Finally, since teacher turnover is costly to school budgets, and more importantly, to student learning, it is critical to address it from all fronts. Providing needed supports for new teachers can strengthen their development as educators and may improve retention (Ingersoll & Smith, 2004). The most effective supports for new teachers include mentoring, coaching, and feedback from experienced teachers; opportunities to observe expert teachers; extended professional learning opportunities; and reduced workloads and extra classroom assistance (Ingersoll and Strong, 2011). And to better inform efforts to retain teachers, it is important to understand why they leave. The Learning Policy Institute (2016) reports that exit surveys can be a "high-leverage" recruitment and retention strategy; indeed, exit surveys or interviews may provide MCPS with information that can help build systems to better develop and support its teachers.

References

Boser, U. (2014). *Teacher diversity revisited.* Washington, D.C.: Center for American Progress. Retrieved from https://www.americanprogress.org/issues/race/reports/2014/05/04/88962/teacher-diversity-revisited/.

Carver-Thomas, D. & Darling-Hammond, L. (2017). Teacher turnover: Why it matters and what we can do about it. Palo Alto, CA: Learning Policy Institute.

Cowan, J., Goldhaber, D., Hayes, K., & Theobald, R. (2016). Missing elements in the discussion of teacher shortages. *CALDER Explainer,* November 11, 2016, National Center for Analysis of Longitudinal Data in Education Research. Retrieved from https://caldercenter.org/missing-elements-discussion-teacher-shortages.

Council of Chief State School Officers. (2017). State Action: Strategies for Building the Teacher Pipeline. Retrieved from http://ccsso.org.

Dee, T. (2005). A teacher like me: Does race, ethnicity, or gender matter? *American Economic Review,* 95 (*2*), 158-165.

Egalite, A. J., & Kisida, B. (2016). The many ways teacher diversity may benefit students. Brookings Institution: Brown Center Chalkboard, August 19, 2016.

Gershenson, S., Hart, C. M. D., Lindsay, C. A., & Papageorge, N. W. (2017). The long-run impacts of same-race teachers. Discussion paper series, No. 10630, IZA Institute of Labor Economics.

Gershenson, S., Holt, S. B., Papageorge, N. (2016). Who believes in me? The effect of student-teacher demographic match on teacher expectations. *Economics of Education Review,* 52, 209-224.

Hanover Research (2017). Attraction, recruitment, and retention of educators. Arlington, Virginia: Hanover Research, February 2017.

Ingersoll, R. (2016). *Ed-Talk: Is There Really a Teacher Shortage?* [Video file]. Retrieved from http://www.aera100.net/richard-ingersoll.html?platform=hootsuite

Ingersoll, R. (2016). Research Fact Sheet. The National Teacher Shortage: Sources and Solutions. AERA Knowledge Forum 2016. Retrieved from http://www.aera.net/Portals/38/docs/Annual_Meeting/2016%20Annual%20Meeting/2016%20Knowledge%20Forum/Ingersoll.pdf

Ingersoll, R., Merrill, L., & Stuckey, D. (2014). Seven trends: the transformation of the teaching force, updated April 2014. CPRE Report (#RR-80). Philadelphia: Consortium for Policy Research in Education, University of Pennsylvania.

Ingersoll, R., and Smith T. (2004). Do Teacher Induction and Mentoring Matter? *NAASP Bulletin* 88, no. 638: 28–40.

Ingersoll, R., and Strong M. (2011). The Impact of Induction and Mentoring Programs for Beginning Teachers: A Critical Review of the Research. *Review of Educational Research 81*, no. 2 (2011): 201–233.

Janulis, E. (2017). Is there a teacher shortage in Maryland? Examining trends in supply and demand. College Park, MD: Maryland Equity Project, The University of Maryland.

Learning Policy Institute (2017). What's the Cost of Teacher Turnover? Retrieved from https://learningpolicyinstitute.org/product/the-cost-of-teacher-turnover

Malkus, N., Mulvaney Hoyer, K., Sparks, D. (2015). Teaching vacancies and difficult-to-staff teaching positions in public schools. *Stats in Brief*, 2015–065. NCES, U.S. Department of Education.

Maryland State Department of Education (2016). Maryland Teacher Staffing Report 2016-2018. Retrieved from http://www.marylandpublicschools.org/about/Documents/DEE/ProgramApproval/MarylandTeacherStaffingReport20162018.pdf

Maryland State Department of Education (2017). Professional Staff by Assignment, Race/Ethnicity and Gender, Maryland Public Schools. Retrieved from http://www.marylandpublicschools.org/about/Documents/DCAA/SSP/20172018Staff/2018_Prof_Staff_by_Race.pdf

Maryland State Department of Education (2018). P-12 Longitudinal Data System Dashboards. Retrieved from https://wcp.k12lds.memsdc.org/public

Montgomery County Public Schools. (2014). Teacher Workforce Diversity Strategic Plan. Memorandum to the Members of the Board of Education, December 9, 2014.

