ANNENBERG
BROWN UNIVERSITY

EdWorkingPaper No. 23-794

Spillover Effects of Black Teachers on White Teachers' Racial Competency: Mixed Methods Evidence from North Carolina

Seth Gershenson
American University and IZA

Constance A. Lindsay
University of North Carolina at Chapel Hill

Nicholas W. Papageorge
Johns Hopkins University, IZA, and NBER

Romaine Campbell
Harvard University

Jessica H. Rendon
American University

The US teaching force remains disproportionately white while the student body grows more diverse. It is therefore important to understand how and under what conditions white teachers learn racial competency. This study applies a mixed-methods approach to investigate the hypothesis that Black peers improve white teachers' effectiveness when teaching Black students. The quantitative portion of this study relies on longitudinal data from North Carolina to show that having a Black same-grade peer significantly improves the achievement and reduces the suspension rates of white teachers' Black students. These effects are persistent over time and largest for novice teachers. Qualitative evidence from open-ended interviews of North Carolina public school teachers reaffirms these findings. Broadly, our findings suggest that the positive impact of Black teachers' ability to successfully teach Black students is not limited to their direct interaction with Black students but is augmented by spillover effects on early-career white teachers, likely through peer learning.

VERSION: June 2023

Suggested citation: Gershenson, Seth, Constance A. Lindsay, Nicholas W. Papageorge, Romaine Campbell, and Jessica H. Rendon. (2023). Spillover Effects of Black Teachers on White Teachers' Racial Competency: Mixed Methods Evidence from North Carolina. (EdWorkingPaper: 23-794). Retrieved from Annenberg Institute at Brown University: https://doi.org/10.26300/jzyz-1m67

Spillover Effects of Black Teachers on White Teachers' Racial Competency: Mixed Methods Evidence from North Carolina

Seth Gershenson[a]
Constance A. Lindsay[b]
Nicholas W. Papageorge[c]
Romaine Campbell [d]
Jessica H. Rendon[e]

Abstract

The US teaching force remains disproportionately white while the student body grows more diverse. It is therefore important to understand how and under what conditions white teachers learn racial competency. This study applies a mixed-methods approach to investigate the hypothesis that Black peers improve white teachers' effectiveness when teaching Black students. The quantitative portion of this study relies on longitudinal data from North Carolina to show that having a Black same-grade peer significantly improves the achievement and reduces the suspension rates of white teachers' Black students. These effects are persistent over time and largest for novice teachers. Qualitative evidence from open-ended interviews of North Carolina public school teachers reaffirms these findings. Broadly, our findings suggest that the positive impact of Black teachers' ability to successfully teach Black students is not limited to their direct interaction with Black students but is augmented by spillover effects on early-career white teachers, likely through peer learning.

Keywords: peer effects, knowledge spillovers, teacher effectiveness, teacher diversity, achievement gaps, education production function

JEL Codes: I2, J24

---

[a] Corresponding author. School of Public Affairs, American University and IZA (seth.gershenson@american.edu).
The authors thank Stefanie DeLuca and conference and seminar participants at the University of Pennsylvania, Brown University, Eastern Economic Association, Society for Research on Educational Effectiveness (SREE), and the Association for Education Finance & Policy (AEFP) for providing helpful feedback. The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305A210434 to American University. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.
[b] School of Education, University of North Carolina at Chapel Hill (email: clindsay@unc.edu)
[c] Department of Economics, Johns Hopkins University, IZA, and NBER (email: papageorge@jhu.edu)
[d] Department of Economics, Harvard University (email: rcampbell@g.harvard.edu)
[e] School of Public Affairs, American University (email: jh3608a@american.edu)

1. Introduction

Teachers affect both contemporaneous and long-run student outcomes and are among the most important school-provided inputs in the education production function (Chetty et al. 2014 a, b; Jackson 2019). Despite this, teachers vary widely in their effectiveness along several dimensions, though we do not generally know what makes a particular teacher effective. This poses a challenge for devising policies that optimally recruit, retain, and allocate teachers to schools and classrooms.

A notable exception is teacher experience, which is both easily observed and positively correlated with effectiveness (Wiswall 2013; Papay & Kraft 2015). Yet, even in this case, we know relatively little about how and why teachers improve over time. For example, research shows the intuitive result that the returns to teaching experience are larger in more supportive schools (Kraft & Papay 2014).

Peers play a critical role in creating and maintaining a supportive work environment and a large literature in labor economics finds compelling evidence of peer effects in the workplace (Cornelissen et al. 2017).[1] Workplace peer effects can operate through two distinct, not necessarily mutually exclusive channels: learning via information transmission (i.e., knowledge spillovers) and increased effort via social pressure (DeGrip & Sauermann 2012). There is credible evidence of workplace peer effects operating through both channels (e.g., Dahl et al. 2014; Falk & Ichino 2006; Godøy & Dale-Olsen 2018; Mas & Moretti 2009).

A related literature in personnel economics and production theory studies the implications of organizing a plant's workforce into teams. Consistent with the idea of knowledge spillovers and team learning, these studies typically find that teams whose workers are diverse in

[1] This is distinct from the literature on student peer effects in educational settings; see Sacerdote (2011) for a review.

ability levels are more productive (e.g., Hamilton et al. 2003). It is theoretically ambiguous, however, whether racially and ethnically diverse teams are beneficial. One reason is that higher communication costs in such teams may hinder performance, though Hamilton et al. (2012) find no evidence a marginal change in the demographic composition of teams in a garment plant changes their productivity or likelihood of dissolving (holding ability constant). However, while worker productivity is likely orthogonal to race and ethnicity in a garment plant, this is not necessarily so in schools, given well documented impacts of exposure to same-race teachers (e.g., Dee 2004; Delhommer 2022; Gershenson et al. 2021; Gershenson et al. 2022).

