

# Teacher Retention: Evidence to Inform Policy

*Policy Brief*  
*Veronica Katz, Ph.D*



UNIVERSITY  
*of* VIRGINIA

CURRY SCHOOL *and*  
BATTEN SCHOOL  
EdPolicyWorks

*This Policy Brief was prepared for Virginia's Teacher Retention Summit,  
held in Charlottesville on October 23, 2018.*

EdPolicyWorks  
University of Virginia  
PO Box 400879  
Charlottesville, VA 22904

EdPolicyWorks policy brief retrieved from:  
<https://curry.virginia.edu/policy-virginia>

# **Teacher Retention: Evidence to Inform Policy**

## **Policy Brief**

### **Introduction**

In 2017, Governor McAuliffe appointed a committee to examine Virginia's teacher shortages. The committee identified teacher turnover as one of the key factors contributing to Virginia's teacher shortages (Advisory Committee on Teacher Shortages, 2017). Virginia is not alone in its concerns about teacher shortages and teacher turnover (Dee & Goldhaber, 2017; Papay, Bacher-Hicks, Page, & Marinell, 2017), nor are these concerns new (Ingersoll, 2001; Murnane, Singer, Willett, Kemple, & Olsen, 1991). School leaders and policymakers have long been concerned about recruiting and retaining qualified teachers in certain schools and subject areas, but these concerns have heightened in recent years as the labor market for all workers has tightened and the options available to prospective teachers have increased.

Teacher shortages are largely focused in some schools and subjects. While most schools are able to fill vacancies in most subjects, it is particularly challenging to recruit teachers to schools with concentrations of high-poverty, low-performing students and teachers with STEM (i.e., science, technology, engineering, and math), special education and English language learner certifications (Dee & Goldhaber, 2017). Understanding the nature of teacher shortages has important implications for teacher retention policies.

School leaders and policy makers in the Commonwealth are increasingly interested in understanding strategies to reduce teacher turnover for many reasons. Most importantly, increasing evidence finds that teacher turnover typically leads to reductions in student achievement (Boyd, Lankford, Loeb, & Wyckoff, 2005; Guin, 2004; Ronfeldt, Loeb, & Wyckoff, 2013). Teacher turnover disrupts the professional networks in schools, which have been shown to affect teacher morale and effectiveness (Jackson & Bruegmann, 2009). Finally, recruiting new teachers is costly (Milanowski & Odden, 2007).

This policy brief summarizes the available evidence on the policy relevant factors that affect teacher turnover. While this review is comprehensive, we focus on working conditions and compensation schemes that have been shown to impact teacher retention. These factors, summarized in Figure 1, point to several changes school and district leaders can adopt to improve teacher retention.

### **Sources of Evidence**

Our understanding of teacher turnover comes from two primary sources of information regarding teacher employment decisions: personnel data (usually for an entire state) that allow us to connect teacher retention decisions to attributes of the divisions and schools in which teachers work, and teacher surveys (e.g., nationally representative surveys like the Schools and Staffing Survey and the Teacher Follow-Up Survey, as well as surveys administered by districts and states). Each of these data sources have distinct advantages as well as limitations. Most valuable is a synthesis of evidence from several sources and methods. When such a synthesis yields

consistent findings, our confidence in policy built on such findings substantially increases. When findings differ, heavier weight should be afforded to evidence that is better able to rule out competing explanations. We review the available research evidence on teacher retention, beginning with a discussion of the nature of the teacher retention problem. We then examine the evidence on interventions that address these problems.

## **Teacher Turnover**

The extent to which teacher turnover is problematic may depend on one's perspective. Teacher transfers are likely a problem for principals in the exiting schools, but may be viewed differently by a superintendent if that teacher transfers to another school in the division rather than leaving the division. Similarly, mobility across schools is different from attrition from the profession.<sup>1</sup> Likewise, the exit of a teacher who is relatively weak, perhaps because they were counseled out of the school, is viewed quite differently than if a highly-valued teacher were to leave. Thus, ideally our discussion of teacher retention is a nuanced one that distinguishes the type of mobility (i.e., from the school, the division or the state) and the effectiveness of the teacher.