Montgomery County Public Schools. (2017a). Policy ACA, Board of Education of Montgomery County: *Nondiscrimination, Equity, and Cultural Proficiency*. Retrieved from http://www.montgomeryschoolsmd.org/departments/policy/pdf/aca.pdf.

Montgomery County Public Schools. (2017b). 2016-2017 School Survey Results. Retrieved from http://sharedaccountability.mcpsmd.org/SurveyResults/content.php

Montgomery County Public Schools. (2017c). MCPS Bulletin: *BOND Project Holds Inaugural Summit on Workforce Diversity*. Retrieved from https://news.montgomeryschoolsmd.org/staff-bulletin/bond-project-holds-inaugural-summit-on-workforce-diversity/

National Council on Teacher Quality. (2017). *NCTQ Questions "National Teacher Shortage" Narrative, Releases Facts to Set the Record Straight*. [Press Release]. Retrieved from https://www.nctq.org/dmsView/Teacher_Shortage_Fact_Sheet

Partee, G.L. (2014). Retaining Teachers of Color in Our Public Schools: A Critical Need for Action. Center for American Progress, June 2014. Retrieved from https://www.americanprogress.org/issues/education-k-12/reports/2014/06/28/91962/retaining-teachers-of-color-in-our-public-schools/

Putnam, H., Hansen, M., Walsh, K., & Quintero, D. (2016). High hopes and harsh realities: The real challenges to building a diverse workforce. Brown Center on Education Policy at Brookings, August 2016. Retrieved from https://www.nctq.org/dmsView/High_Hopes_Harsh_Realities

Ronfeldt, M., Lankford, H., Loeb, S., and Wyckoff, J. (2011). How Teacher Turnover Harms Student Achievement. NBER Working Paper No. 17176, June 2011. Retrieved from http://www.nber.org/papers/w17176.pdf

Sutcher, L., Darling-Hammond, L., and Carver-Thomas, D. "A Coming Crisis in Teaching? Teacher Supply, Demand, and Shortages in the U.S." Learning Policy Institute. September 2016. pp. 1 and 37. Retrieved from https://learningpolicyinstitute.org/sites/default/files/product-files/A_Coming_Crisis_in_Teaching_REPORT.pdf

Taie, S., and Goldring, R. (2017). Characteristics of Public Elementary and Secondary School Teachers in the United States: Results From the 2015–16 National Teacher and Principal Survey First Look (NCES 2017-072). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. Retrieved May 2018 from https://nces.ed.gov/pubs2017/2017072.pdf

U.S. Department of Education. (2015). Public School Teacher Attrition and Mobility in the First Five Years: Results from the First Through Fifth Waves of the 2007-2008 Beginning Teacher Longitudinal Study (NCES 2015-337). Washington D.C.: National Center for Education Statistics. Retrieved from http://nces.ed.gov/pubsearch.

U.S. Department of Education (2017). Table 322.10, Bachelor's degrees conferred by postsecondary institutions, by field of study: Selected years, 1970-71 through 2015-2016. National Center for Education Statistics. Retrieved from https://nces.ed.gov/programs/digest/d17/tables/dt17_322.10.asp

U.S. Department of Education. (2017). 2017 Title II Reports: National Teacher Preparation Data. Retrieved May 2018 from https://title2.ed.gov/Public/Home.aspx

U.S. Department of Education. (2017). 2015-16 National Teacher and Principal Survey (NTPS) Restricted-Use Data Files. National Center for Education Statistics. Retrieved from https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2017156

Appendix A – Research Question 1

Table A1
Demographic Characteristics of FY 2018 Newly-Hired Elementary, Middle, and High School Teachers by Gender, Race/Ethnicity, and Age

	Elementary		Middle		High	
	N	%	N	%	N	%
Gender						
Female	401	89.3	200	73.0	150	64.4
Male	48	10.7	74	27.0	83	35.6
Race/Ethnicity						
Asian	20	4.5	26	9.5	17	7.3
Black or African American	51	11.4	50	18.2	27	11.6
Hispanic/Latino	40	8.9	32	11.7	25	10.7
Two or More	13	2.9	8	2.9	9	3.9
White	325	72.4	158	57.7	155	66.5
Age						
20 – 29 years	274	61.0	117	42.7	93	39.9
30 – 39 years	95	21.2	86	31.4	65	27.9
40 – 49 years	46	10.2	49	17.9	41	17.6
50 – 59 years	31	6.9	18	6.6	26	11.2
60+ years	≤ 5	≤ 1.0	≤ 5	1.5	8	3.4
Total	449	100.0	274	100.0	233	100.0