Generally, schools are no different than other workplaces in that peer effects and knowledge spillovers occur amongst the workforce (i.e., teachers). Maturana and Nickerson (2019) find that teachers, especially younger ones, are more likely to refinance their mortgage when their colleagues do. Papay et al. (2020) find persistent increases in teaching effectiveness among ineffective teachers after they are paired with an effective teacher. Sun et al. (2017) similarly find that when an effective teacher changes schools, she increases the effectiveness of her new same-grade colleagues. That the authors find no analogous harm caused by the move of an ineffective teacher suggests that there are net gains to be had by creating teacher peer groups of diverse skill levels. Jackson and Bruegmann (2009), henceforth JB, similarly find significant and long-lasting increases in teacher effectiveness when they have more effective same-grade peers (as measured by value-added scores). These teacher peer effects are likely due in large part to information transmission, or knowledge spillover. However, effort could increase as well: Bradley et al. (2007) find that teachers' absences are affected by the attendance habits of their same-school peers.

The current study extends the teacher peer effects and teams literatures by examining the extent to which teachers learn a specific skill from their peers: racial competency. Specifically, we ask whether white teachers' effectiveness with students of color increases during or after exposure to a same-grade peer of color. While earlier work provides increasingly indisputable evidence that Black students benefit from having a Black teacher, the current study asks whether there are also spillover effects: i.e., do Black teachers indirectly improve Black students' performance via their impacts on white teachers' approaches to teaching and interacting with Black students. We address this question using a similar identification strategy as introduced in JB. Our identification relies on within-school-year comparisons of grade levels that do and do not have teachers of color and within-teacher comparisons of years that they have and have not been exposed to a same-grade peer of color.

The importance of this question is motivated by the following set of facts. There are sizable immediate and long-run benefits to students of color of having a same-race teacher on a variety of outcomes including test scores, attendance, suspensions, high-school graduation, and college enrollment (Dee 2004; Delhommer 2022; Gershenson et al. 2022; Lindsay & Hart 2017; Tran & Gershenson 2021). However, the teaching force is disproportionately white, which means that many students of color have few, if any, teachers of color during their time in school. For example, data from the nationally representative ECLS-K: 2011 survey show that only half of Black and Latino students have had a same race (ethnicity) teacher through third grade, compared to 99% of white students (Gershenson et al. 2021).

An obvious policy response would be to create a more representative teaching force, but doing so will take time (Gershenson et al. 2021). In the meantime, policymakers and school leaders must ensure that white teachers are prepared and trained to effectively instruct and

nurture the talent in our nation's increasingly diverse classrooms. The results of our study provide crucial insight into this problem and suggest that until the teaching workforce is truly representative of the student population in their charge, a second-best alternative may involve the strategic placement of teachers of color. Doing so effectively leverages the idea that Black teachers' positive impacts on Black students not only include direct interactions with them, but also indirect "knowledge spillover" effects through their interactions with white teachers tasked with teaching Black students. Thoughtful placement of Black teachers to increase their interactions with white teachers can thus increase the total benefits that Black teachers can have on Black students and improve the overall effectiveness of the white teaching force.

There are two broad reasons that peers of color might improve white teachers' facility with students of color. The first is an extension of Allport's (1954) "contact hypothesis," which suggests that intergroup contact can reduce racial biases. This has been demonstrated with students and their peers in school. Carrell et al. (2019) show that exposure to high quality Black peers changes white Air Force cadets' racial attitudes and behaviors, and Billings et al. (2021) find that attending a more diverse school affects students' social and political attitudes in adulthood. Similarly, in India Rao (2019) shows that personal interactions with poor classmates changes rich students' social attitudes, making them more prosocial and generous and less discriminatory. In our context, white teachers' biases towards Black students are likely a key determinant of the well documented same-race teacher effects experienced by Black students (Gershenson et al. 2016; Papageorge et al. 2020). Exposure to peers of color can help to assuage such biases.

The second is peer learning, which can happen indirectly by observation or directly via information transmission, mentoring, and advice to white teachers about how to communicate

and build trusting relationships with students of different backgrounds. A central concept here is culturally relevant pedagogy (CRP), which refers to the teaching practices and techniques used by many teachers of color to connect with students whose backgrounds, cultures, and lived experiences are often excluded from the mainstream school curriculum (Ladson-Billings 2008, 2022). White teachers may observe how their peers of color communicate with students of color in certain situations and learn from that. Alternatively, they may ask for guidance and advice about how to handle certain situations or how to communicate best with certain students.

Our quantitative analyses of administrative data from North Carolina find that overall, there is no detectable effect of having a Black peer on white teachers' effectiveness with Black students. However, analyses of the full sample mask important variation by teachers' experience: novice white teachers (and their Black students) do benefit greatly when they have a Black same-grade peer. Specifically, the math and reading scores of Black students of novice white teachers' increase by 4 (9%) and 5 (12%) percentage points, respectively, when their teacher has a same-grade Black peer.