Understanding the causes of different types of mobility will provide insight to policies to increase teacher retention. For instance, high rates of cross-district mobility might suggest that teachers are moving across districts in pursuit of better compensation or different working conditions. On the other hand, high rates of mobility within a district may be correlated with differences in working conditions, given that compensation generally does not vary within a district.

As mentioned above, some turnover can be beneficial. In particular, the quality of the teacher workforce will improve if low-performing teachers leave the profession and are replaced with higher-performing teachers. However, both of these conditions must be met for turnover to yield a net benefit with respect to teacher quality. That is, teacher quality is unlikely to improve if schools simply redistribute low-performing teachers, nor will teacher quality improve if schools replace low-performing teachers with other low-performing teachers. Improving the hiring process is therefore an important correlate of improving teacher quality via selective retention.

## **Teacher Attributes**

A large body of evidence documents the characteristics of teachers who are most likely to turnover. With respect to both age and experience, teacher mobility and attrition follow a u-shaped pattern: younger and older teachers are more likely to turnover relative to middle-aged teachers (Allensworth, Ponisciak, & Mazzeo, 2009; Guarino, Santibañez, & Daley, 2006; Johnson, Berg, & Donaldson, 2005); similarly, novice teachers turnover at higher rates relative to more experienced colleagues who are not yet eligible to retire, and turnover rates increase once again as veteran teachers approach retirement (Allensworth et al., 2009; Ingersoll, 2001; Marvel, Lyter, Peltola, Strizek, & Morton, 2007). Turnover among novice teachers is of particular concern because effectiveness improves rapidly among early career teachers (Boyd,

---

<sup>1</sup> Beyond attrition and mobility, there are other types of teacher turnover that are less frequent and often harder to track, such as movement to a non-teaching school-based position.

Lankford, Loeb, Rockoff, & Wyckoff, 2008; Harris & Sass, 2011; Rivkin, Hanushek, & Kain, 2005; Rockoff, 2004). In other words, when schools lose a large proportion of their early career teachers, they also lose a significant portion of their talent pipeline.

High turnover rates among novice teachers are further compounded by the pathways teachers follow into the profession, as novice teachers who enter the profession through an alternate certification program like Teach for America (TFA) are more likely to turnover relative to teachers who follow a traditional preparation route (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2006; Kane, Rockoff, & Staiger, 2008). Additionally, there is evidence that teachers hired after the start of the school year are more likely to turnover relative to on-time hires (Papay & Kraft, 2016).

There are two additional trends that run somewhat contrary to each other: whereas more qualified teachers (as measured by their certification exam scores and the ranking of their undergraduate institution) are more likely to leave the profession (Boyd et al., 2005), more effective teachers (as measured by student achievement gains) are less likely to turnover (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2008; Boyd, Lankford, Loeb, Ronfeldt, & Wyckoff, 2011b; Goldhaber, Gross, & Player, 2011; Hanushek, Kain, & Rivkin, 2004). A leading hypothesis consistent with these somewhat conflicting trends is that more qualified teachers exit because their qualifications are more highly valued in other professions, whereas effective teachers tend to remain in the profession because they derive satisfaction from their success with their students.