Appendix B – Research Question 2

Table B1
Distribution of MCPS Teachers by Schools Levels of Poverty and School Level

	Total Elementary	Elementary N = 6,126				**Total Middle**	Middle N = 2,766			**Total High**	High N = 3,387		
		Schools Levels of Poverty %					Schools Levels of Poverty %				Schools Levels of Poverty %		
	N	0-34	35-49	50-74	75+	**N**	0-34	35-49	50+*	**N**	0-34	35-49	50+*
Gender													
Female	**5,581**	46.6	11.2	26.6	15.6	**2,024**	49.7	24.4	26.0	**2,149**	61.1	31.3	7.7
Male	**545**	46.4	10.6	28.8	14.1	**742**	49.5	23.7	26.8	**1,238**	61.4	30.5	8.1
Race/Ethnicity													
White	**4,677**	50.4	11.2	24.8	13.6	**1,932**	54.3	23.1	22.6	**2,436**	66.7	26.6	6.7
Black or African American	**598**	24.4	14.4	39.0	22.2	**427**	30.2	31.6	38.2	**459**	40.1	47.7	12.2
Hispanic/ Latino	**390**	33.8	9.5	32.3	24.4	**184**	44.6	23.9	31.5	**242**	49.2	39.7	11.2
Asian	**358**	48.0	8.9	24.0	19.0	**166**	53.0	16.9	30.1	**189**	57.7	34.9	7.4
Other	**103**	42.7	7.8	35.0	14.6	**57**	40.4	28.1	31.6	**61**	59.0	32.8	8.2
Years of Teaching Experience**													
0.0-1.0	**289**	37.4	10.7	27.7	24.2	**131**	28.2	24.4	47.3	**114**	43.9	44.7	11.4
1.1-5.0	**1,111**	40.1	9.9	30.3	19.7	**474**	34.6	27.6	37.8	**409**	53.1	37.2	9.8
5.1-10.0	**1,164**	46.1	10.9	26.4	16.6	**477**	48.2	24.3	27.5	**569**	61.5	31.1	7.4
10.1-15.0	**1,170**	46.8	11.4	25.7	16.1	**536**	53.5	24.8	21.6	**713**	63.8	28.3	7.9
15.1-20.0	**997**	51.2	11.3	25.3	12.2	**475**	56.4	21.9	21.7	**665**	63.3	29.2	7.5
20.1+	**1,368**	50.4	12.4	26.1	11.0	**652**	58.1	23.0	18.9	**901**	63.2	30.0	6.9
Degree Attained**													
Bachelor's	**980**	39.1	9.0	31.1	20.8	**284**	36.6	25.4	38.0	**210**	50.5	41.4	8.1
Master or equivalent	**5,091**	48.0	11.6	25.9	14.4	**2,437**	51.3	24.0	24.6	**3,098**	62.0	30.2	7.7
Higher than a master	**25**	28.0	12.0	44.0	16.0	**23**	39.1	34.8	26.1	**60**	53.3	36.7	10.0

* No middle and high schools have more than 75% of students in FARMS.
** Data about years of teaching experience and degree attained was not available for all teachers.

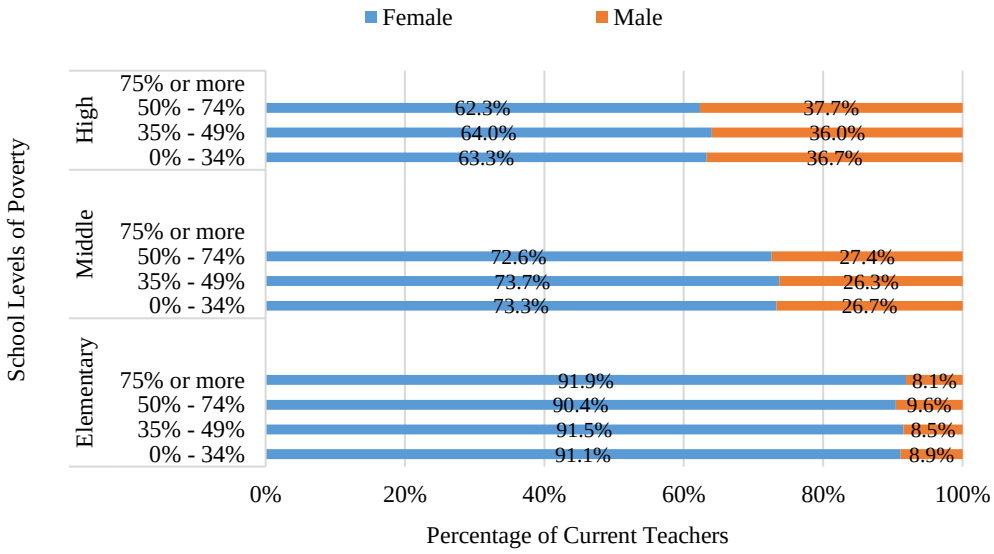

Figure B1. Percentage of Female and Male Teachers by School Levels of Poverty

Table B2
Relationship Between Female and Male Teachers (Current and Newly-Hired) and School Levels of Poverty for Elementary, Middle, and High Schools