That these peer effects are stronger among novice teachers is consistent with prior research on teacher peer effects (JB 2009; Maturana & Nickerson 2019) and suggests that peer learning is a primary mechanism through which these effects operate. Further support for this interpretation of the results comes from the finding that the effects of historical exposures to peers of color remain statistically significant and larger in magnitude than contemporaneous exposures. Falsification tests showing that there is neither an effect of having a Black peer on white teachers' white students' educational outcomes nor an effect of future Black peers on current outcomes bolster a causal interpretation of our results.

Qualitative analyses of open-ended, in-depth interviews of teachers in North Carolina largely affirm the results of the quantitative analysis and suggest a few potential avenues via which teachers learn from each other about how to teach and serve students on several dimensions including race. Specifically, the qualitative data suggest that teachers learn both formally and informally from their peers as well as through formative student interactions that enable teachers to learn about race and other elements of student identity writ large.

The paper proceeds as follows: Section 2 describes the quantitative and qualitative data. Section 3 describes the quantitative and qualitative methods. Sections 4 and 5 present the quantitative and qualitative results, respectively. Section 6 concludes.

2. Data

2.1 Administrative Data from North Carolina

We analyze administrative data from the North Carolina Education Research Data Center (NCERDC). In partnership with the North Carolina Department of Public Instruction, the NCERDC collects data on all public school students in the state, including district-, school-, and teacher-level data. These data are publicly available to researchers who pay a usage fee and satisfy certain data security requirements (Gershenson & Langbein 2015; Muschkin, Bonneau, & Dodge, 2011). These are the same data analyzed by Jackson and Bruegmann (2009).

Summary statistics for our analytic sample are presented in Table 1. Our sample includes approximately 306,000 student-year observations for Black students matched to white self-contained classroom teachers in grades 3 through 5 between 1996 and 2018 in North Carolina public schools. The main outcomes are end-of-grade state test scores for math and ELA that are standardized across all students in the NCERDC data to have mean zero and unit variance within

the grade-year. The students in our analytical sample have an average standardized math score of -0.45 with a standard deviation of 0.89. They have an average standardized ELA score of -0.41 with a standard deviation of 0.92. The negative averages are consistent with previous findings in the literature documenting Black students' underperformance relative to their white peers.

Students in our sample are absent on average 4.2 days per academic year with a standard deviation of 5.17. Approximately 3 percent of students are considered chronically absent (i.e., absent for at least 18 days in an academic year). Students have on average 0.34 out-of-school suspension days with a standard deviation of 1.77. In a given year, about 10 percent of students have ever received out-of-school suspension. Absence and suspension data are missing for about 25% of students and this data is largely missing at the school-year level.

These student-year observations map to 63,706 teacher-year observations. By design, all teachers in this sample are white. Approximately 30 percent of teachers have a Black peer in their same grade in a given academic year. This share is relatively unchanged when we consider both Black and Hispanic peers, because there are relatively few Hispanic teachers in our data. The average class size is around 29 students with a standard deviation of 7. Approximately 8 percent of teachers in our sample are new to teaching and another 18 percent have between 1 and 3 years of experience. For the purpose of heterogeneity analyses below, we consider teachers with 3 or fewer years of experience to be novices. We are missing teacher experience for 1 percent of our sample. About 29 percent of teachers hold an advanced degree. The majority of teachers in our sample (76 percent) have received a regular state license instead of, for example, working under a provisional or temporary license and about 8 percent of teachers have national board certification.

We also standardize teachers' license exam scores on the elementary and early childhood education tests required for all North Carolina teachers to have mean zero and unit variance in each year. Teachers in our analytical sample have an average score of 0.17 with a standard deviation of 1.16. Approximately 91 percent of teachers are female. Teachers have average value-added of 0.03 and 0.02 with standard deviations of 0.52 and 0.48 for math and ELA, respectively. Following JB, we also report the average value-added measures in math and ELA of each teacher's same grade peers, along with other observed qualifications, in Table 1.

2.2 Open-Ended, In-Depth Teacher Interviews

We use semi-structured, open-ended interviews to identify how, when, and under what circumstances teachers learn from their peers and classroom experiences. To start, the team conducted pilot interviews (Deterding & Waters 2018) over zoom. Using a grounded approach, we analyzed those interviews and found some broad themes. We then adjusted the protocol to ask questions of the interviewees more directly regarding race. To date, the team has conducted 32 interviews with teachers from racially diverse schools.

To generate text data for the analysis, our team used an outside transcription service, and NVivo software to code the text data. We analyzed the interview data using the analytic strategy of grounded theory. Through this approach, we worked through the data from the "ground up" using an iterative process. Repeated ideas became apparent and were then tagged with open coding. Open coding allowed for inductive building of theory (Corbin & Strauss 2008) that identified common themes and ideas that arose organically in the data. In this way, we sought to synthesize the participants' answers to questions regarding their experiences learning from other teachers, administrators, and their students. The interview protocol covers teachers' own early

schooling experiences, pre-service activities, teaching motivations, equity orientations and experiences, sources of learning, school climate, and relevant contextual factors about the school(s) where they have taught.

3. Quantitative Methods

To understand how Black and Hispanic peers affect white teachers' effectiveness with Black and Hispanic students we augment the regressions estimated by Jackson and Bruegmann (2009) to include a measure of peer race in the vector of peer characteristics as an input in the education production function. Intuitively, the identification strategy pioneered by Jackson and Bruegmann includes the observable characteristics of teachers' current, same-grade peers (e.g., certification status, experience, and value-added measures of effectiveness) as an additional measure of teacher quality in value-added models of the education production function. We consider two functional forms for peer race: a binary indicator for having at least one (current) Black (and/or Hispanic) colleague and the share of current peers who are Black (and/or Hispanic). Again following Jackson and Bruegmann, we use lags and leads of these peer-race variables in mechanism and falsification tests, respectively.

