This Study

While there is a growing body of research on the factors associated with turnover in specific settings or for specific groups of teachers, this is the first study in the current era of shortages to examine a range of factors associated with turnover nationally and across states and types of districts. With changes in the teacher workforce—in particular the decline in teacher preparation enrollments (Sutcher, Darling-Hammond, & Carver-Thomas, 2019) and a growing interest in teacher diversity (Miller, 2018; Hansen, & Quintero, 2018)— understanding retention is increasingly important. Specifically, we ask, what are national turnover rates and how do they vary for distinctive locations and types of teachers and in key shortage areas? What factors currently predict teacher turnover?

This article first discusses turnover trends generally. We then look at these trends by subject area and by teacher and school characteristics, including shortage areas like mathematics, science, special education, and English language development teachers, as well as teachers in schools serving the most students of color and students from low-income families. We discuss turnover trends for teachers of color and teachers trained through alternative certification pathways. Next, we discuss predictors of teacher turnover that have been surfaced in previous research and test them with the most recent national data. We end with a discussion of policy considerations, based on research on stemming teacher turnover.

Data

This paper draws primarily from the U.S. Department of Education, National Center for Education Statistics Schools and Staffing Survey (2011–12) and Teacher Follow-up Survey (2012–13), which are the most recent data available. (Although the main survey of teachers was repeated in 2015, there was no teacher followup survey that would allow study of attrition.) The Schools and Staffing Survey (SASS) is a set of questionnaires administered to a nationally representative sample of teachers across the country in 1987–88, 1990–91, 1993–94, 1999–2000, 2003–04, 2007–08, and 2011–12. District and school personnel also complete questionnaires to provide contextual information on the schools and districts where teachers teach.

The Teacher Follow-up Survey (TFS) has three components: (1) the Teacher Status Form, (2) a questionnaire for former teachers, and (3) a questionnaire for current teachers. The Teacher Status Form is sent to all schools that had at least one teacher complete the SASS the previous year. The principal, or other knowledgeable staff member, indicates the occupational status of any of those teachers (National Center for Education Statistics, 2015). This form yields data for most SASS completers with a response rate of 79.6%. The former and current teacher questionnaires, in contrast, are administered to a subset of SASS respondents. Finally, the TFS dataset is completed with imputed data and sampling weights. The NCES uses survey weights to account for variations in overall and item response rates. *The NCES Handbook of Survey Methods* includes a thorough discussion of the survey methods used to produce the SASS and TFS data. In addition, this study draws in small part from previous years of the SASS and TFS.

All estimations of means, differences in means, and regression modeling account for the survey structure of the data and use balanced, repeated replication to compute standard errors. Movers and leavers are combined into non-stayers in order to capture all movement of full-time teachers out of public schools.

Methodology

This study reports descriptive statistics and differences of means test results to identify differences in turnover rates across teacher and school characteristics. Then we use a logistic regression model to examine the relationship between teacher turnover and a series of school characteristics, teacher characteristics, main teaching subject, and workplace conditions. The outcome of interest is the probability that a teacher will leave his or her school to move to another school or will leave the profession. For a complete description of each independent variable, their means overall, and means across teacher subgroups, see the Appendix.

For simplicity sake, we do not list separately each variable included in the model; however, all variables included can be found in Table 1 in the Appendix. Here we present our preferred model, which includes the most comprehensive set of control variables: school characteristics, teacher characteristics, main teaching subject, and working conditions.

$$\log p(attrite) / (1-p(attrite)) = \beta_0 + S\beta_1 + T\beta_2 + M\beta_3 + W\beta_4,$$

where S is all school characteristics, T is all teacher characteristics, M is main teaching subject, and W is all working conditions

Using the Pearson chi-square goodness of fit test, the preferred model has a *p*-value of .9030, indicating that the model does indeed fit our observations.

Table 2 (see Appendix) displays the odds ratios estimated for the logistic regression model. Odds ratios are used to compare the relative odds of the occurrence of the outcome of interest (in this case, leaving teaching at a given school), given certain other factors (e.g., school level, working conditions, salaries, etc.). The odds ratio can also be used to determine whether a particular factor is a risk factor for a particular outcome and to compare the magnitude of various risk factors for that outcome.

After estimating the preferred logistic regression model, we predict the probability of teacher turnover (moving or leaving) given a variety of conditions. Reporting predicted probabilities allows for a more intuitive interpretation of the regression outcomes. In this article, predicted probabilities hold all other variables constant at their means. For example, when predicting turnover given administrative support, only administrative support varies from 1 to 4, which is reported along the horizontal axis. Meanwhile, all other variables (teacher characteristics, student characteristics, and working conditions) are held at their mean value.

Findings

Teacher turnover varies considerably across states and regions of the country, among and within school districts, and among teachers of different types. Below, we discuss the variation in turnover trends, including nationally; regionally; in math, science, special education, and English language development; in schools serving students in poverty and students of color; and among teachers of color.

National Trends

In addition to the 8% of teachers who leave the profession each year, about 8% shift schools. Thus, the overall turnover rate is currently about 16%. Movers and leavers may leave their schools or the teaching profession voluntarily or involuntarily, and they may leave to retire or for other preretirement reasons.

As the data being analyzed were collected during the Great Recession, when layoffs were occurring, involuntary turnover rates were higher in 2012-13 than in 2008-09; 14% of teacher turnover was involuntary in 2012-13 compared to 8% in 2008-09. Most teachers in 2012–13 attributed their involuntary moves to budget cuts, school closures, reduced student enrollment, and school transfers. Almost all involuntary movers went on to regular teaching positions; the remaining few become itinerant teachers who travel between school sites, long-term substitutes, or other nontraditional teachers.

About 18% of total turnover (including movers and leavers) was due to retirement. Another 30% of turnover was due to voluntary, pre-retirement leavers and voluntary movers contributed to the remaining 37% of turnover. In total, 67% of turnover between the 2011–12 and 2012–13 school years was voluntary, preretirement turnover (see Figure 1).

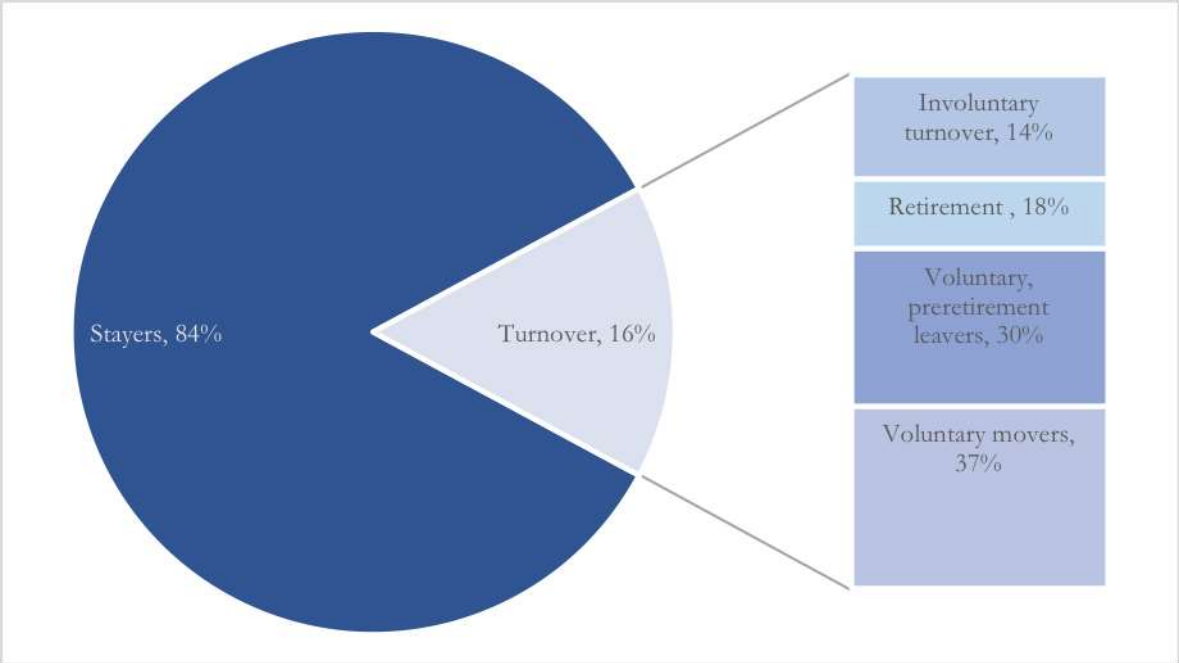

Figure 1. Sources of teacher turnover, 2011–12 to 2012–13

Regional and State Trends

The highest turnover rates tend to be in the South, reaching about 16 to 17% in cities and suburbs and 14 to 15% in towns and rural areas (see Figure 2). The Northeast averages the lowest turnover rates across all district types, with about 10% turnover overall and less than 8% turnover in its towns and rural areas.