	Test	Test Statistic	df	p-value
Elementary				
Current Teachers	Chi-Square Test	1.75	3	0.63
Newly-Hired Teachers	Chi-Square Test	3.71	3	0.30
Middle				
Current Teachers	Chi-Square Test	0.24	2	0.89
Newly-Hired Teachers	Chi-Square Test	1.89	2	0.39
High				
Current Teachers	Chi-Square Test	0.31	2	0.86
Newly-Hired Teachers	Chi-Square Test	0.55	2	0.76

Table B3
Relationship Between White, Black or African American, and Hispanic/Latino Teachers (Current and Newly-Hired) and School Levels of Poverty

	Test	Test Statistic	df	p-value
Elementary				
Current Teachers	Chi-Square Test	199.73	12	0.00
Newly-Hired Teachers	Fisher's Exact Test	-	-	0.01
Middle				
Current Teachers	Chi-Square Test	94.88	8	0.00
Newly-Hired Teachers	Fisher's Exact Test	-	-	0.78
High				
Current Teachers	Chi-Square Test	133.36	8	0.00
Newly-Hired Teachers	Fisher's Exact Test	-	-	0.39

Note: Fisher's Exact Test for Count Data with simulated p-value (based on 2,000 replicates).

Table B4
Relationship Between Teachers' Years of Experience (Current and Newly-Hired) and School Levels of Poverty

	Test	Test Statistic	df	p-value
Overall				
Current Teachers	One-way ANOVA	59.94	3	0.00
Newly-Hired Teachers	One-way ANOVA	1.59	3	0.19
Elementary				
Current Teachers	One-way ANOVA	24.85	3	0.00
Newly-Hired Teachers	One-way ANOVA	1.34	3	0.26
Middle				
Current Teachers	One-way ANOVA	49.33	2	0.00
Newly-Hired Teachers	One-way ANOVA	2.42	2	0.09
High				
Current Teachers	One-way ANOVA	6.28	2	0.00
Newly-Hired Teachers	One-way ANOVA	1.34	2	0.26

Table B5
Relationship Between Highest Degree of Elementary, Middle, and High School Teachers (Current and Newly-Hired) and School Levels of Poverty

	Test	p-value
Elementary		
Current Teachers	Fisher's Exact Test	0.00
Newly-Hired Teachers	Fisher's Exact Test	0.84
Middle		
Current Teachers	Fisher's Exact Test	0.00
Newly-Hired Teachers	Fisher's Exact Test	0.19
High		
Current Teachers	Fisher's Exact Test	0.03
Newly-Hired Teachers	Fisher's Exact Test	0.04

Note: Fisher's Exact Test for Count Data with simulated p-value (based on 2,000 replicates).

Table B6
Distribution of MCPS Teachers by Schools Levels of Complexity and School Level