Specifically, we estimate models of the form:

$$y_{ijgst} = \alpha y_{i,t-1} + \beta_1 X_{it} + \beta_2 W_{jt} + \theta_{gt} + \omega_{st} + \varphi_{js} + \delta Peer_{jgt} + u_{ijgst}, \quad (1)$$

where the subscripts *i*, *j*, *g*, *s*, and *t* index students, teachers, grades, schools, and years, respectively, and *y* is a student-year specific outcome. The main outcomes are standardized end-of-grade math and reading scores, though we also estimate models where the outcome is the count of student absences, a binary indicator for chronic absence (18 or more absences in year *t*),

or a binary indicator for ever being suspended in year t.[2] We estimate this multi-dimensional fixed effects (FE) specification using the `reghdfe` package and estimator (Correia 2016). We cluster standard errors by teacher-year, as this is the level at which the treatment of interest varies and all students of a given teacher in a given year receive the same treatment (Abadie et al. 2023); nonetheless, the main results are robust to the level(s) at which the standard errors are clustered.

Equation (1) depicts a standard value-added specification that controls for lagged achievement, which the literature agrees sufficiently adjusts for nonrandom sorting of students to classrooms (Chetty et al. 2014). X and W are vectors of possibly time-varying observed student and classroom characteristics, respectively, like student sex and observable measures of peer quality: teacher race, experience, education, certification, licensure, Praxis score, and class size.

The innovation in Equation (1) is the inclusion and specification of the *Peer* vector, which includes the aforementioned peer-race variable as well as measures of peer quality used in Jackson and Bruegmann (2009): average observable characteristics and estimated value-added of a teacher's peers. For each teacher, we compute the mean characteristics (e.g., experience, licensure) of all other teachers in the same school-year-grade, excluding the observed teacher. These average teacher characteristics then serve as a proxy for teacher peer quality.

Second, we estimate teacher value-added using an adjusted test score growth model with data from 1995-2000. Like the observed characteristics of teacher quality, we compute the average teacher value-added for each teacher's school-grade-year peer group. We use these pre-sample estimates of value-added when investigating the effect of peer quality on student achievement using data from 2001-2018. Because these value-added estimates are time-

[2] The end-of-grade tests are implemented statewide in the spring. We will standardize them to have mean 0 and standard deviation 1 to facilitate comparisons across years.

invariant, any variation in mean peer value-added is due to changes in the composition of a teacher's peers. The main disadvantage to this approach is that teachers who are not in the pre-sample data (1995-2000) will not have a value-added estimate. Following Jackson and Bruegmann (2009), we take advantage of the full sample of teachers by assigning the mean to teachers with missing value-added estimates and including a control for missing value-added.

While the lag score controls for student sorting into classrooms, our interest is in the parameter δ, which means that we also must control for teacher sorting into peer groups. Following Jackson and Bruegmann, we do so by adjusting for school-by-year (ω_{st}) and teacher-by-school (φ_{js}) FE. Adjusting for fixed effects at the school-year level will ensure that we compare student (or teacher) outcomes across teachers in the same school, in the same year. We control for Black and Latino colleagues directly affecting students in other classrooms by exploiting variation over time in exposure to Black colleagues via the teacher-by-school FE. We also control for grade (or grade-by-year) indicators to flexibly account for differences across grades and teacher or teacher-school FE to identify off of within-teacher variation in peer characteristics. Hence the key identifying assumption is that in a given year, Black and Latino teachers in the school are (conditional on some basic teacher and student controls) randomly distributed across grade levels.

We probe the plausibility of the identifying assumptions using two placebo, or falsification, tests. First, as in Jackson and Bruegmann, we show that leads of the *Peer* variables (the characteristics of future peers) do not affect current performance. Second, unique to our context, we show that having a Black peer does not affect the performance of white teachers' white students or Black teachers' Black students. This suggests that the documented effect is the

transmission of racial competency and not some more general teaching skill uniquely possessed by Black teachers.

4. Quantitative Results

4.1 Main Results

We present our main results in Table 2. Table 2 presents the estimated effects of having at least one same-grade Black peer on white teachers' Black students' current outcomes.[3] The table is divided into three panels: A, B, and C, which correspond to outcome measures for student academic performance, student attendance, and suspensions. Across the columns of Table 2, we present results for the full sample of teachers, and separately for novice teachers (with no more than 3 years of experience) and experienced teachers (with 4 or more years of experience).[4]

We begin with Panel A, which focuses on standardized end-of-grade (EOG) scores in Math and English Language Arts (ELA). Our results suggest that having at least one Black same-grade peer significantly increases the math and reading scores of Black students with white novice teachers. Specifically, we observe an increase of 5.6 percent and 6.2 percent of a standard deviation for math and reading scores, respectively. These estimates represent a 10.7 and 12.9 percent increase relative to the control group's average math and reading scores, which are significant at the 5 percent level. We do not find statistically significant results among all

[3] In Appendix Table A1, we broaden the sample to include Hispanic peers and Hispanic students. The results are qualitatively similar. This is largely because there are relatively few Hispanic teachers in our sample. One notable change is that the estimate of the effect of having a Black or Hispanic same-grade peer on the math scores of white teachers' Black students, while still positive, is no longer statistically significant.