### **Student Attributes**

The negative effects of teacher turnover are generally exacerbated by the high rates of attrition among teachers in schools with higher concentrations of low-income, low-performing, minority students (Allensworth et al., 2009; Boyd et al., 2005; Hanushek et al., 2004; Scafidi, Sjoquist, & Stinebrickner, 2007). This trend is especially problematic because the most disadvantaged students confront the highest rates of teacher turnover. However, studies that have delved deeper into these trends find that school working conditions explain much of the variation in teacher turnover. That is, schools serving high concentrations of low-income, low-performing, minority students tend to have less desirable working conditions, and these working conditions are strongly associated with teacher employment decisions. As one study aptly summarizes, “teachers who leave high-poverty schools are not fleeing their students. Rather, they are fleeing the poor working conditions that make it difficult for them to teach and for their students to learn” (Simon & Johnson, 2015, p. 1). The next section discusses the working conditions that influence teacher employment decisions.

### **School Attributes**

The context, culture and policies of schools have all been associated with teacher attrition. Surveys of teachers employing national data, as well as data from several states and school districts, examine how teachers’ perceptions of their working conditions affect retention (Allensworth et al., 2009; Boyd, Grossman, et al., 2011; Grissom, 2011; Johnson, Kraft, & Papay, 2012; Ladd, 2011; Loeb, Darling-Hammond, & Luczak, 2005). Collectively, they identify

several malleable aspects of schools relevant to policies intended to improve teacher retention, including: the quality of school leadership, the sense of trust and collective responsibility that administrators and teachers share, teacher self-efficacy, as well as student behavior and related disciplinary policies. Clearly, these factors are often closely related to each other. Across surveys, school leadership typically emerges as the most salient factor, while collegial relationships among staff and resource considerations are also significant predictors of teacher turnover.

Many studies have even been able to home in on specific practices school leaders can employ to improve teacher retention. Specifically, school leaders build trust and increase teacher satisfaction by giving teachers more autonomy (Grissom, 2011; Johnson, 2006), supporting teacher development (Grissom, 2011), including teachers in decision-making (Allensworth et al., 2009; Ingersoll, 2001), helping teachers connect with parents (Allensworth et al., 2009), and recognizing strong teachers (TNTP, 2012). In turn, these practices are associated with improved teacher retention. Given mounting evidence linking school leaders to improved teacher retention, it makes a lot of sense to continue investigating what principals do to improve teacher retention, while also investing in efforts to place a strong leader in every school.

In addition, teachers who are satisfied with their school facilities and access to resources, like textbooks, are more likely to continue teaching (Loeb et al., 2005). Thus, ensuring access to adequate physical and material resources is a first step toward improving teacher retention. Another basic condition related to teacher turnover is safety and discipline: teacher turnover is more common in schools that have poor safety and little discipline (Allensworth et al., 2009; Boyd, Lankford, Loeb, Ronfeldt, & Wyckoff, 2011a; Grissom, 2011; Ingersoll, 2001).

## **Compensation**

An extensive literature suggests that teachers' employment decisions are sensitive to compensation. Across a variety of contexts, researchers have documented higher rates of teacher turnover in schools with lower salaries (Baugh & Stone, 1982; Dolton & van der Klaauw, 1995, 1999; Hanushek et al., 2004; Imazeki, 2005; Ingersoll, 2001; Kirby, Berends, & Naftel, 1999; Loeb & Reininger, 2004; Murnane & Olsen, 1989, 1990). However, researchers have also pointed out that teacher salaries would have to increase substantially to influence teacher retention decisions (Dee & Goldhaber, 2017). While modest across-the-board raises may be warranted for other reasons, they are unlikely to meaningfully address the teacher retention issue. Thus, rather than offering an undifferentiated salary increase, it is more cost-effective to offer financial incentives targeting the teachers who are most likely to turnover and the positions that are hardest to fill.

There is substantial evidence that teachers respond to targeted financial incentives. For example, North Carolina offered secondary math, science and special education teachers an \$1800 bonus to remain in schools with large percentages of poor or low-achieving students. Researchers found this incentive reduced attrition by an average of 17 percent (Clotfelter, Glennie, Ladd, & Vigdor, 2008). Similarly, Tennessee offered a \$5000 bonus to high-performing teachers in low-achieving schools. The program is estimated to have improved retention of teachers in tested grades and subjects by 20 percent (Springer, Swain, & Rodriguez, 2016). In another example, Chicago

Public Schools employed performance-based bonuses that ranged between \$1100 and \$2500, with larger incentives for teachers selected as mentors. Teachers in participating schools were 20 percent more likely to remain in those schools three years later than teachers in schools without the bonuses (Glazerman & Seifullah, 2012).