	Total Elem.	Elementary N = 6,126				Total Middle	Middle N = 2,766				Total High	High N = 3,387			
		Schools Levels of Complexity %					Schools Levels of Complexity %					Schools Levels of Complexity %			
	N	Lowest	Low	High	Highest	N	Lowest	Low	High	Highest	N	Lowest	Low	High	Highest
Gender															
Female	**5,581**	14.5	19.3	21.1	25.1	**2,024**	20.6	18.2	19.6	20.6	**2,149**	18.2	19.2	21.5	21.6
Male	**545**	13.6	18.0	22.8	23.7	**742**	19.0	20.6	19.1	20.8	**1,238**	20.0	18.3	21.5	21.4
Race/Ethnicity															
White	**4,677**	16.5	20.8	20.0	22.2	**1,932**	23.1	20.3	17.6	17.7	**2,436**	21.5	21.1	19.0	18.1
Black or African American	**598**	3.3	9.9	31.4	36.0	**427**	8.9	11.0	27.9	29.3	**459**	7.2	9.8	33.8	33.6
Hispanic/Latino	**390**	5.6	14.1	22.6	37.9	**184**	15.8	19.6	21.7	25.0	**242**	11.2	19.4	19.8	32.6
Asian	**358**	14.8	20.9	17.9	27.9	**166**	25.9	19.3	17.5	24.7	**189**	24.3	11.1	23.8	22.2
Other	**103**	13.6	14.6	27.2	24.3	**57**	3.5	22.8	17.5	29.8	**61**	14.8	21.3	27.9	21.3
Years of Teaching Experience*															
0.0-1.0	**289**	10.7	17.0	22.1	33.2	**131**	9.2	10.7	27.5	35.9	**114**	16.7	11.4	22.8	35.1
1.1-5.0	**1,111**	12.8	15.7	22.3	31.1	**474**	12.7	13.7	23.8	30.0	**409**	15.4	15.6	21.5	28.4
5.1-10.0	**1,164**	14.6	19.0	21.3	25.4	**477**	22.6	18.0	20.1	21.2	**569**	17.4	18.6	22.8	20.6
10.1-15.0	**1,170**	13.6	20.8	20.6	24.8	**536**	22.2	20.7	20.7	16.2	**713**	18.1	19.6	19.1	20.3
15.1-20.0	**997**	16.0	20.1	20.3	21.9	**475**	21.9	22.9	16.6	18.1	**665**	18.5	21.4	21.1	20.5
20.1+	**1,368**	15.8	20.9	21.7	19.9	**652**	23.6	20.4	14.6	15.6	**901**	22.5	19.3	22.6	19.0
Degree Attained*															
Bachelor's	**980**	10.2	16.4	23.7	31.7	**284**	11.3	13.4	22.9	30.3	**210**	13.8	13.8	23.3	28.6
Master or equivalent	**5,091**	15.2	19.8	20.8	23.6	**2,437**	21.3	19.7	18.8	19.5	**3,098**	19.3	19.2	21.2	21.0
Higher than a master	**25**	12.0	12.0	40.0	28.0	**23**	21.7	4.3	26.1	21.7	**60**	13.3	21.7	30.0	21.7

* Data about years of teaching experience and degree attained was not available for all teachers.

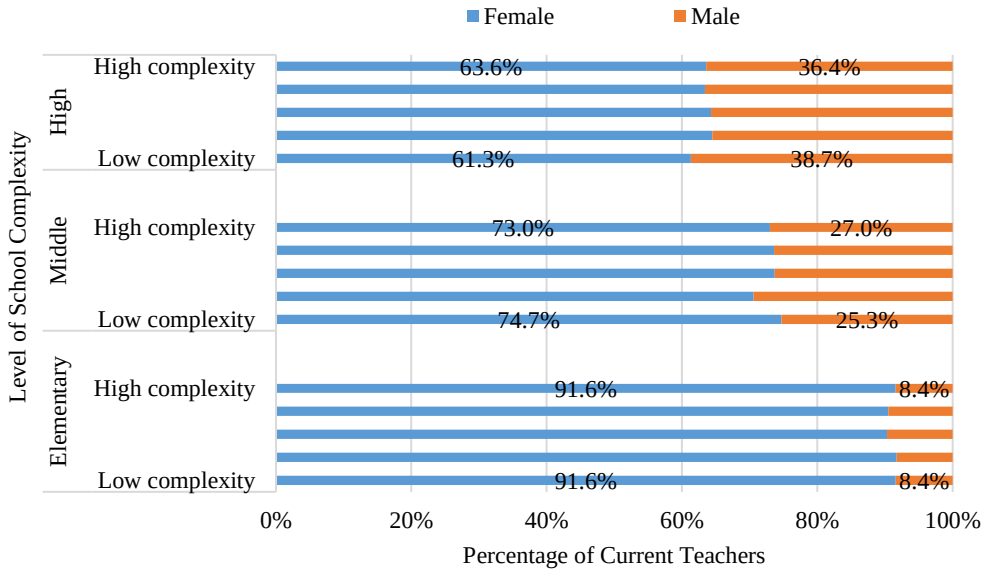

Figure B2. Percentage of Female and Male Teachers by School Levels of Complexity

Table B7
Relationship Between Female and Male Teachers in Elementary, Middle, and High Schools (Current and Newly-Hired) and School Levels of Complexity

	Test	Test Statistic	df	p-value
Elementary				
Current Teachers	Chi-Square Test	2.68	4	0.61
Newly-Hired Teachers	Chi-Square Test	0.78	4	0.94
Middle				
Current Teachers	Chi-Square Test	2.54	4	0.64
Newly-Hired Teachers	Chi-Square Test	2.06	4	0.73
High				
Current Teachers	Chi-Square Test	1.84	4	0.77
Newly-Hired Teachers	Chi-Square Test	3.01	4	0.56