[4] The novice and experienced sample sizes do not sum to the full sample size because experience is missing for a nontrivial share of teachers. In the full sample, this is controlled for by a "missing experience" indicator.

teachers or when we restrict our sample to experienced teachers. This indicates that peer effects are particularly salient for novice teachers.

We also report the effect of average same-grade peer quality (using the peer value-added measure) in these regressions. We find effect sizes that are consistent with those reported in Jackson and Bruegmann (2009). The coefficient on the peer value-added measure (Peer VAM) in column 1 is 0.052. This suggests that a one standard deviation increase in same-grade peer quality increases math scores by 5.2 percent of a standard deviation. Similarly, the coefficient in column 4 suggests that a one standard deviation increase in same-grade peer quality increases reading scores by 2 percent of a standard deviation. Both effects are significant at the 1 percent level. We observe higher estimated effects among novice teachers (columns 2 and 5). A one standard deviation increase in the quality of same-grade peers increases the math scores of novice white teachers' Black students by 7.1 percent of a standard deviation. The estimate is significant at the 5 percent level. The results for reading are starker. A one standard deviation increase in the quality of same-grade peers increases the reading scores of novice white teachers' Black students by 11 percent of a standard deviation. This estimate is significant at the 1 percent level.

In Panels B and C, we show our results on school attendance and suspensions. We do not find statistically significant effects on school attendance either in terms of the number of absences or the likelihood of being chronically absent (defined as 18 or more annual absences). That said, the absence estimates are imprecise and do not allow us to rule out economically meaningful changes in either direction. We find similarly insignificant and imprecise results for out-of-school suspension days. However, when examining whether students are ever suspended over the course of the school year, we find that white teachers with at least one Black same-grade

peer are less likely to suspend their Black students. This finding is strongest among experienced teachers. The coefficient in column 4 of Panel C is -0.009, suggesting that having at least one Black same-grade peer is associated with a nearly one percentage point decrease in the likelihood that white teachers' Black students are ever suspended. This effect is significant at the 5 percent level and represents a 9 percent decrease relative to the control group mean of 0.10. This finding is also economically meaningful considering the growing literature on the role of suspensions in the school to prison pipeline (Bacher-Hicks et al, 2019).

4.2 Falsification Tests

We hypothesize two key mechanisms that help to explain the effect of white teachers' exposure to Black same-grade peers on the outcomes of their Black students. The first mechanism involves intergroup contact, which has the potential to reduce racial biases. The second mechanism pertains to peer learning, which can enhance white teachers' effectiveness in educating students of color. To validate these mechanisms, we conduct falsification tests by examining the effect of such exposure on other (placebo) groups where it should have no effect.

We examine two specific placebo groups in Table 3: white students of white teachers and Black students of Black teachers. If the effect of exposure to same-grade Black peers on white teachers' Black students' outcomes operates through our proposed mechanisms, then we should not expect to see effects of having a Black peer on white teachers' white students or Black teachers' Black students. Panel A of Table 3 shows the results for white teachers' white students' test scores and Panel B displays the results for Black teachers' Black students' test scores. As expected, most of the estimates of the effect of having at least one Black same-grade peer among

these groups are statistically insignificant and relatively small. However, we do observe two small, marginally significant estimates, which is about what we would expect to see by chance.

Following JB, in Table 4 we estimate a series of models that include lags and/or leads of the Black-peer treatment indicator. The lag models reported in columns 1 and 2 show that after conditioning on prior exposure to a Black peer, current peers have no effect. However, the lagged Black peer indicators are statistically significant, suggesting that these racial peer effects persist over time. This indicates that the peer-learning mechanism is important: white teachers learn skills from their Black peers that stick with them.

In columns 3 and 4 of Table 4 we add leads (indicators of future exposures) of the Black-peer treatment indicator. The leads provide another falsification exercise, as future peers cannot affect current outcomes. Importantly, we find no relationship between a white teachers' future Black peers and the outcomes of her current Black students. Coupled with the placebo exercises reported in Table 3, the insignificant lead coefficients in Table 4 provide compelling evidence that the documented peers effects are in fact causal.

4.3 Teacher Level Outcomes

Another mechanism through which peer effects may operate is effort provision (Bradley et al. 2007). Indeed, employee absences are responsive to workplace environments (Ichino & Maggi 2000; Ose 2005). Teacher absences in particular are a crude proxy for effort in the workplace that harm student achievement and respond to accountability and financial incentives (Gershenson 2016, Clotfelter et al. 2009, Herrmann & Rockoff 2012; Jacob 2013). However, we find no evidence that having a Black same-grade peer affects the attendance of white or Black

teachers.[5] This is an intuitive null result for white teachers, whose ineffectiveness teaching students of color was likely due to skill mismatch and not low effort.

The null finding for Black teachers is somewhat surprising, since having a Black peer may alleviate feelings of isolation and make for a more welcoming workplace environment (Bristol 2018; Bristol & Shirrell 2019). Accordingly, we also estimate teacher-year level turnover models. Estimates for the sample of Black teachers are reported in Table 5. Turnover is a similarly important outcome in that it harms student achievement and generally disrupts schools by causing teacher reassignments and lowering the stock of school-specific knowledge among the teaching force (Ronfelt et al. 2013; Hanushek et al. 2016). We consider three distinct turnover-related outcomes: stays in the same school and grade level, stays in the same school but not necessarily the same grade, and exits the NC public school system. We distinguish between changing schools and changing grades within the school because the latter is also disruptive and potentially harmful (Atteberry et al. 2017). The estimated effects of having a Black peer on Black teacher retention are in the expected directions and largest for novice Black teachers, though are imprecisely estimated.