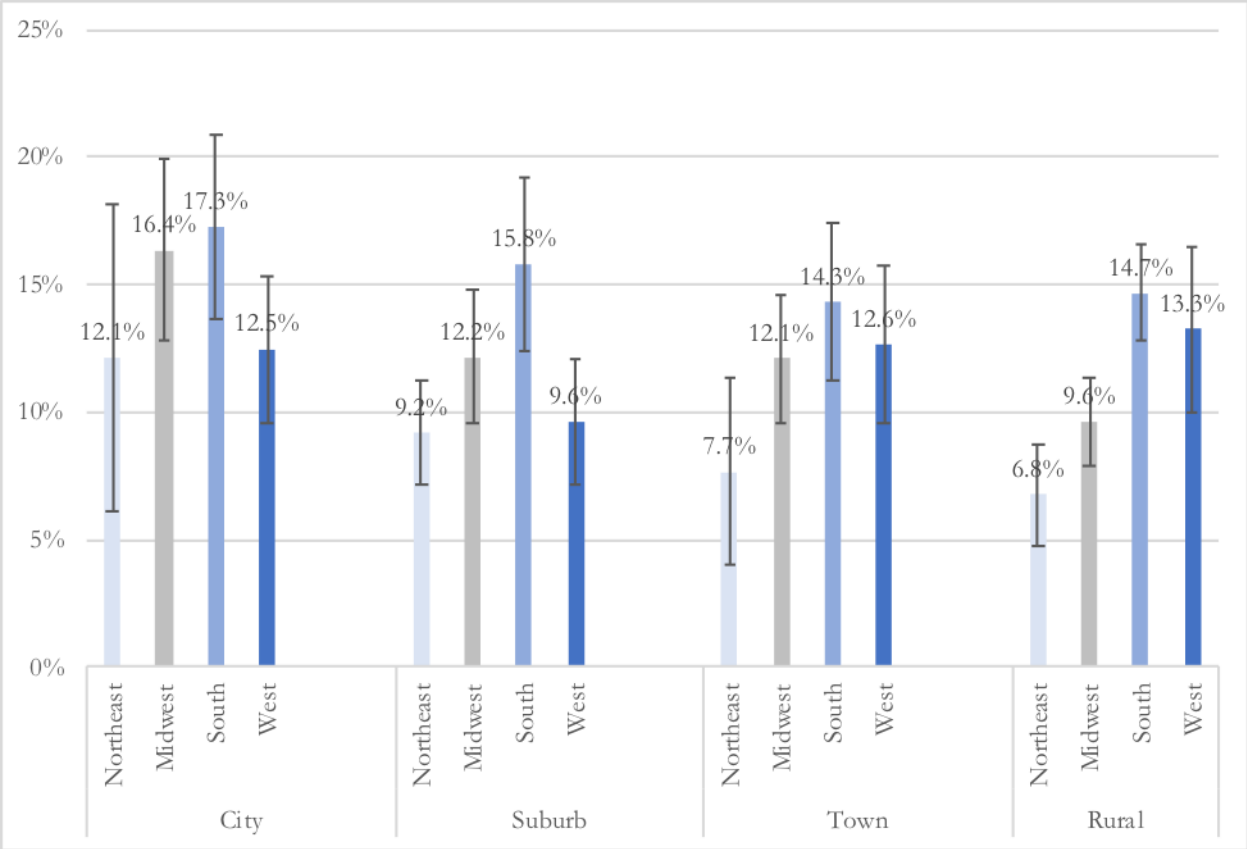

Figure 2. Turnover rates by region and district type

Notes: Brackets represent 95% confidence interval of the estimate. District types are based on 2000 Census population and geography information. For more information, see Documentation to the NCES Common Core of Data Public Elementary/Secondary School Universe Survey: School Year 2009–10 (NCES 2008–332).

The variation in annual turnover is even greater between states, ranging from just over 8% in Utah to 24% in Arizona (see Figure 3). In almost every state, the bulk of turnover is due to preretirement leaving and moving. Retirement represents less than a third of all turnover in every state except for Oregon and New Jersey, where retirement accounts for 37% and 44% of turnover, respectively. In 30 states, retirement turnover is 25% or less of all turnover.

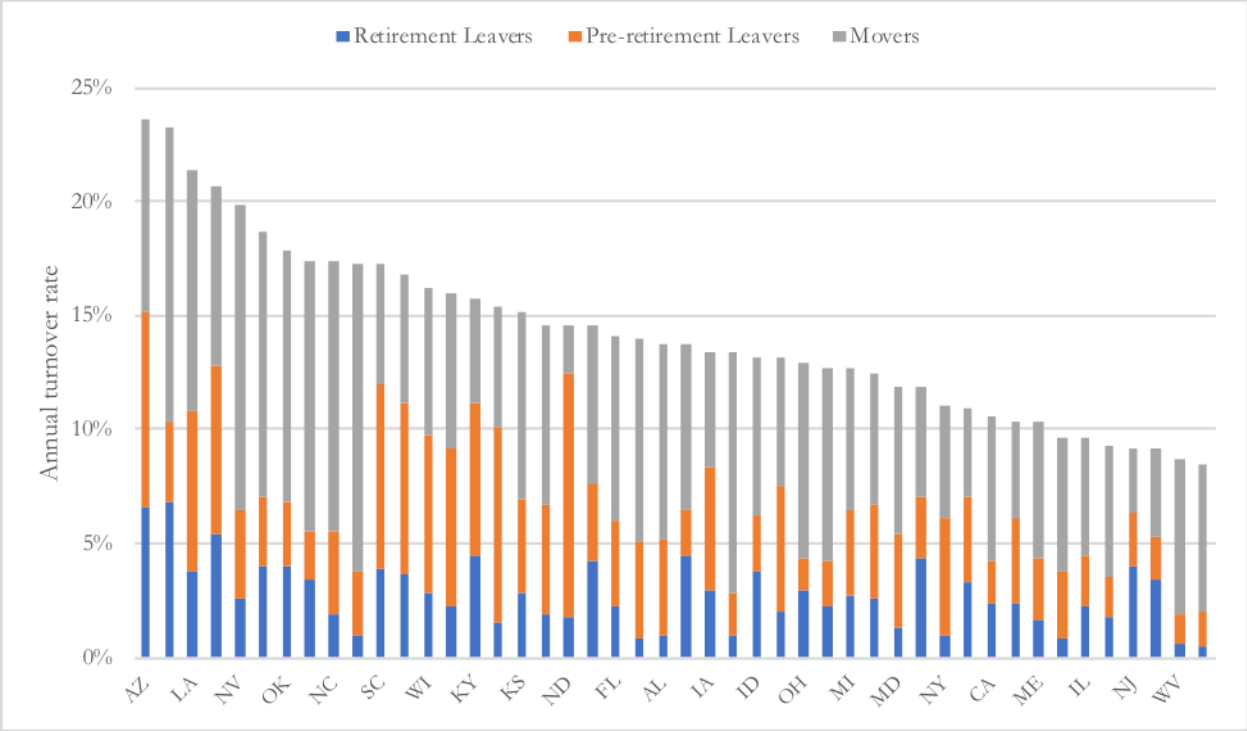

Figure 3. Turnover rates by state.

Note: States with fewer than 25 teachers surveyed were excluded (DC, HI, and WY). Three small New England states with similar data patterns were combined (NH, RI, VT). Additional state teacher shortage data can be found at https://learningpolicyinstitute.org/product/understanding-teacher-shortages-interactive

Turnover in Schools Serving Historically Underserved Students

Title I schools. Title I schools are those with high percentages of low-income students that receive federal funds under Title I of the Elementary and Secondary Education Act to help students meet academic standards. The turnover rate in Title I schools is nearly 50% greater than that in non-Title I schools (16% versus 11%, $p < 0.01$) (see Figure 4). Mathematics and science teacher turnover rates are nearly 70% greater in Title I schools than in non-Title I schools (18% vs. 11%, $p < 0.01$), and alternative certification teacher turnover is more than 80% higher (20% vs. 11%, $p < 0.05$). While turnover rates for teachers with 3 or fewer years of experience are high for teachers in all schools (with no statistically significant difference between those in Title I and non-Title 1 schools), teachers with more experience have turnover rates nearly 80% higher in Title I schools than in non-Title I schools (9% vs. 16%, $p < 0.01$).