Table B8
Relationship Between White, Black or African American, and Hispanic/Latino Teachers (Current and Newly-Hired) and School Levels of Complexity

	Test	Test Statistic	df	p-value
Elementary				
Current Teachers	Chi-Square Test	234.23	16	0.00
Newly-Hired Teachers	Fisher's Exact Test	-	-	0.04
Middle				
Current Teachers	Chi-Square Test	120.83	16	0.00
Newly-Hired Teachers	Fisher's Exact Test	-	-	0.52
High				
Current Teachers	Chi-Square Test	191.20	16	0.00
Newly-Hired Teachers	Fisher's Exact Test	-	-	0.29

Note: Fisher's Exact Test for Count Data with simulated p-value (based on 2,000 replicates).

Table B9
Relationship Between Teachers' Years of Experience (Current and Newly-Hired) and School Levels of Complexity

	Test	Test Statistic	df	p-value
Overall				
Current Teachers	One-way ANOVA	36.27	4	0.00
Newly-Hired Teachers	One-way ANOVA	0.31	4	0.87
Elementary				
Current Teachers	One-way ANOVA	15.89	4	0.00
Newly-Hired Teachers	One-way ANOVA	0.09	4	0.99
Middle				
Current Teachers	One-way ANOVA	22.34	4	0.00
Newly-Hired Teachers	One-way ANOVA	0.88	4	0.48
High				
Current Teachers	One-way ANOVA	7.04	4	0.00
Newly-Hired Teachers	One-way ANOVA	1.13	4	0.34

Table B10
Relationship Between Highest Degree of Elementary, Middle, and High School Teachers (Current and Newly-Hired) and School Levels of Complexity

	Test	p-value
Elementary		
Current Teachers	Fisher's Exact Test	0.00
Newly-Hired Teachers	Fisher's Exact Test	0.58
Middle		
Current Teachers	Fisher's Exact Test	0.00
Newly-Hired Teachers	Fisher's Exact Test	0.54
High		
Current Teachers	Fisher's Exact Test	0.04
Newly-Hired Teachers	Fisher's Exact Test	0.32

Note: Fisher's Exact Test for Count Data with simulated p-value (based on 2,000 replicates).

Table B11
Distribution of MCPS Teachers by Perception of School Climate and School Level

	Total Elem.	Elementary N = 6,126				Total Mid.	Middle N = 2,725*				Total High	High N = 3,412*			
		Perception of School Climate %					Perception of School Climate %					Perception of School Climate %			
	N	Lowest	Low	High	Highest	N	Lowest	Low	High	Highest	N	Lowest	Low	High	Highest
Gender															
Female	**5,581**	21.1	22.1	17.8	18.3	**1,995**	18.8	19.8	18.4	21.8	**2,158**	16.3	21.3	18.5	21.5
Male	**545**	22.6	19.6	20.2	17.4	**730**	17.8	20.3	16.2	21.4	**1,254**	14.5	20.6	20.8	20.6
Race/Ethnicity															
White	**4,677**	19.6	21.8	19.0	19.0	**1,903**	17.5	18.8	19.3	23.0	**2,455**	14.0	20.8	18.7	22.9
Black or African American	**598**	34.3	21.1	15.2	10.5	**422**	25.1	23.2	12.8	14.5	**461**	24.9	21.9	21.3	15.6
Hispanic/ Latino	**390**	24.1	25.1	12.1	15.4	**181**	18.2	22.7	19.9	21.5	**243**	13.6	27.6	23.0	11.9
Asian	**358**	16.5	21.2	16.2	24.6	**163**	14.1	20.9	14.1	23.3	**192**	15.6	16.1	17.7	25.0
Other	**103**	29.1	17.5	19.4	15.5	**56**	19.6	23.2	8.9	25.0	**61**	19.7	11.5	24.6	21.3
Years of Teaching Experience**															
0.0 - 1.0	**289**	27.0	18.0	16.6	17.0	**129**	27.1	20.2	14.0	12.4	**114**	16.7	20.2	19.3	16.7
1.1 - 5.0	**1,111**	24.7	22.7	14.0	17.0	**466**	23.6	22.1	15.5	18.7	**409**	14.4	21.0	21.3	17.6
5.1-10.0	**1,164**	20.4	21.4	17.3	20.8	**467**	18.8	19.5	16.5	23.6	**570**	13.5	20.4	18.1	21.4
10.1-15.0	**1,170**	19.3	22.7	19.1	18.2	**527**	16.5	20.3	19.2	22.6	**716**	14.0	23.5	18.4	21.9
15.1-20.0	**997**	19.0	23.8	19.7	17.7	**467**	16.7	18.2	19.5	21.0	**667**	17.2	21.7	18.7	20.5
20.1+	**1,368**	21.3	20.0	20.3	17.7	**648**	15.4	19.9	19.3	24.4	**920**	17.7	18.8	20.4	23.2

* Silver Creek Middle School does not have 2016–2017 climate perception data and high school data includes Thomas Edison High School of Technology.
**Data about years of teaching experience and degree attained was not available for all teachers.