In perhaps the most relevant evidence, researchers examined Florida's Critical Teacher Shortage Program, which provides direct payments and loan forgiveness to early career teachers who were certified and taught in critical shortage subject areas. They found that relatively modest payments of \$500 to \$1000 substantially reduced teacher attrition, in some cases by as much as 25 percent. For some subjects, such as special education, payments of \$2500 appear to be necessary. The evidence also suggests that direct payments are more cost-effective than loan forgiveness. This research has important implications for policy in Virginia. (Feng & Sass, 2018)

### **Implications for Policy**

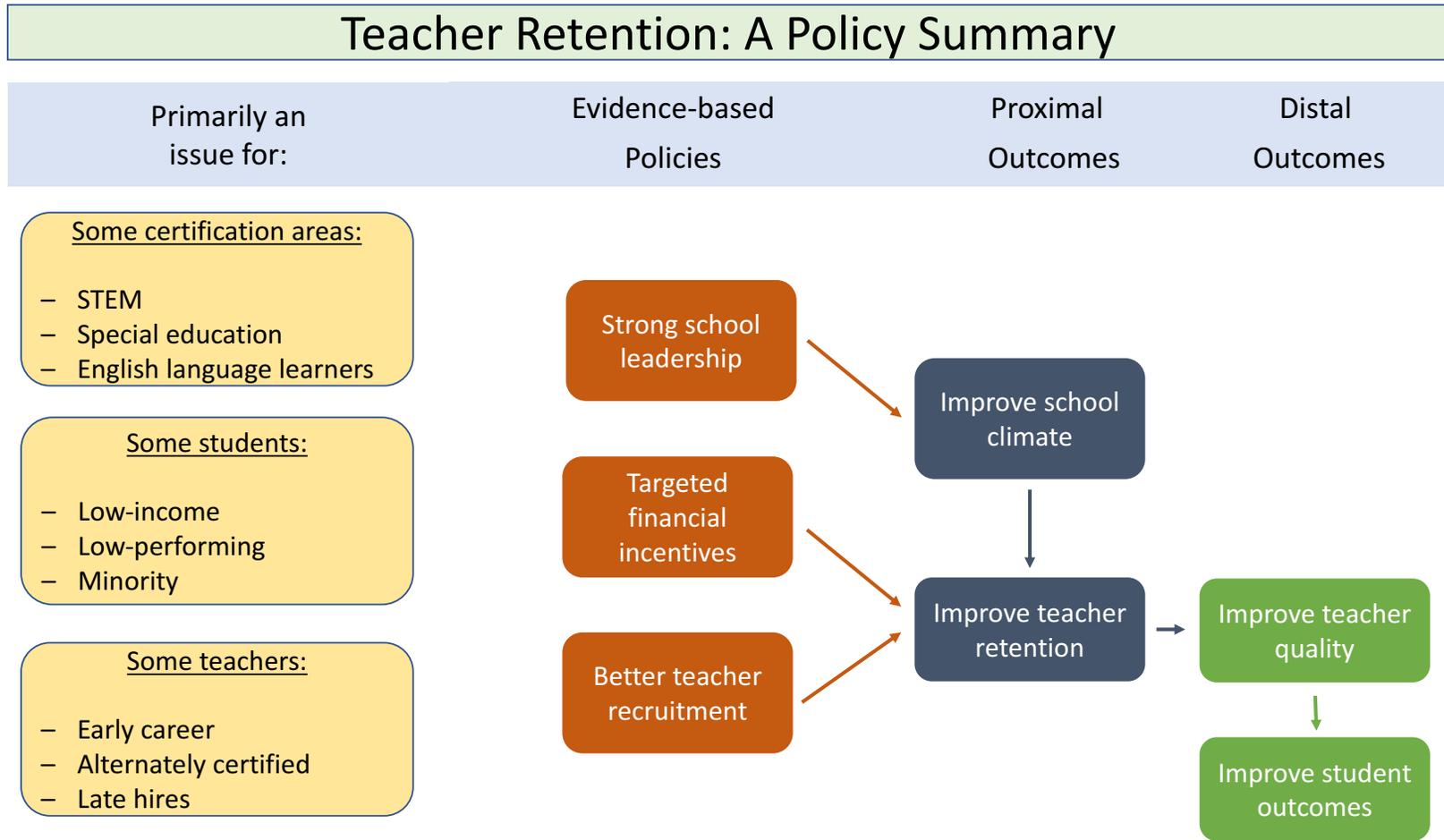
Many factors influence teacher retention decisions. This policy brief has summarized the evidence linking teacher, student, school, and labor market attributes to teacher turnover. Ultimately, understanding the landscape of teacher turnover can help policy makers and school leaders make informed decisions about how to stem undesirable teacher turnover. Given the resource limitations confronting all school systems, this policy brief makes the following evidence-based recommendations:

- (1) ***Focus retention efforts on novice teachers***, especially those who show early signs of promise. Because turnover is highest among early career teachers, focusing retention efforts on these teachers in effect “plugs the leakiest pipe.”
- (2) ***Differentiate pay***. Given Virginia's concern with staffing high-need areas, it makes good sense to offer additional compensation to teachers willing to fill these high-need positions. As mentioned above, prior research documents improved retention in response to financial incentives offered to teachers who are certified to teach STEM, special education and in some cases English language learners. The evidence also supports incentives to teach in high-need schools.
- (3) ***Build a cadre of excellent principals***. Teachers are more likely to continue teaching in schools with strong school leaders who build a culture of trust and increase teacher satisfaction.

It is important to note that these recommendations are mutually reinforcing and can be pursued simultaneously. For instance, divisions could opt to offer additional compensation to novice teachers assigned to high-need positions. Moreover, there is good evidence to suggest that most principals can identify their strongest teachers (Jacob & Lefgren, 2008) and that teachers value recognition from their principal (TNTP, 2012). This suggests that strong principals can flag their most effective teachers, which could in turn help refine and reinforce retention efforts.

In closing, the research summarized in this policy brief points to promising practices that school and district leaders can employ to improve teacher retention.

**Figure 1. Policies to Improve Teacher Retention**



## References

- Advisory Committee on Teacher Shortages. (2017). *Preliminary Report from the Advisory Committee on Teacher Shortages*. Retrieved from <https://www.education.virginia.gov/media/governorvirginiagov/secretary-of-education/pdf/final-acts-report.pdf>
- Allensworth, E., Ponisciak, S., & Mazzeo, C. (2009). *The Schools Teachers Leave: Teacher Mobility in Chicago Public Schools*. Consortium on Chicago School Research. Retrieved from <https://eric.ed.gov/?id=ED505882>
- Baugh, W. H., & Stone, J. A. (1982). Mobility and wage equilibration in the educator labor market. *Economics of Education Review*, 2(3), 253–274.
- Boyd, D. J., Grossman, P. L., Ing, M., Lankford, H., Loeb, S., & Wyckoff, J. (2011). The Influence of School Administrators on Teacher Retention Decisions. *American Educational Research Journal*, 48(2), 303–333. <https://doi.org/10.3102/0002831210380788>
- Boyd, D. J., Grossman, P. L., Lankford, H., Loeb, S., & Wyckoff, J. (2006). How Changes in Entry Requirements Alter the Teacher Workforce and Affect Student Achievement. *Education Finance and Policy*, 1(2), 176–216. <https://doi.org/10.1162/edfp.2006.1.2.176>
- Boyd, D. J., Grossman, P. L., Lankford, H., Loeb, S., & Wyckoff, J. (2008). *Who Leaves? Teacher Attrition and Student Achievement* (Working Paper No. 14022). Cambridge, MA: National Bureau of Economic Research. Retrieved from <http://www.nber.org/papers/w14022>
- Boyd, D. J., Lankford, H., Loeb, S., Rockoff, J., & Wyckoff, J. (2008). The narrowing gap in New York City teacher qualifications and its implications for student achievement in high-poverty schools. *Journal of Policy Analysis and Management*, 27(4), 793–818. <https://doi.org/10.1002/pam.20377>