5. Qualitative Results

Two broad forms of teacher learning about race emerged from our initial analyses of the interview transcripts. First, teachers indicated that they learned about how to interact with students of different backgrounds from their colleagues (peer learning). Second, teachers indicated that they learned about how to interact with students of different backgrounds through formative student interactions, primarily from interactions with students from different racial

[5] Results available from authors upon request.

backgrounds from themselves (learning by doing). We focus on the former here and leave a detailed analysis of the latter to future work.

Several teachers interviewed described the ways in which their peers influenced their classroom behavior. Consistent with our quantitative results, novice teachers frequently reported that other teachers served as a resource that supplemented their formal teacher training and leadership guidance. As one novice white teacher indicated:

"*I think one of the most influential things for my growth as a teacher is seeing other teachers. I always feel like that is one of the most helpful things just being able to get in any other classroom. It doesn't really matter the grade or subject, but just watching other teachers helps, even if you're in there and you pick up something like how they do their homework on the board, but hopefully, you're picking up more. Being able to watch other teachers has really been a positive influence*."

Without specifically mentioning race, this teacher articulated the critical role other teachers have in the professional learning process for new teachers. Though this teacher mentioned an informal learning process, other teachers discussed a more formal role of learning via mentorship in their early professional development:

"*There was one mentor teacher that I had my first year that was a great, positive support to me and she was just a de facto mentor teacher that now we're close personal friends and she showed me how to be more of a self-advocate in my own career and job and what I was doing with my kids. She was probably the most influential. I don't particularly feel like the admin that I've worked directly under have been particularly influential in what I'm doing in a classroom ever. I think just watching the people around me and trying to grow my practice based on what I like from observing other teachers or what I don't think works for me. I think that's been really influential. So, I just try to take a little piece of everything I see*."

Another white teacher commented on the racial mix of their teaching peers and administrators as being another vehicle for learning about how to most effectively teach students of color:

"*I think it's sometimes tougher because our admin team is White and then a lot of our teachers are White, so you can see it in staff meetings, but I think that the school has done a good job in addressing that and labeling, I have a very limited perspective as a White teacher or as a White staff member and owning and recognizing that before you can go any further. I have been really fortunate [that] out of our four 5th grade teachers, two of them are Black women and then me and the other one are White women and I have really appreciated and grown with the ability and*

openness within our [group], like, hey, this happened today, I just want to talk through it and make sure that I'm in my appropriate space or how can I handle this situation or here is something that a student said and I'm not sure if that needs to be addressed and putting our heads together with our different perspectives and getting to a place that's okay to [inaudible], but also to call someone out lovingly, like, you said this and that didn't make me feel okay, has been something that our school has worked on and I know we still have room to grow in that, but I think we have taken ownership of the fact that we are a largely White staff and what does that mean for us and how do we go about it?"

Overall, the teachers interviewed thus far critically reflected on their own learning about race and the ways that they have developed racial competence through their peers and classroom experiences. The qualitative data largely corroborate the results of the econometric analyses: white teachers, particularly novice white teachers, do learn elements of racial competency from their Black peers. They learn more broadly about effective teaching and classroom management strategies from their peers as well, which is consistent with JB, and further distinguish between two types of learning: informal ad hoc discussion and formal mentoring.

6. Conclusion

This study provides both qualitative and quantitative evidence from North Carolina that white teachers learn racial competency—and specifically how to more effectively educate Black and Hispanic students—from their Black and Hispanic peers. Black teachers not only benefit Black students through direct interactions, but also indirectly via knowledge spillovers that change how white teachers interact with Black students. The results are driven by the peer learning of novice teachers, as the math and reading scores of Black students of novice white teachers' increase by 4 (9%) and 5 (12%) percentage points, respectively, when their teacher has a same-grade Black peer. These effects are arguably causal, as falsification tests show that there is neither an effect of having a Black peer on white teachers' white students' educational

outcomes nor an effect of future Black peers on current outcomes bolster a causal interpretation of our results.

That these peer effects are stronger among novice teachers is consistent with prior research on teacher peer effects (JB 2009; Maturana & Nickerson 2019) and suggests that peer learning is a primary mechanism through which these effects operate. Further support for this interpretation of the results comes from the semi-structured, open-ended interviews of teachers and the finding that historical exposures to peers of color remain statistically significant and larger in magnitude than contemporaneous exposures.

These findings have important implications for policy and practice. Most importantly, they suggest an opportunity for closing racial and ethnic achievement gaps right now by more thoughtfully assigning teachers to schools and to grade levels. While the benefits of having a diverse and representative teaching force are well documented, achieving such a teaching force will take time (e.g., Gershenson et al. 2021). Creating opportunities for peer learning to occur for the disproportionately white teaching force is therefore a potentially useful and cost-effective strategy to pursue in the meantime. Doing so amounts to augmenting positive impacts Black teachers have on Black students through direct interactions to more effectively leverage indirect impacts via knowledge spillovers to white teachers. Organic and informal interactions that facilitate peer learning could also be formalized and incorporated into teacher training programs and in-service mentoring programs.

Finally, and more broadly, the types of spillover effects we document here suggest that the frustratingly persistent finding that Black students benefit more from Black teachers compared to white teachers is a problem that policy can help to address. While the goal of diversifying the teaching workforce is the most obvious way forward, it will take time

(Gershenson et al. 2021). Whether we can address the issue using the teaching workforce we currently have depends on whether policy-relevant factors have any detectable impact on how effectively white teachers teach Black students. Our findings suggest that one particular malleable factor – regular contact with Black teachers – can.