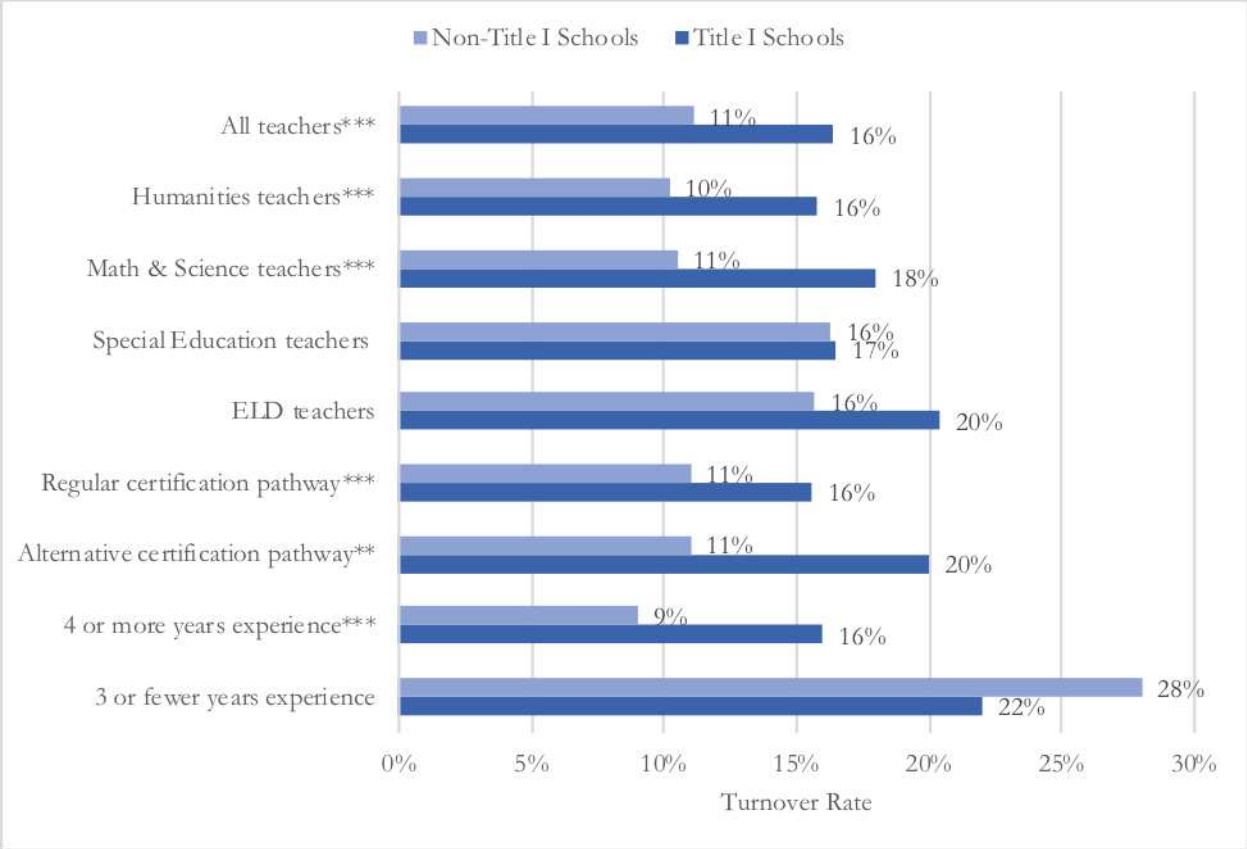

Figure 4. Teacher turnover by Title I status and teacher characteristics
Note: Percentages are rounded to the nearest whole number; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Teachers in Title I schools have spent about 2 years less at their current school ($p < 0.01$) and have a year less of overall teaching experience than teachers in non-Title I schools ($p < 0.01$). Teachers certified through a regular pathway have the greatest longevity at their current Title I school (9 years), while alternatively certified teachers spend the least time (6 years) teaching at their current Title I school. For the most part, differences in years of teaching experience are slight between teachers in Title I schools and non-Title I schools. Mathematics and science teachers, however, have 2 fewer years of experience in Title 1 schools.

Schools serving students of color. In the top quartile of schools by students of color (more than 55%), the turnover rate is about 70% greater than that in the bottom quartile of schools (school with less than 10% students of color) (17% vs. 10%, $p < 0.01$). Across the board, turnover rates in top quartile schools are higher, regardless of teachers' subject taught, years of experience, or certification pathway (see Figure 5). Mathematics and science teacher turnover rates are 90% higher in the top quartile of schools than in the bottom (19% vs. 10%, $p<0.01$).

Special education teachers are more than 80% more likely to turn over (20% vs. 11%, $p<0.05$), and teachers certified via an alternative pathway are 150% more likely to leave top quartile schools than bottom quartile schools (20% vs. 8%, $p<0.01$). Teachers with 3 or fewer years of experience have high turnover rates in both top quartile and bottom quartile schools. In addition, English language development teachers and humanities teachers did not have statistically significant differences in turnover rates.

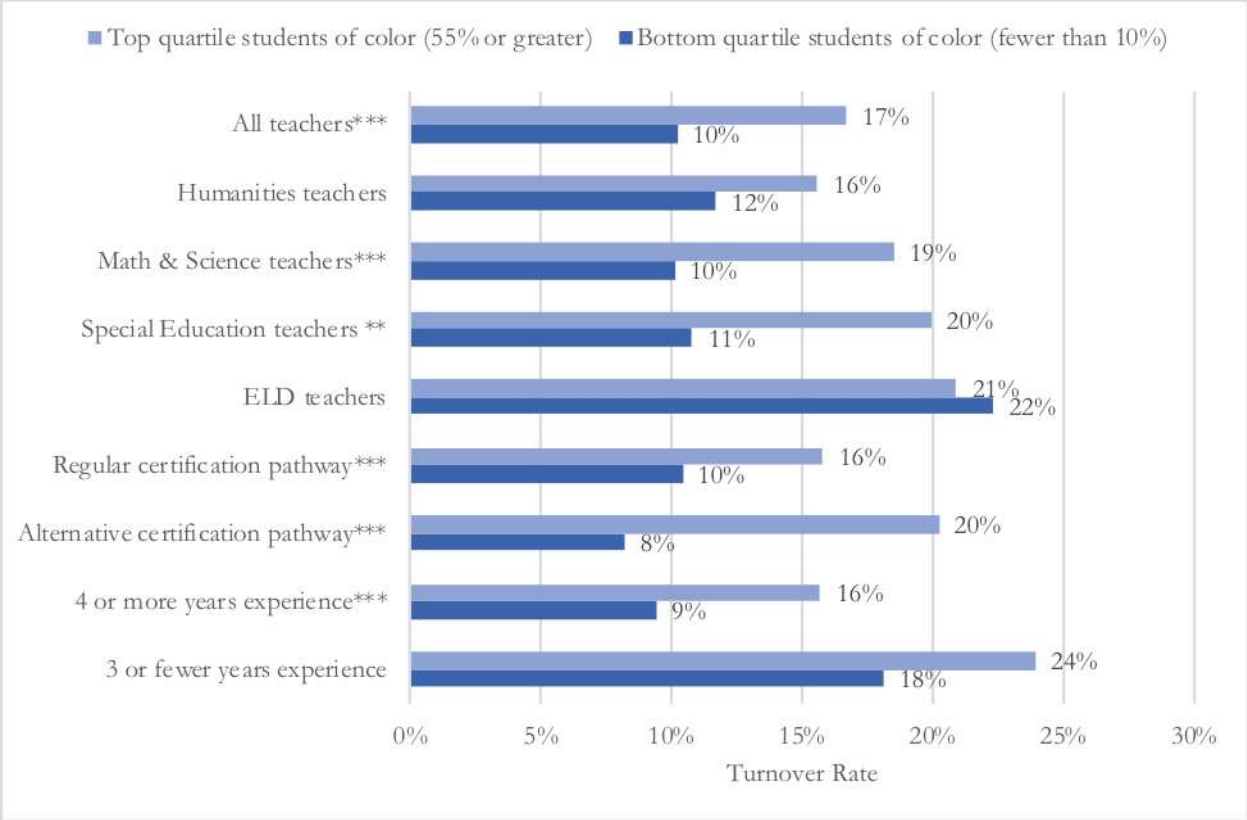

Figure 5. Teacher turnover by percent students of color enrolled and teacher characteristics
Note: Percentages are rounded to the nearest whole number; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Alternatively certified teachers spend about 3 fewer years at schools with predominantly students of color than regularly certified teachers and have 5 fewer years of experience overall. More than half of all alternative certification teachers teach in schools with the greatest concentrations of students of color and account for 21% of teachers in these schools. In contrast, alternative certification teachers account for less than 9% of teachers in schools with predominantly White students.

Controlling for all other variables, teachers at schools with the greatest proportion of students of color move schools or leave teaching at a rate 46% higher than teachers in schools with the fewest students of color (13.3% vs. 9.1%, $p < 0.05$) (see Figure 6). However, as other studies show, the predictive relationship between student race and teacher turnover is reduced when working conditions are included as well, suggesting that these conditions explain at least some of the high rates of teacher turnover in schools serving more students of color.