- Boyd, D. J., Lankford, H., Loeb, S., Ronfeldt, M., & Wyckoff, J. (2011a). The Effect of School Neighborhoods on Teachers' Career Decisions. In G. J. Duncan & R. J. Murnane (Eds.), *Wither Opportunity? Rising Inequality, Schools, and Children's Life Chances* (pp. 377–395). New York, NY.
- Boyd, D. J., Lankford, H., Loeb, S., Ronfeldt, M., & Wyckoff, J. (2011b). The role of teacher quality in retention and hiring: Using applications to transfer to uncover preferences of teachers and schools. *Journal of Policy Analysis and Management*, 30(1), 88–110. <https://doi.org/10.1002/pam.20545>
- Boyd, D. J., Lankford, H., Loeb, S., & Wyckoff, J. (2005). Explaining the Short Careers of High-Achieving Teachers in Schools with Low-Performing Students. *American Economic Review*, 95(2), 166–171. <https://doi.org/10.1257/000282805774669628>

- Clotfelter, C. T., Glennie, E., Ladd, H. F., & Vigdor, J. L. (2008). Would higher salaries keep teachers in high-poverty schools? Evidence from a policy intervention in North Carolina. *Journal of Public Economics*, 92(5–6), 1352–1370. <https://doi.org/10.1016/j.jpubeco.2007.07.003>
- Dee, T. S., & Goldhaber, D. (2017). *Understanding and Addressing Teacher Shortages in the United States* (Policy Proposal No. 2017–05). Washington, D.C.: The Hamilton Project.
- Dolton, P., & van der Klaauw, W. (1995). Leaving Teaching in the UK: A Duration Analysis. *The Economic Journal*, 105(429), 431–444. <https://doi.org/10.2307/2235502>
- Dolton, P., & van der Klaauw, W. (1999). The Turnover of Teachers: A Competing Risks Explanation. *Review of Economics and Statistics*, 81(3), 543–550. <https://doi.org/10.1162/003465399558292>
- Feng, L., & Sass, T. R. (2018). The Impact of Incentives to Recruit and Retain Teachers in “Hard-to-Staff” Subjects. *Journal of Policy Analysis and Management*, 37(1), 112–135. <https://doi.org/10.1002/pam.22037>
- Glazerman, S., & Seifullah, A. (2012). *An Evaluation of the Chicago Teacher Advancement Program (Chicago TAP) after Four Years. Final Report* (Mathematica Reference No. 06736–520). Mathematica Policy Research, Inc. Retrieved from <http://eric.ed.gov/?id=ED530098>
- Goldhaber, D., Gross, B., & Player, D. (2011). Teacher career paths, teacher quality, and persistence in the classroom: Are public schools keeping their best? *Journal of Policy Analysis and Management*, 30(1), 57–87. <https://doi.org/10.1002/pam.20549>
- Grissom, J. A. (2011). Can good principals keep teachers in disadvantaged schools? Linking principal effectiveness to teacher satisfaction in hard-to-staff environments. *Teachers College Record*, 113(11), 2552–2585.
- Guarino, C. M., Santibañez, L., & Daley, G. A. (2006). Teacher Recruitment and Retention: A Review of the Recent Empirical Literature. *Review of Educational Research*, 76(2), 173–208. <https://doi.org/10.3102/00346543076002173>
- Guin, K. (2004). Chronic Teacher Turnover in Urban Elementary Schools. *Education Policy Analysis Archives*, 12(0), 42. <https://doi.org/10.14507/epaa.v12n42.2004>
- Hanushek, E. A., Kain, J. F., & Rivkin, S. G. (2004). Why public schools lose teachers. *Journal of Human Resources*, XXXIX(2), 326–354. <https://doi.org/10.3368/jhr.XXXIX.2.326>
- Harris, D. N., & Sass, T. (2011). Teacher training, teacher quality and student achievement. *Journal of Public Economics*, 95(7–8), 798–812. <https://doi.org/10.1016/j.jpubeco.2010.11.009>