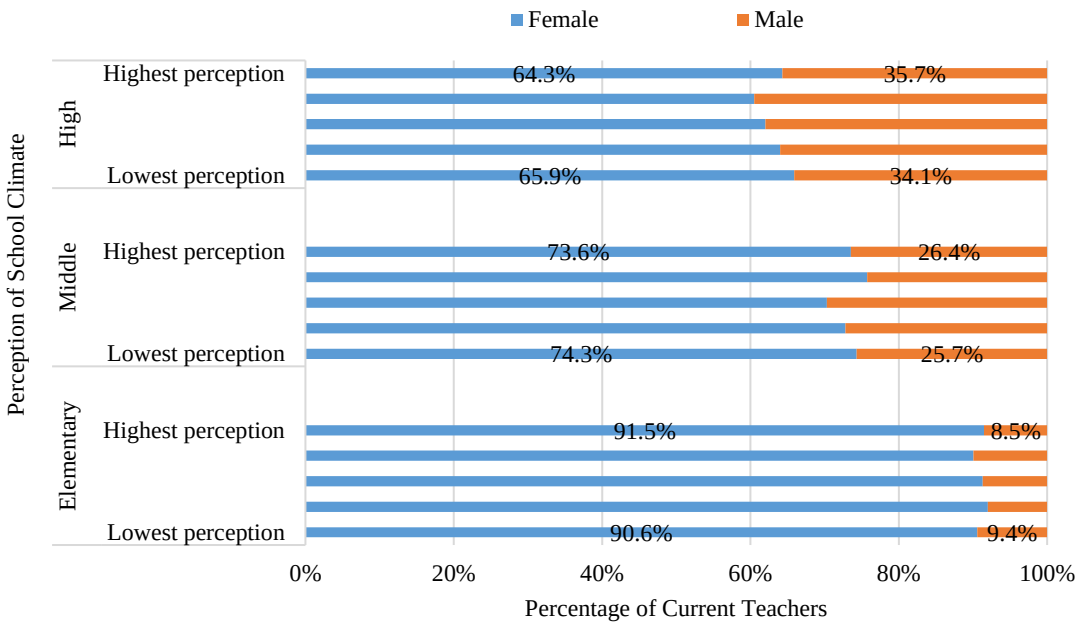

Figure B3. Percentage of Female and Male Teachers (Elementary, Middle, and High Schools) by Perception of School Climate

Table B12
Relationship Between Female and Male Teachers in Elementary, Middle, and High Schools (Current and Newly-Hired) and Perception of School Climate

	Test	Test Statistic	df	p-value
Elementary				
Current Teachers	Chi-Square Test	3.60	4	0.46
Newly-Hired Teachers	Chi-Square Test	1.80	4	0.77
Middle				
Current Teachers	Chi-Square Test	4.57	4	0.33
Newly-Hired Teachers	Chi-Square Test	0.74	4	0.95
High				
Current Teachers	Chi-Square Test	4.79	4	0.31
Newly-Hired Teachers	Chi-Square Test	6.68	4	0.15

Table B13
Relationship Between White, Black or African American, and Hispanic/Latino Teachers (Current and Newly-Hired) and Perception of School Climate

	Test	Test Statistic	df	p-value
Elementary				
Current Teachers	Chi-Square Test	112.60	16	0.00
Newly-Hired Teachers	Fisher's Exact Test	-	-	0.04
Middle				
Current Teachers	Chi-Square Test	47.48	16	0.00
Newly-Hired Teachers	Fisher's Exact Test	-	-	0.42
High				
Current Teachers	Chi-Square Test	76.56	16	0.00
Newly-Hired Teachers	Fisher's Exact Test	-	-	0.13

Note: Fisher's Exact Test for Count Data with simulated p-value (based on 2,000 replicates).

Table B14
Relationship Between Teachers' Years of Experience (Current and Newly-Hired) and Perception of School Climate

	Test	Test Statistic	df	p-value
Elementary				
Current Teachers	One-way ANOVA	4.38	4	0.00
Newly-Hired Teachers	One-way ANOVA	1.15	4	0.33
Middle				
Current Teachers	One-way ANOVA	5.16	4	0.00
Newly-Hired Teachers	One-way ANOVA	0.89	4	0.47
High				
Current Teachers	One-way ANOVA	4.14	4	0.00
Newly-Hired Teachers	One-way ANOVA	0.93	4	0.45

Appendix C – Research Question 4

Appendix C1. Comparison between gender and race/ethnicity distribution of teachers' resignations and terminations and overall gender and race/ethnicity distribution of teachers in MCPS.