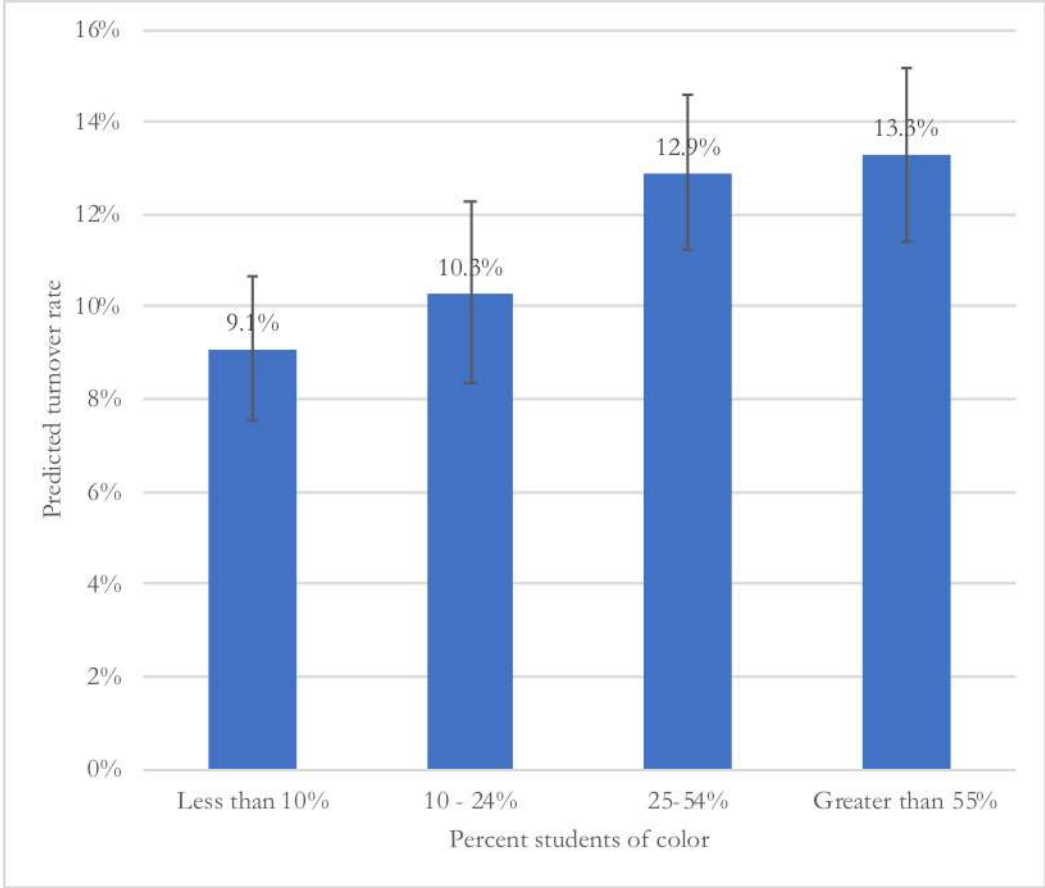

Figure 6. Predicted turnover rate by percent students of color enrolled
Note: Brackets represent 95% confidence interval of the estimate.

Turnover of Teachers of Color

While the overall teacher mover rate has remained fairly steady, that is not so for teachers of color, with mover rates ranging from 6% to 10% since 1988. Teachers of color and White teachers have left the workforce at similar rates over time (see Figure 7) but have moved schools at markedly different rates (see Figure 8).

Teachers of color are also more likely to enter teaching through an alternative pathway. A quarter of teachers of color did so, double the share for White teachers. Alternative certification is even more common among new Black teachers, nearly half of whom entered teaching through these programs. While there is a statistically significant difference in the overall turnover rates of teachers of color and White teachers (18.9% and 15.1%, respectively), this does not hold true across school types. When teachers of color and White teachers work in schools with the same proportion of students of color, their turnover rates are statistically indistinguishable. This suggests that teachers of color are simply more likely to teach in schools where turnover rates are higher for all teachers.

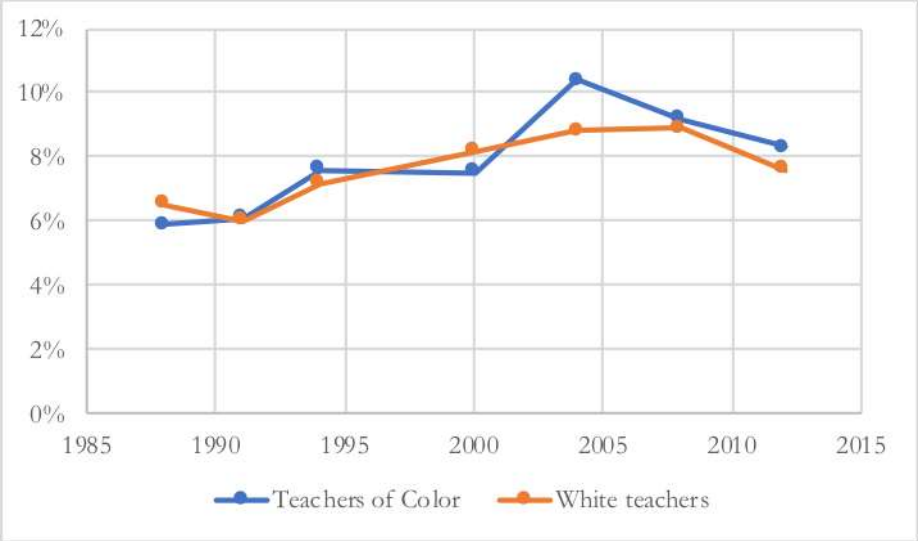

Figure 7. Teacher leaving rates, 1988–89 to 2012–13

Sources: Authors' analysis of National Center for Education Statistics Schools and Staffing Survey, 2011–12 and Teacher Follow-up Survey; Bobbitt, Faupel, & Burns, 1991; Bobbitt, Leich, Whitener, & Lynch, 1994; Whitener et al., 1997; Luekens, Lyter, Fox, & Chandler, 2004; Marvel et al., 2007; and Keigher, 2010.

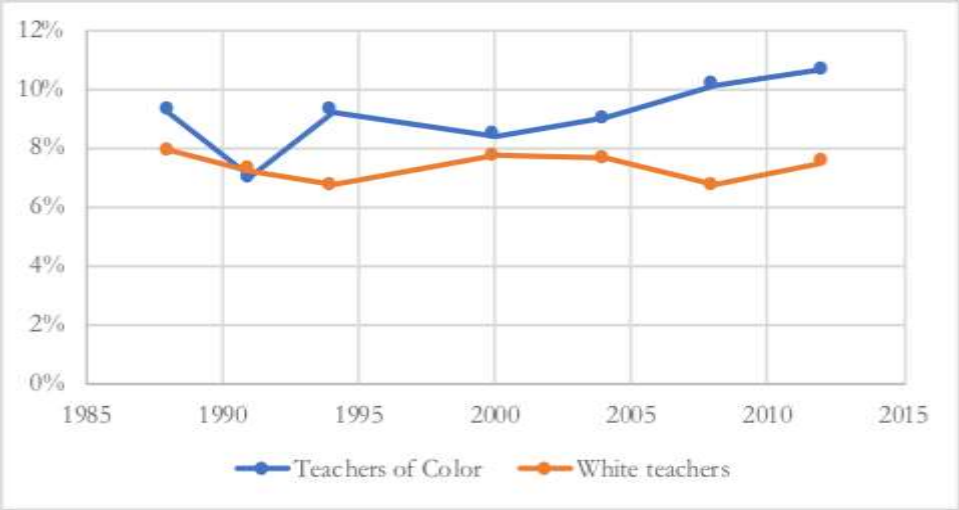

Figure 8. Teacher moving rates, 1988–89 to 2012–13

Sources: Authors' analysis of National Center for Education Statistics Schools and Staffing Survey, 2011–12 and Teacher Follow-up Survey; Bobbitt, Faupel, & Burns, 1991; Bobbitt, Leich, Whitener, & Lynch, 1994; Whitener et al., 1997; Luekens, Lyter, Fox, & Chandler, 2004; Marvel et al., 2007; and Keigher, 2010.

Predictors of Teacher Turnover

The descriptive data presented above illustrate patterns of attrition; however, they do not control for various influences that might be associated with these trends. There are a number of factors that have been found to impact teachers' decisions to stay in their classrooms, move schools, or leave teaching altogether, including compensation, student characteristics, teacher preparation and mentoring, age and experience, and working conditions.

In order to learn how each of these contribute to decisions to move or leave, we calculated teachers' predicted probabilities of leaving their school using a series of logistic regression models

that control, first, for a variety of school characteristics, then teacher characteristics, and, finally, workplace conditions (see Appendix).

School characteristics. Consistent with previous research, we found that, controlling for school size and student poverty rates, those teaching in schools with 25% or more students of color were more likely to move or leave teaching than teachers in schools with fewer students of color, all else being equal. Student characteristics, such as eligibility for free or reduced-price lunch, were not significantly related to turnover, but we note that they became less predictive of teacher turnover when other variables, such as working conditions, were also included in the model. Teacher turnover rates were negatively correlated with school size and positively, though not significantly, with class size, but not with variables such as urbanicity and school level.