References

Abadie, A., Athey, S., Imbens, G. W., & Wooldridge, J. M. (2023). When should you adjust standard errors for clustering?. *The Quarterly Journal of Economics*, *138*(1), 1-35.

Allport, Gordon W. (1954). *The Nature of Prejudice*. Oxford: Perseus Books Group.

Atteberry, A., Loeb, S., & Wyckoff, J. (2017). Teacher churning: Reassignment rates and implications for student achievement. *Educational Evaluation and Policy Analysis*, *39*(1), 3-30.

Bacher-Hicks, A., Billings, S. B., & Deming, D. J. (2019). The school to prison pipeline: Long-run impacts of school suspensions on adult crime. NBER Working Paper (no. w26257).

Billings, S. B., Chyn, E., & Haggag, K. (2021). The long-run effects of school racial diversity on political identity. *American Economic Review: Insights*, *3*(3), 267-284.

Bradley, S., Green, C., & Leeves, G. (2007). Worker absence and shirking: Evidence from matched teacher-school data. *Labour Economics*, *14*(3), 319-334.

Bristol, T. J. (2018). To be alone or in a group: An exploration into how the school-based experiences differ for Black male teachers across one urban school district. *Urban Education*, *53*(3), 334-354.

Bristol, T. J., & Shirrell, M. (2019). Who is here to help me? The work-related social networks of staff of color in two mid-sized districts. *American Educational Research Journal*, *56*(3), 868-898.

Carrell, S. E., Hoekstra, M., & West, J. E. (2019). The impact of college diversity on behavior toward minorities. *American Economic Journal: Economic Policy*, *11*(4), 159-82.

Chetty, R., Friedman, J. N., & Rockoff, J. E. (2014 a). Measuring the impacts of teachers I: Evaluating bias in teacher value-added estimates. *American Economic Review*, *104*(9), 2593-2632.

Chetty, R., Friedman, J. N., & Rockoff, J. E. (2014 b). Measuring the impacts of teachers II: Teacher value-added and student outcomes in adulthood. *American Economic Review*, *104*(9), 2633-79.

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2009). Are teacher absences worth worrying about in the United States?. *Education Finance and Policy*, *4*(2), 115-149.

Cornelissen, T., Dustmann, C., & Schönberg, U. (2017). Peer effects in the workplace. *American Economic Review*, 107(2), 425-456.

Correia, S. (2016). A feasible estimator for linear models with multi-way fixed effects. *Preprint at http://scorreia. com/research/hdfe. pdf*.

Dahl, G. B., Løken, K. V., & Mogstad, M. (2014). Peer effects in program participation. *American Economic Review*, *104*(7), 2049-74.

Dee, Thomas S. 2004. Teachers, race, and student achievement in a randomized experiment. *The Review of Economics and Statistics* 86 (1):195-210.

De Grip, A., & Sauermann, J. (2012). The effects of training on own and co-worker productivity: Evidence from a field experiment. *The Economic Journal*, *122*(560), 376-399.

Delhommer, S. (2022). High school role models and minority college achievement. *Economics of Education Review*, *87*, 102222.

Falk, A., & Ichino, A. (2006). Clean evidence on peer effects. *Journal of Labor Economics*, *24*(1), 39-57.

Gershenson, S., & Langbein, L. (2015). The effect of primary school size on academic achievement. *Educational Evaluation and Policy Analysis*, *37*(1_suppl), 135S-155S.

Gershenson, S. (2016). Performance standards and employee effort: Evidence from teacher absences. *Journal of Policy Analysis and Management*, *35*(3), 615-638.

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

Gershenson, S., Hansen, M. J., & Lindsay, C. A. (2021). *Teacher diversity and student success: Why racial representation matters in the classroom*. Cambridge, MA: Harvard Education Press.

Gershenson, S., Hart, C. M., Hyman, J., Lindsay, C. A., & Papageorge, N. W. (2022). The long-run impacts of same-race teachers. *American Economic Journal: Economic Policy*, *14*(4), 300-342.

Godøy, A., & Dale-Olsen, H. (2018). Spillovers from gatekeeping–Peer effects in absenteeism. *Journal of Public Economics*, *167*, 190-204.

Goldhaber, D., Krieg, J., & Theobald, R. (2020). Effective like me? Does having a more productive mentor improve the productivity of mentees?. *Labour Economics*, *63*, 101792.

Hamilton, B. H., Nickerson, J. A., & Owan, H. (2003). Team incentives and worker heterogeneity: An empirical analysis of the impact of teams on productivity and participation. *Journal of Political Economy*, *111*(3), 465-497.

Hamilton, B. H., Nickerson, J. A., & Owan, H. (2012). Diversity and productivity in production teams. In *Advances in the Economic Analysis of Participatory and Labor-Managed Firms* (Vol. 13, pp. 99-138). Emerald Group Publishing Limited.

Hanushek, E. A., Rivkin, S. G., & Schiman, J. C. (2016). Dynamic effects of teacher turnover on the quality of instruction. *Economics of Education Review*, *55*, 132-148.

Herrmann, M. A., & Rockoff, J. E. (2012). Worker absence and productivity: Evidence from teaching. *Journal of Labor Economics*, *30*(4), 749-782.

Ichino, A., & Maggi, G. (2000). Work environment and individual background: Explaining regional shirking differentials in a large Italian firm. *The Quarterly Journal of Economics*, *115*(3), 1057-1090.