Table C1.1.
Gender Distribution of Voluntary Resignations and Terminations for FY 2015 to 2017 compared to Average Teacher Gender Distribution

	Total Sum of Resignations and Terminations FY 2015–2017		Average teacher distribution FY 2015–2017	
	N	%	N	%
Female	1,181	**82.3**	10,022	**80.4**
Male	254	**17.7**	2,448	**19.6**
Total	1,435	100.0	12,470	100.0

Table C1.2.
Analysis of Percentage Differences between the Gender Distribution of Teachers' Resignations and Terminations and Overall Teachers' Gender Distribution From FY 2015 to 2017

	Test	Test Statistic	df	p-value
Percentage Difference in FY 2015	Chi-Square Test	2.04	1	0.15
Percentage Difference in FY 2016	Chi-Square Test	3.37	1	0.07
Percentage Difference in FY 2017	Chi-Square Test	0.00	1	1.00

Note: Null hypothesis assumes the gender distribution of teachers who resigned or got terminated from FY 2015 to 2017 is equal to the average gender makeup of teachers in MCPS.

Table C1.3.
Race/Ethnicity Distribution of Voluntary Resignations and Terminations for FY 2015 to 2017 compared to Average Teacher Gender Distribution

	Total Sum of Resignations and Terminations FY 2015–2017		Average Teacher Distribution FY 2015–2017	
	N	%	N	%
White	1,060	**73.9**	9,394	**75.3**
Black or African American	164	**11.4**	1,448	**11.6**
Hispanic/Latino	95	**6.6**	740	**5.9**
Asian	88	**6.1**	690	**5.5**
Other	28	**2.0**	199	**1.6**
Total	1,435	100.0	12,471	100.0

Table C1.4.
Analysis of Percentage Differences between the Race/Ethnicity Distribution of Teachers' Resignations and Terminations and Overall Teachers' Race/Ethnicity Distribution From FY 2015 to 2017

	Test	Test Statistic	df	p-value
Percentage Difference in FY 2015	Chi-Square Test	1.71	4	0.79
Percentage Difference in FY 2016	Chi-Square Test	7.95	4	0.09
Percentage Difference in FY 2017	Chi-Square Test	6.00	4	0.20

Note: Null hypothesis assumes the race/ethnicity distribution of teachers who resigned or got terminated from FY 2015 to 2017 is equal to the average racial/ethnic makeup of teachers in MCPS

Appendix C2. Teacher attrition rate by gender and race/ethnicity.

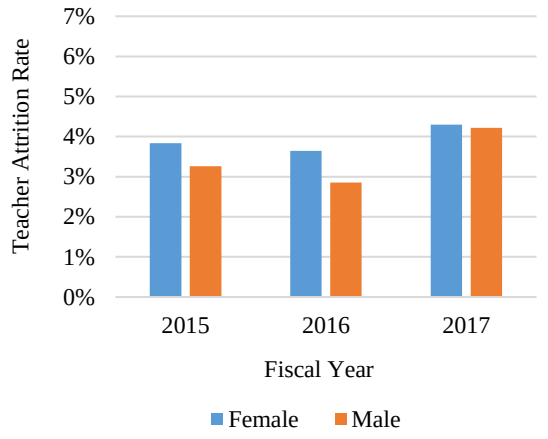

Figure C2.1. Teacher Attrition Rate by Gender from FY 2015 to 2017

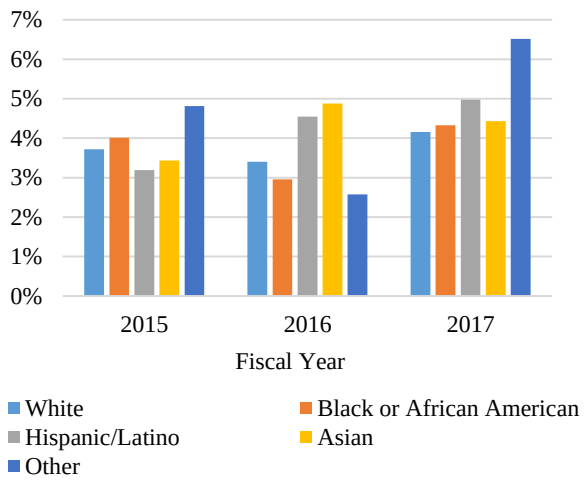

Figure C2.2. Teacher Attrition Rate by Race/Ethnicity from FY 2015 to 2017