Teacher characteristics. As expected, teacher age is related to leaving rates, with the youngest and oldest categories of teachers having higher rates than those who were mid-career. After controlling for age, experience levels did not have an effect on turnover. With controls for other student and teacher characteristics, teachers' race did not influence turnover.

However, we found that teachers' preparation pathway did influence turnover. Those who entered the profession through an alternative certification program were 25% more likely to leave their schools than were full-time teachers who entered teaching through a regular certification program, holding all else constant.

Subject area. Differences in attrition rates for mathematics and science teachers in comparison to teachers in other secondary subject areas are not statistically significant overall; however, mathematics and science teachers leave Title I schools at a significantly higher rate than they leave non-Title I schools. In Title I schools, the turnover rate for mathematics and science teachers is nearly 70% greater than it is in non-Title I schools (17.8% versus 10.5%, $p < 0.01$).

Additionally, in schools serving low-income students and students of color, mathematics and science teachers are also more likely to have been certified via an alternative pathway. In schools with the most students of color, 30% of mathematics and science teachers entered teaching via an alternative pathway, compared to just 12% of mathematics and science teachers at schools with mostly White students.

Turnover rates for special education teachers are among the highest at 14.2%. Special education teachers have about the same turnover rates in Title I schools as they do in non-Title I schools. However, in the top quartile of schools by students of color, their turnover rates are considerably higher than turnover rates in the bottom quartile of school (19.9% versus 10.8%, $p < 0.05$). Special education teachers in these top quartile schools are also 3.5 times more likely to be alternatively certified than special education teachers in bottom quartile schools (24.7% versus 6.9%).

Holding all else constant, mathematics and science teachers have a predicted turnover rate 37% greater than elementary teachers, special education teachers have a rate 46% higher, and foreign language teachers have a rate 87% higher (see Figure 9).

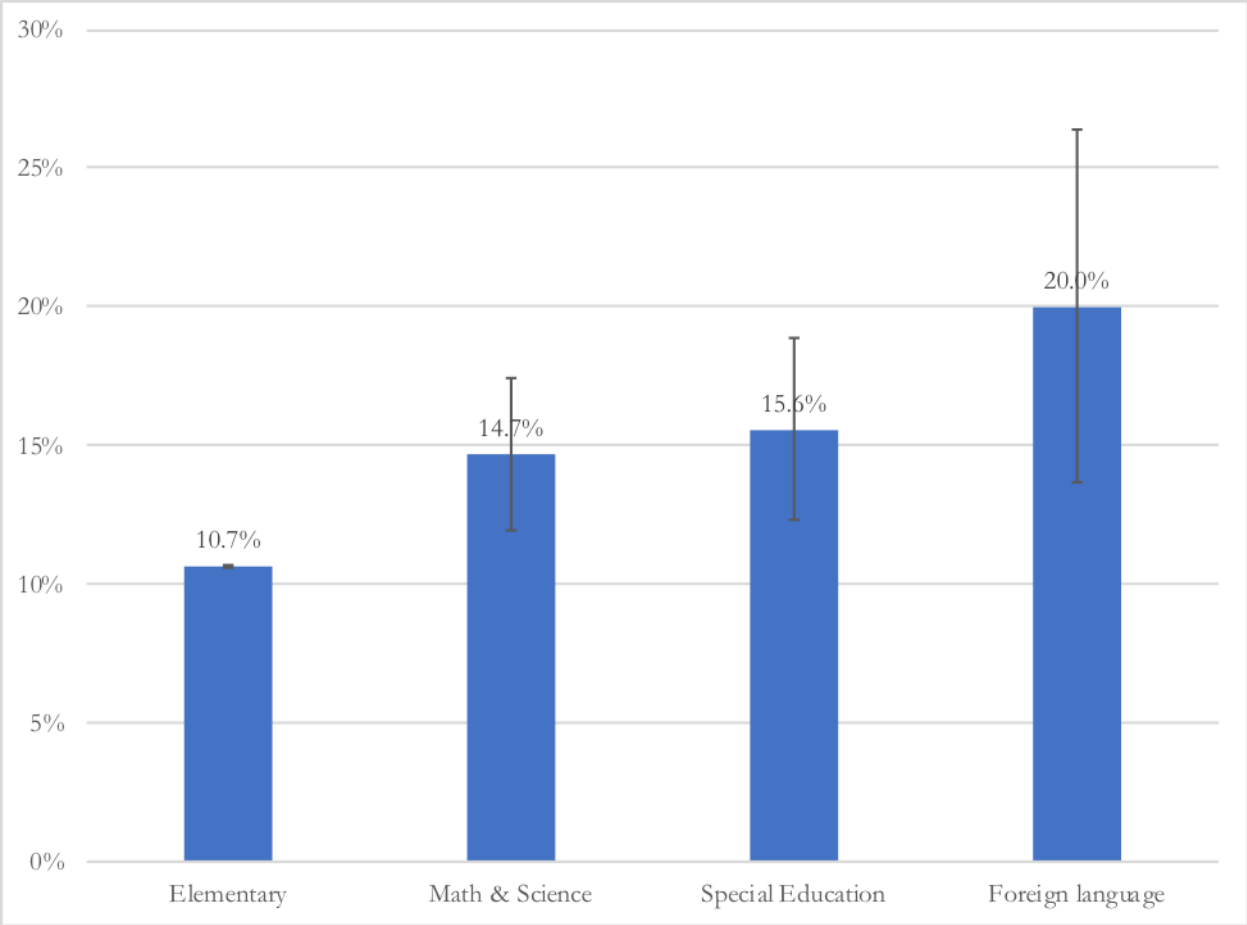

Figure 9. Predicted turnover rate by subject area
Note: Brackets represent 95% confidence interval of the estimate.

Workplace conditions. While most working conditions variables in our model did not have statistically significant relationships with turnover, compensation and administrative support did have significant relationships. We found that the level of beginning teacher salaries was not predictive of teacher turnover in our model; however, the highest possible district salary was related to teacher turnover (see Figure 10). That is, teachers who could earn more than $78,000 at the highest end of their district salary schedules—the top quintile of teachers— had a predicted turnover rate 31% lower than those with maximum district salaries less than $60,000—the bottom quintile of teachers. Teachers in districts that offered salaries up to $72,000 to $78,000 were 20% less likely to turn over than those in the bottom quintile.

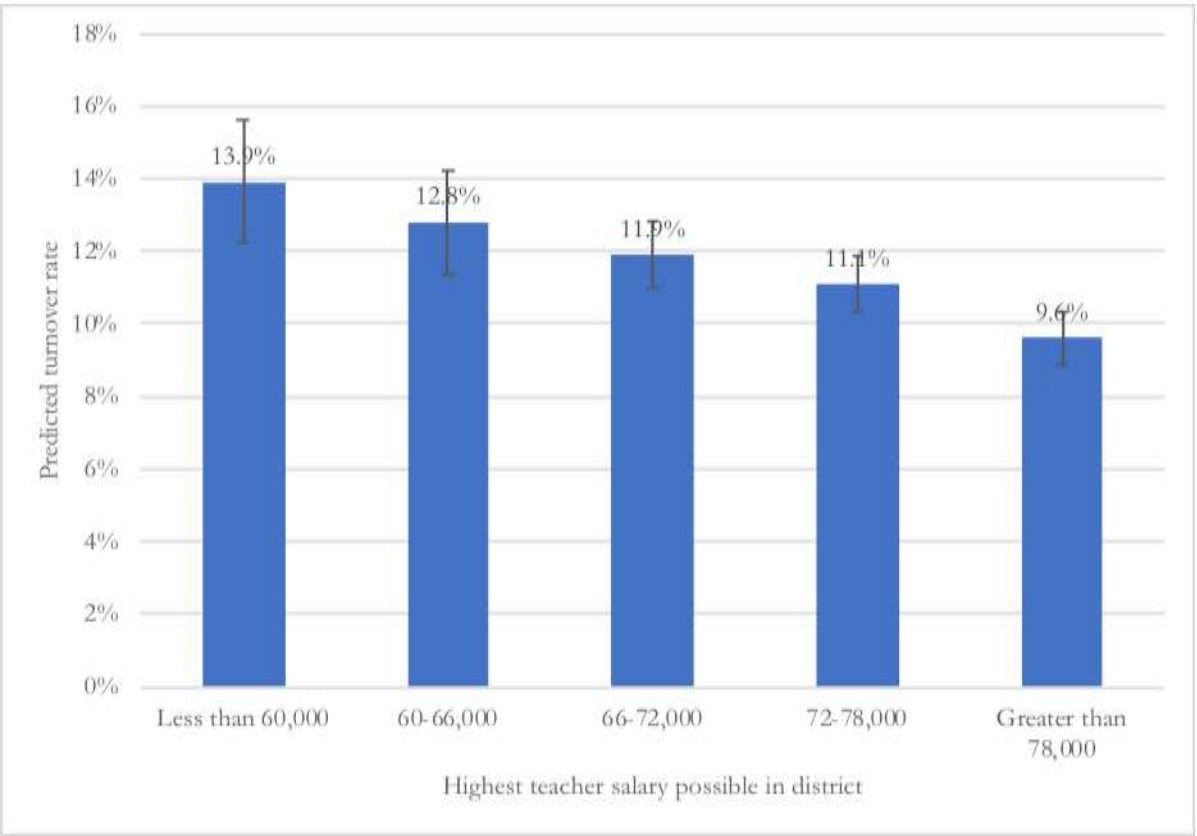

Figure 10. Predicted turnover rate by highest district salary
Note: Brackets represent 95% confidence interval of the estimate.