- Imazeki, J. (2005). Teacher salaries and teacher attrition. *Economics of Education Review*, 24(4), 431–449. <https://doi.org/10.1016/j.econedurev.2004.07.014>
- Ingersoll, R. M. (2001). Teacher Turnover and Teacher Shortages: An Organizational Analysis. *American Educational Research Journal*, 38(3), 499–534. <https://doi.org/10.3102/00028312038003499>
- Jackson, C. K., & Bruegmann, E. (2009). Teaching Students and Teaching Each Other: The Importance of Peer Learning for Teachers. *American Economic Journal: Applied Economics*, 1(4), 85–108. <https://doi.org/10.1257/app.1.4.85>
- Jacob, B. A., & Lefgren, L. (2008). Can Principals Identify Effective Teachers? Evidence on Subjective Performance Evaluation in Education. *Journal of Labor Economics*, 26(1), 101–136. <https://doi.org/10.1086/522974>
- Johnson, S. M. (2006). *The Workplace Matters: Teacher Quality, Retention, and Effectiveness* (Working Paper). Washington, D.C.: National Education Association. Retrieved from <https://files.eric.ed.gov/fulltext/ED495822.pdf>
- Johnson, S. M., Berg, J. H., & Donaldson, M. L. (2005). *Who Stays in Teaching and Why: A Review of the Literature on Teacher Retention*. Harvard Graduate School of Education: The Project on the Next Generation of Teachers. Retrieved from [http://assets.aarp.org/www.aarp.org/\\_articles/NRTA/Harvard\\_report.pdf](http://assets.aarp.org/www.aarp.org/_articles/NRTA/Harvard_report.pdf)
- Johnson, S. M., Kraft, M. A., & Papay, J. P. (2012). How context matters in high need schools: The effects of teachers' working conditions on their professional satisfaction and their students' achievement. *Teachers College Record*, 114(10), 1–39.
- Kane, T. J., Rockoff, J. E., & Staiger, D. O. (2008). What does certification tell us about teacher effectiveness? Evidence from New York City. *Economics of Education Review*, 27(6), 615–631. <https://doi.org/10.1016/j.econedurev.2007.05.005>
- Kirby, S. N., Berends, M., & Naftel, S. (1999). Supply and Demand of Minority Teachers in Texas: Problems and Prospects. *Educational Evaluation and Policy Analysis*, 21(1), 47–66. <https://doi.org/10.3102/01623737021001047>
- Ladd, H. F. (2011). Teachers' Perceptions of Their Working Conditions: How Predictive of Planned and Actual Teacher Movement? *Educational Evaluation and Policy Analysis*, 33(2), 235–261. <https://doi.org/10.3102/0162373711398128>
- Loeb, S., Darling-Hammond, L., & Luczak, J. (2005). How Teaching Conditions Predict Teacher Turnover in California Schools. *Peabody Journal of Education*, 80(3), 44–70. [https://doi.org/10.1207/s15327930pje8003\\_4](https://doi.org/10.1207/s15327930pje8003_4)