The workplace condition most predictive of teacher turnover was a perceived lack of administrative support, a construct that measures how teachers rate an administrator's ability to encourage and acknowledge staff, communicate a clear vision, and generally run a school well. When teachers strongly disagree that their administration is supportive, they are more than twice as likely to move schools or leave teaching than when they strongly agree that their administration is supportive (see Figure 11).

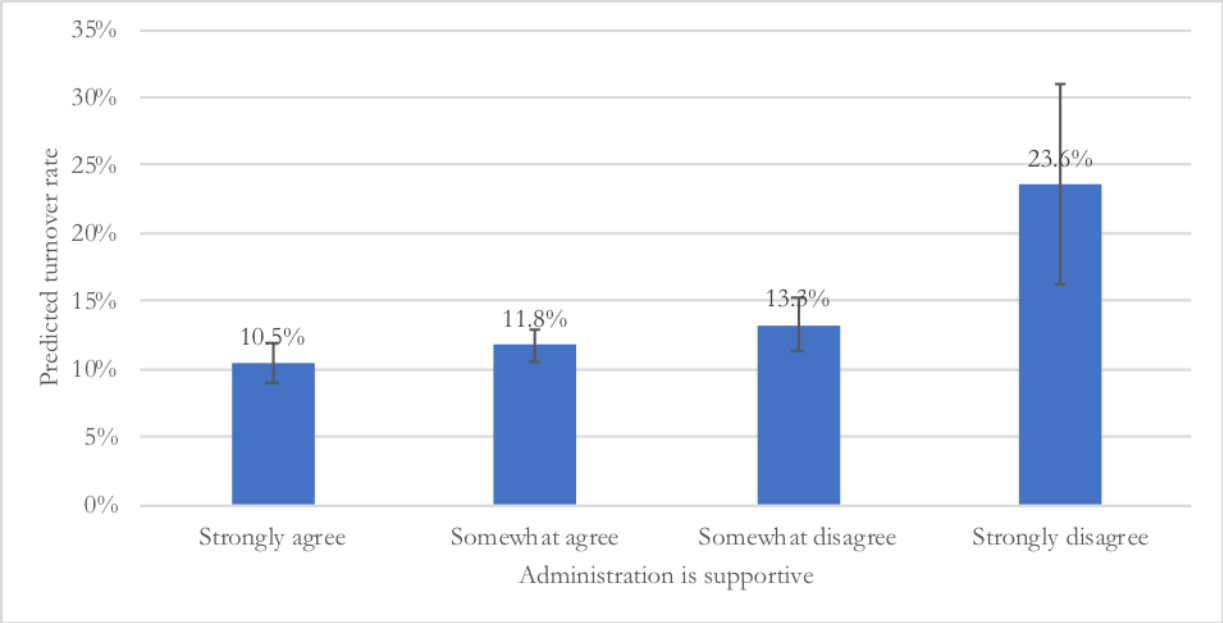

Figure 11. Predicted turnover rate by reports of administrative support
Note: Brackets represent 95% confidence interval of the estimate.

We did not find independent, significant effects on turnover of other workplace conditions, including teachers' reports of student behavior, parent support, school resources, duties and paperwork that interfere with teaching, collegial support, concerns about job security due to accountability measures, classroom control, or teacher influence over school decisions. It is possible that the strong impact of administrative support on turnover in our model subsumes many of these variables, since school leaders have an effect on most aspects of school operations, including virtually all of these factors.

Discussion

At 8% annually, teacher attrition in the United States is noticeably higher than that in some other high- achieving countries where teacher attrition is half that rate or less. More than two-thirds of this attrition is due to reasons other than retirement..

In addition to those who leave the profession each year, another 8% of teachers move between schools, creating costs and disruptions in the schools they leave behind. High rates of attrition have significant financial costs. Attrition also carries costs for student learning, as high turnover rates reduce achievement for students whose classrooms are directly affected and for other students in the school.

Overall turnover rates are highest in the South, while they are lowest in northeastern states. Teachers of mathematics, science, special education, and foreign languages are more likely to leave their school or the profession than those in other subjects. These are teaching fields that experience shortages in most states across the country.

Data show that teachers are more likely to leave schools where there are more students of color and more low-income students, where salaries are lower, and where working conditions are worse. These are frequently conditions that coexist. In schools with a majority of low-income students and students of color, turnover rates can be double the rates in schools with

more White students and fewer low-income students. These schools wind up with teachers who have fewer years of experience and, often, significantly less training to teach.

Teachers who enter the profession through alternative certification pathways are much more likely to leave their schools and the profession, especially when they teach in schools with high proportions of students of color. These teachers—who constituted 25% of entering teachers in 2012 and a higher share in schools with more students of color and students from low-income families—have had less coursework and student teaching, on average, than teachers who are prepared through traditional programs. This predicts high rates of leaving, even after controlling for other student and teacher characteristics and working conditions. Teachers of color and mathematics and science teachers are more likely to enter teaching through alternative pathways that typically provide less training. Ironically, while policymakers often seek to address shortages of mathematics and science teachers, as well as teachers of color, the use of shortcut training programs exacerbates the turnover that keeps shortages prevalent.

The factors that are associated with higher turnover rates for teachers generally likely also drive higher turnover rates of teachers of color. In addition to being more likely to enter teaching without having completed teacher preparation, teachers of color also disproportionately teach in school serving the most students of color and students from low-income families where lack of resources and poor working conditions can depress job satisfaction.

Other factors that are highly predictive of teacher turnover in statistically controlled models are lack of administrative support, maximum district salaries, school size, and the proportion of students of color. Teachers in districts with the highest salary scales, who are better prepared, and who feel the most supported by their school leaders, are least likely to leave their school or teaching altogether.

Policy Considerations

Retaining teachers requires a comprehensive approach that ensures teachers are well prepared for the challenges of teaching, compensates them adequately for their labor, and provides the teaching and learning environments that support their growth and help them to be effective. Policymakers should pursue strategies that can advance these goals in all schools, but especially in those where turnover rates are most extreme—schools serving students of color and students in poverty. We highlight policy considerations below that address the findings of this study.

Compensation

As in countries with well-developed teaching systems, states and districts should work to provide compensation packages that are competitive with those of other occupations requiring similar levels of education and that are equitable across districts, so all schools can compete in the labor market for well-prepared teachers.

Currently, salaries vary widely across and within states, and these differences are associated with both attrition rates and shortage levels (Sutcher, Darling-Hammond, & Carver-Thomas, this volume). Overall, however, teacher salaries have declined since the 1990s. Based on state reports, average U.S. teacher salaries in constant dollars were 1.7% lower in 2016-17 than in 1989-90 (US Department of Education, 2017). Further, some states—Alaska, Arizona, Colorado, Florida, Indiana, Kansas, Michigan, Virginia, and Wisconsin—saw considerable declines of 10% or more. While beginning teacher salaries may be more important for recruiting than retaining teachers, more generous district salary schedules do influence teacher retention decisions.

Federal and state governments can also provide other forms of compensation that reduce the debt burden of teaching, which is currently severe for most college students (Greenstone & Looney, 2013). Service scholarship and loan forgiveness programs that pay the cost of teacher preparation in exchange for a commitment to teach in a subject or location of need for 3–5 years can help retain teachers in two ways: (1) they provide the financial incentive for teachers to continue teaching, and (2) they draw prospective teachers into the workforce through high-quality preparation programs associated with greater teacher retention. Loan forgiveness and service scholarships can be particularly useful when targeted to the subjects and schools where teachers are least likely to be well prepared and where turnover is greatest: mathematics, science, special education, and in schools serving students of color and students in poverty.

Research shows that college students' potential debt burdens have an influence on their decisions about what profession to enter, and that these kinds of incentives are effective in recruiting and retaining individuals in teaching and other professions (Podolsky & Kini, 2016).

Teacher Preparation and Support

In teacher residency programs, based on the medical residency model, residents train in schools deemed high-needs by the district for an entire school year under the guidance and supervision of a master teacher, while earning a credential and a master's degree from a partnering university. Most programs offer tuition assistance and a stipend for living expenses, plus two years of mentoring after the training year.

In exchange, residents commit to teaching in the district for 3 to 5 years after their residency year. This has the triple benefit of filtering out candidates not willing to make a serious commitment to teach, ensuring that they are well prepared for the particular context in which they will teach, and continue to teach in high-needs schools as their effectiveness increases (Wiswall, 2013). Teacher residencies have been successful at recruiting teachers of color and mathematics and science teachers to high-need urban and rural districts, and yield above-average teacher retention rates even after 5 years (Boston Teacher Residency, 2016; Guha, Hyler, & Darling-Hammond, 2016; National Center for Teacher Residencies, 2016; Solomon, 2009).

Grow your own teacher preparation models create a pool of potential teachers by recruiting high school students, paraprofessionals, after-school program staff, or other local community members into teaching. These models capitalize on the fact that teachers are more likely to stay and continue teaching near where they grew up (Boyd, Lankford, Loeb, & Wyckoff, 2005; Reininger, 2012). Grow your own models often provide incentives to participants to pursue teacher training through the kind of high-quality preparation programs associated with improved teacher retention. For instance, California's Paraprofessional Teacher Training Program, funded from 1995 to 2011, successfully recruited, supported, and funded community college, bachelor's degrees, and teacher preparation expenses for more than 2,200 racially and linguistically diverse paraprofessionals to become fully certified teachers by 2014 (Commission on Teacher Credentialing, 2008; Podolsky, Kini, Bishop, & Darling-Hammond, 2016). The program was renewed in 2016.

Districts should provide high-quality mentoring and induction to beginning teachers, and in particular, should consider how these supports can meet the needs of a diverse workforce. Induction programs that include being assigned a mentor, meeting frequently, and focusing on high-leverage activities—observation and feedback; analyzing student strengths and needs; discussing instructional issues; and developing a professional growth plan—have been found to result in improved teacher retention (Picucci, 2016a, 2016b).

School Leadership

To develop strong school leaders, state policymakers, in partnership with local education agencies, school leadership training programs, and other key stakeholders, can develop rigorous training program accreditation and principal licensure standards aligned with research on effective school leadership, as well as systems for regular program review by qualified experts.

As provided in Title II of the Every Student Succeeds Act, federal and state governments can fund residencies for principal training and state leadership academies that coordinate mentoring and professional learning to develop school leadership capacity to build and nurture school settings that encourage teacher retention. These approaches have been found effective in developing leaders who both support effective teaching and enable stronger student learning (Darling-Hammond, LaPointe, Meyerson, Orr, & Cohen, 2007; Sutcher, Podolsky, & Espinoza, 2017).

Districts can also consider strategies for ensuring principals enter leadership positions with the skills needed to nurture positive school environments, such as partnering with local administrative credential programs to determine and support competencies participants need to develop; nominating and subsidizing teachers who show instructional leadership skills to pursue administrative credentials; nominating and training mentor principals to provide high-quality clinical training experiences; creating principal pipeline programs that focus on the skills administrators need to be effective as both assistant principals and principals; and assigning highly qualified and experienced administrators to the schools in need of the greatest support.

Conclusion

While recruiting teachers is a major concern during times of teacher shortages, doing so in ways that create more turnover needlessly inflates teacher demand, making it harder to solve shortages in the long run. Effectively retaining teachers is crucial to making sure there are enough well-prepared and committed teachers to staff all of our nation's schools and that the teachers in our classrooms have the time and experience to effectively serve all students. Tailored policy interventions can play a role in addressing the key factors that drive teachers from their schools, stabilizing and ultimately improving the teacher workforce so that it can serve all students well.

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Appendix

Measures

Age has a U-shaped relationship with turnover, and so we control for teachers younger than 30 and older than 50 (Ingersoll & May, 2011). School size is a measure of the number of students enrolled in a school during the base year and is measured as a categorical variable (bins of 49 from 1 to 199, bins of 149 to 499, bins of 249 to 999, then 1,000–1,199, 1,200–1,499, 1,500–1,999, and 2,000 or more students). Secondary school is an indicator variable that is 1 when the base year school is either a secondary school or includes middle or high school grades (i.e., 6–8, 8–12, 6–12, k–8 or k–12). The variable is 0 when the school is just an elementary school. Bivariate analyses of urbanicity detected a significant relationship between teaching in a city and higher turnover. City and rural teachers are included as control variables while teachers in suburbs and towns are omitted. For more information, please refer to Documentation to the NCES Common Core of Data Public Elementary/Secondary School Universe Survey: School Year 2009–10 (NCES 2008–332).

We divide all teachers into quartiles by the percentage of students eligible for the National School Lunch Program (NSLP) at their school. The bottom quartile of teachers teach at schools with the fewest eligible students, and the top quartile teach at schools with the most eligible students.

We also create a variable representing the percentage of students of color in a school, such that the bottom quartile of teachers teach in schools with the fewest students of color (less than 10%), and the top quartile of teachers teach in schools with the most students of color (greater than 55%). Students of color are non-White students in a school and include Asian American, Pacific Islander, Black, Latino, Native American, and multiracial students. Of course, these groups are heterogeneous both internally and across racial categories. However, we expect to find some similar trends among students of color. The students of color category yields a conservative estimate of some of those trends, which are more extreme when looking at outcomes concerning Black and Latino students alone.

The teachers of color variable is a self-reported indicator signifying a teacher identifies as non-White, including Asian American, Pacific Islander, Black, Latino, and Native American, or any combination, including one or more of those identifications. Non-Hispanic White teachers are represented as 0.

Alternative pathway is an indicator variable signifying a teacher reports s/he entered teaching through an alternative certification program and 0 if s/he indicates entering through a regular pathway. It should be noted that *regular pathway* and *regular certification* are not interchangeable terms. A teacher who enters teaching through an alternative pathway may eventually complete all the requirements to earn a regular certification but would still be an alternative pathway teacher.

For elementary school teachers and other self-contained classroom teachers, average class size is the mean of the class size that those teachers report in the base year. For secondary school teachers, average class size is the mean of the number of students they have in each class or section they teach in the base year. Push-in and pull-out teachers are excluded from this portion of the analysis, since they do not manage a full class in the same way that classroom teachers do. Self-contained special education classes are included in class size; however, we also control for a teacher's main assignment being special education. We divide average class size into quartiles from 12 to greater than 50 students.

We include a set of binary variables for main teaching subject according to teachers' self-reported main teaching subject. Humanities combines English and Social Studies. Mathematics and Science combines all mathematics and natural science subjects.

We create working condition constructs from survey responses, using Cronbach's alpha to combine multiple responses on the same topic. All Cronbach alphas are equal to at least 0.7. Variables include the following:

Administrative support is a construct that measures teacher attitudes on four questions about their administrator and is on a scale from 1 to 4, where 1 is the most favorable attitude toward their administrator and 4 is the least favorable attitude.

Student behavior problems is a construct created from seven survey responses about whether student behaviors are a problem (i.e., tardiness, misbehavior).

Parent support is a measure of whether teachers agree that they have the support they need from parents. A 1 means they strongly agree that they have parent support and 4 means that they strongly disagree.

Resources is a measure of whether teachers agree that resources are available to them in their school, where 1 means they strongly agree that they have resources available and 4 means they strongly disagree.

Interference is a measure of whether teachers believe that paperwork and other duties interfere with their teaching time. A 1 means they strongly disagree that paperwork and duties interfere with their teaching time and 4 means they strongly agree.

Collegiality is a construct that combines three survey questions that measure the degree to which staff collaborate and hold similar values and is scaled from 1 to 4. A 1 represents the most positive attitude of colleagues and 4 represents the least positive attitudes about colleagues.

Job security is a measure of how worried teachers are about their job security due to assessment and accountability measures. A 1 indicates that a teacher strongly disagrees that s/he is worried and 4 indicates that a teacher strongly agrees that s/he is worried about job security.

Classroom control and school influence are constructs created from six and seven survey questions, respectively, and measure the degree of either control or influence a teacher feels s/he has. A 1 represents having the most control or influence and 4 represents having none at all.

We also control for the lowest starting salary in the district and the highest possible salary in the district, based on district reports of average beginning salaries and the highest salaries offered. These data are reported by districts through the district SASS questionnaire and merged to teacher data files. We use the Comparable Wage Index, a measure of non-teaching professional salaries, controlling for age, education, and hours worked, to account for geographical variation in wages. The CWI can be used to adjust teacher salaries that may differ due to prevailing local wages—an indicator of cost of living. Each school district is linked to a labor market based on the Common Core of Data. For more details, see NCES documentation. (Taylor & Glander 2006). Finally, beginning and highest teacher salaries are divided into quintiles.

Our results are similar whether we include each working conditions as a separate variable in our model or create a construct where working conditions vary from worst working conditions overall to best working conditions overall.