- Loeb, S., & Reininger, M. (2004). *Public Policy and Teacher Labor Markets. What We Know and Why It Matters*. The Education Policy Center at Michigan State University. Retrieved from <http://eric.ed.gov/?id=ED485592>
- Marvel, J., Lyter, D. M., Peltola, P., Strizek, G. A., & Morton, B. A. (2007). *Teacher Attrition and Mobility: Results From the 2004-05 Teacher Follow-up Survey*. [NCES]. Washington, D.C.: U.S. Department of Education, National Center for Education Statistics. <https://doi.org/10.1037/e609712011-008>
- Milanowski, A. T., & Odden, A. R. (2007). *A New Approach to the Cost of Teacher Turnover* (Working Paper No. 13). Seattle, WA: School Finance Redesign Project, Center on Reinventing Public Education. Retrieved from [https://www.crpe.org/sites/default/files/wp\\_sfrp13\\_milanowskiodden\\_aug08\\_0.pdf](https://www.crpe.org/sites/default/files/wp_sfrp13_milanowskiodden_aug08_0.pdf)
- Murnane, R. J., & Olsen, R. J. (1989). The Effect of Salaries and Opportunity Costs on Duration in Teaching: Evidence from Michigan. *The Review of Economics and Statistics*, 71(2), 347–352. <https://doi.org/10.2307/1926983>
- Murnane, R. J., & Olsen, R. J. (1990). The Effects of Salaries and Opportunity Costs on Length of Stay in Teaching: Evidence from North Carolina. *The Journal of Human Resources*, 25(1), 106–124. <https://doi.org/10.2307/145729>
- Murnane, R. J., Singer, J. H., Willett, J. B., Kemple, J. R., & Olsen, R. J. (1991). *Who Will Teach? Policies that Matter* (First Edition). Harvard University Press.
- Papay, J. P., Bacher-Hicks, A., Page, L. C., & Marinell, W. H. (2017). The Challenge of Teacher Retention in Urban Schools: Evidence of Variation From a Cross-Site Analysis. *Educational Researcher*, 46(8), 434–448. <https://doi.org/10.3102/0013189X17735812>
- Papay, J. P., & Kraft, M. A. (2016). The Productivity Costs of Inefficient Hiring Practices: Evidence From Late Teacher Hiring. *Journal of Policy Analysis and Management*, 35(4), 791–817. <https://doi.org/10.1002/pam.21930>
- Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, Schools, and Academic Achievement. *Econometrica*, 73(2), 417–458. <https://doi.org/10.1111/j.1468-0262.2005.00584.x>
- Rockoff, J. E. (2004). The Impact of Individual Teachers on Student Achievement: Evidence from Panel Data. *The American Economic Review*, 94(2), 247–252.
- Ronfeldt, M., Loeb, S., & Wyckoff, J. (2013). How Teacher Turnover Harms Student Achievement. *American Educational Research Journal*, 50(1), 4–36. <https://doi.org/10.3102/0002831212463813>

- Scafidi, B., Sjoquist, D. L., & Stinebrickner, T. R. (2007). Race, poverty, and teacher mobility. *Economics of Education Review*, 26(2), 145–159. <https://doi.org/10.1016/j.econedurev.2005.08.006>
- Simon, N. S., & Johnson, S. M. (2015). Teacher Turnover in High-Poverty Schools: What We Know and Can Do. *Teachers College Record*, 117(3).
- Springer, M. G., Swain, W. A., & Rodriguez, L. A. (2016). Effective Teacher Retention Bonuses: Evidence From Tennessee. *Educational Evaluation and Policy Analysis*, 38(2), 199–221. <https://doi.org/10.3102/0162373715609687>
- TNTP. (2012). *The Irreplaceables: Understanding the Real Retention Crisis in America's Urban Schools*. New York: TNTP. Retrieved from <http://eric.ed.gov/?id=ED533959>