Table 1
Independent Variable Means for Teachers Overall and Teacher Subgroups

Independent variables	Overall		Mathematics and science		Special education		Teachers of color		Alternative pathway	
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
School size	7.50	2.17	8.23	2.84	7.36	2.22	7.82	1.84	7.95	2.26
Secondary school	0.37	0.48	0.62	0.58	0.36	0.49	0.34	0.40	0.48	0.49
Quartile % NSLP eligible	1.67	1.15	1.55	1.37	1.74	1.15	2.26	0.86	1.95	1.08
Quartile % students of color	1.82	1.11	1.77	1.33	1.84	1.12	2.68	0.56	2.20	0.99
Quartile class size	1.62	1.15	1.58	1.18	1.80	1.78	1.57	0.94	1.55	1.12
Rural	0.29	0.45	0.30	0.55	0.27	0.45	0.18	0.32	0.26	0.43
City	0.27	0.44	0.25	0.52	0.28	0.46	0.45	0.42	0.35	0.46
Female	0.76	0.43	0.64	0.57	0.86	0.35	0.74	0.37	0.69	0.45
Older than 50	0.28	0.45	0.24	0.51	0.30	0.47	0.26	0.37	0.23	0.41
Younger than 30	0.15	0.36	0.17	0.45	0.16	0.37	0.13	0.28	0.14	0.34
Teacher of color	0.18	0.38	0.17	0.45	0.18	0.39	1.00	0.00	0.31	0.45
Alternative pathway teacher	0.15	0.35	0.21	0.49	0.17	0.38	0.25	0.36	1.00	0.00
Total years of experience	13.76	9.35	12.97	10.89	12.90	9.55	12.17	7.24	9.05	6.19
Mathematics and science	0.16	0.37	1.00	0.00	(omitted)	(omitted)	0.15	0.30	0.23	0.41
Humanities	0.17	0.38	(omitted)		(omitted)	(omitted)	0.16	0.31	0.18	0.37
Special education	0.12	0.33	(omitted)		1.00	0.00	0.12	0.27	0.15	0.34
English language development	0.02	0.13	(omitted)		(omitted)	(omitted)	0.04	0.17	0.02	0.13
Arts	0.05	0.22	(omitted)		(omitted)	(omitted)	0.03	0.13	0.04	0.19
Foreign languages	0.03	0.16	(omitted)		(omitted)	(omitted)	0.06	0.19	0.04	0.19
Physical education	0.05	0.22	(omitted)		(omitted)	(omitted)	0.05	0.19	0.04	0.18
Career technical education	0.04	0.21	(omitted)		(omitted)	(omitted)	0.03	0.15	0.08	0.26
Miscellaneous	0.00	0.06	(omitted)		(omitted)	(omitted)	0.01	0.08	0.01	0.08

Table 1 (Cont'd)
Independent Variable Means for Teachers Overall and Teacher Subgroups

Independent variables	Overall		Mathematics and science		Special education		Teachers of color		Alternative pathway	
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Administrative support	1.82	0.79	1.90	0.94	1.78	0.78	1.84	0.70	1.87	0.81
Student behavior	2.10	0.74	2.36	0.89	2.05	0.75	2.16	0.64	2.24	0.74
Parent support	2.44	0.91	2.60	1.05	2.41	0.92	2.51	0.80	2.57	0.91
Resources	1.86	0.87	1.84	1.04	1.93	0.90	1.96	0.78	1.96	0.90
Interferences	2.89	0.92	2.86	1.06	3.08	0.90	2.90	0.79	2.88	0.89
Collegiality	1.91	0.72	2.04	0.85	1.91	0.70	1.97	0.65	2.02	0.74
Job security	2.31	1.00	2.35	1.19	2.35	1.01	2.40	0.86	2.37	0.99
Control	1.67	0.64	1.68	0.71	1.64	0.65	1.72	0.55	1.73	0.65
Influence	2.88	0.70	2.91	0.80	2.85	0.69	2.87	0.65	2.97	0.69
District beginning salary	2.07	1.39	2.06	1.67	2.09	1.40	2.24	1.10	2.16	1.36
District highest salary	2.06	1.43	2.05	1.74	2.15	1.45	1.94	1.17	1.74	1.39

Table 2
Logistic Regression Odds Ratios: Probability of Teachers Moving or Leaving

Independent variables	Odds ratio	Standard error
School size	0.92***	*-0.02*
Secondary school	0.89	*-0.1*
2nd quartile % eligible for NSLP	1.06	*-0.13*
3rd quartile % eligible for NSLP	0.99	*-0.12*
Top quartile % eligible for NSLP	1.09	*-0.13*
2nd quartile % students of color enrolled	1.14	*-0.12*
3rd quartile % students of color enrolled	1.48**	*-0.19*
Top quartile % students of color enrolled	1.52**	*-0.2*
Average class size	1.04	*-0.04*
Rural	0.98	*-0.08*
City	1.07	*-0.12*
Female	0.98	*-0.1*
Older than 50	1.40**	*-0.15*
Younger than 30	2.23***	*-0.24*
Teacher of color	1.08	*-0.14*
Alternative pathway	1.25**	*-0.13*
Total years of experience	1	*-0.01*
Mathematics and science	1.37**	*-0.16*
Humanities	1.21	*-0.14*
Special education	1.45**	*-0.21*
English language development	1.38	-0.7
Arts	1.26	*-0.2*
Foreign languages	1.91**	*-0.4*
Physical education	1.41	*-0.33*
Career technical education	1.44	*-0.3*
Miscellaneous	1.28	*-0.85*
Administrative support: somewhat agree	1.14	*-0.11*
Administrative support: somewhat disagree	1.30**	*-0.16*
Administrative support: strongly disagree	2.63***	*-0.61*
Student behavior problems	1.05	*-0.07*
Lack of parent support	1.03	*-0.06*
Lack of resources	1.01	*-0.05*
Teaching interferences	1.01	*-0.05*
Lack of collegiality	1.04	*-0.07*
Lack of job security	0.94	*-0.04*
Lack of classroom control	1.15	-0.08

Table 2 (Cont'd)
Logistic Regression Odds Ratios: Probability of Teachers Moving or Leaving

Independent variables	Odds ratio	Standard error
Lack of school influence	1.12	-0.07
Beginning salary ($32.000–34,000)	0.93	-0.11
Beginning salary ($34,000–36,000)	0.95	-0.12
Beginning salary ($36,000–41,000)	1.03	-0.11
Beginning salary (Greater than $41,000)	1.03	-0.14
Highest salary ($60,000–66,000)	0.91	-0.11
Highest salary ($66,000–72,000)	0.84	-0.1
Highest salary ($72,000–78,000)	0.78**	-0.09
Highest salary (Greater than $78,000)	0.66**	-0.09
Constant	0.063***	-0.0187
Observations	26,916	
Population size	2,473,469	
McKelvey & Zavoina's R^2	0.89	

Note: *** $p<0.001$, ** $p<0.01$, * $p<0.05$

About the Authors

Desiree Carver-Thomas
Learning Policy Institute
dcarverthomas@learningpolicyinstitute.org
Desiree Carver-Thomas is a Research and Policy Associate on LPI's Educator Quality Team. She is the lead author of *Addressing California's Growing Teacher Shortage: 2017 Update* and *Teacher Turnover: Why it Matters and What we can Do about It.* Previously, she taught in New York City public schools, and consulted on strategies for diverting recidivism and implementing a full-service community schools initiative.

Linda Darling-Hammond
Learning Policy Institute
ldh@learningpolicyinstitute.org
Linda Darling-Hammond is President of the Learning Policy Institute and Charles E. Ducommun Professor of Education Emeritus at Stanford University. She was principal investigator for the team that designed the federal Schools and Staffing Surveys and has conducted extensive research on issues of educator supply, demand, and quality. Among her award-winning publications in this area are the 1996 report of the National Commission on Teaching and America's Future, *What Matters Most: Teaching for America's Future*; *Teaching as the Learning Profession*; and *Preparing Teachers for a Changing World: What Teachers Should Learn and Be Able to Do.*

About the Guest Editors

Linda Darling-Hammond
Learning Policy Institute
ldh@learningpolicyinstitute.org
Dr. Linda Darling-Hammond is President of the Learning Policy Institute and Charles E. Ducommun Professor of Education Emeritus at Stanford University. She has conducted extensive research on issues of educator supply, demand, and quality. Among her award-winning publications in this area are *What Matters Most: Teaching for America's Future; Teaching as the Learning Profession; Powerful Teacher Education;* and *Preparing Teachers for a Changing World: What Teachers Should Learn and Be Able to Do.*

Anne Podolsky
Learning Policy Institute
apodolsky@learningpolicyinstitute.org
Anne Podolsky is a Researcher and Policy Analyst at the Learning Policy Institute. Her research focuses on improving educational opportunities and outcomes, especially for students from underserved communities.

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Please send errata notes to Audrey Amrein-Beardsley at audrey.beardsley@asu.edu

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