Jacob, B. A. (2013). The effect of employment protection on teacher effort. *Journal of Labor Economics*, *31*(4), 727-761.

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.

Jackson, C Kirabo. 2019. What do test scores miss? The importance of teacher effects on non-test score outcomes. *Journal of Political Economy*.

Kraft, M. A., & Papay, J. P. (2014). Can professional environments in schools promote teacher development? Explaining heterogeneity in returns to teaching experience. *Educational Evaluation and Policy Analysis*, *36*(4), 476-500.

Ladson-Billings, G. (2008). Yes, but how do we do it?": Practicing culturally relevant pedagogy. *City kids, city schools: More reports from the front row*, 162-177.

Ladson-Billings, G. (2022). *The dreamkeepers: Successful teachers of African American children*. John Wiley & Sons.

Lindsay, C. A., & Hart, C. M. (2017). Exposure to same-race teachers and student disciplinary outcomes for Black students in North Carolina. *Educational Evaluation and Policy Analysis*, *39*(3), 485-510.

Mas, A., & Moretti, E. (2009). Peers at work. *American Economic Review*, *99*(1), 112-145.

Maturana, G., & Nickerson, J. (2019). Teachers teaching teachers: The role of workplace peer effects in financial decisions. *The Review of Financial Studies*, *32*(10), 3920-3957.

Muschkin, C., Bonneau, K., & Dodge, K. (2011). North Carolina education research data center: Final report to the Spencer Foundation (Grant# 200300138). Retrieved from http://childandfamilypolicy.duke.edu/ pdfs/projects/NCERDC_SpencerFoundationReport. pdf

Ose, S. O. (2005). Working conditions, compensation and absenteeism. *Journal of Health Economics*, *24*(1), 161-188.

Papageorge, N. W., Gershenson, S., & Kang, K. M. (2020). Teacher expectations matter. *Review of Economics and Statistics*, *102*(2), 234-251.

Papay, J.P., & Kraft, M.A. (2015). Productivity returns to experience in the teacher labor market: Methodological challenges and new evidence on long-term career improvement. *Journal of Public Economics*. 130:105-119.

Papay, J. P., Taylor, E. S., Tyler, J. H., & Laski, M. E. (2020). Learning job skills from colleagues at work: Evidence from a field experiment using teacher performance data. *American Economic Journal: Economic Policy*, *12*(1), 359-88.

Rao, G. (2019). Familiarity does not breed contempt: Generosity, discrimination, and diversity in Delhi schools. *American Economic Review*, *109*(3), 774-809.

Ronfeldt, M., Loeb, S., & Wyckoff, J. (2013). How teacher turnover harms student achievement. *American Educational Research Journal*, *50*(1), 4-36.

Sacerdote, B. (2011). Peer effects in education: How might they work, how big are they and how much do we know thus far? In *Handbook of the Economics of Education* (Vol. 3, pp. 249-277). Elsevier.

Sun, M., Loeb, S., & Grissom, J. A. (2017). Building teacher teams: Evidence of positive spillovers from more effective colleagues. *Educational Evaluation and Policy Analysis*, *39*(1), 104-125.

Tran, L., & Gershenson, S. (2021). Experimental estimates of the student attendance production function. *Educational Evaluation and Policy Analysis*, *43*(2), 183-199.

Wiswall, Matthew. 2013. The dynamics of teacher quality. *Journal of Public Economics,*100: 61-78.

TABLE 1: Summary Statistics

Variable	Observations	Mean	SD
Unit of observation: student-year			
Standardized Math Score	305,800	-0.45	0.89
Standardized ELA Score	304,718	-0.41	0.92
Absences	241,084	4.24	5.17
Chronic Absence	241,084	0.03	
Out-of-School Suspension (OSS) Days	230,722	0.34	1.77
Ever Suspended	230,722	0.10	
Female	305,800	0.50	
Same Sex Teacher	305,800	0.51	
Unit of observation: teacher-year			
Any Black Peer	63,706	0.30	
Any Black or Hispanic Peer	63,706	0.30	
Class Size	63,706	28.78	7.03
Experience 0 years	63,706	0.08	
Experience 1-3 years	63,706	0.18	
Experience 4-9 years	63,706	0.26	
Experience 10-24 years	63,706	0.37	
Experience 25+ years	63,706	0.11	
Experience Missing	63,706	0.01	
Advanced Degree	63,706	0.29	
Regular License	63,706	0.76	
Certified	63,706	0.08	
License Exam Score	63,706	0.17	1.16
Female	63,706	0.91	
Math Value-added	63,706	0.03	0.52
ELA Value-added	63,706	0.02	0.48
Peer Experience 0 years	63,706	0.07	0.18
Peer Experience 1-3 years	63,706	0.18	0.26
Peer Experience 4-9 years	63,706	0.25	0.30
Peer Experience 10-24 years	63,706	0.37	0.33
Peer Experience 25+ years	63,706	0.12	0.22
Peer Experience Missing	63,706	0.01	0.07
Peer License Exam Score	63,706	0.07	0.75
Peer Advanced Degree	63,706	0.30	0.32
Peer Regular License	63,706	0.76	0.35
Peer Certified	63,706	0.08	0.19
Peer Math Value-added	63,706	0.02	0.38
Peer ELA Value-added	63,706	0.02	0.35
Peer Math Value-added missing	63,706	0.62	0.41
Peer ELA Value-added missing	63,706	0.62	0.40

Notes: We limit our sample to Black students in grades 3-5 with white teachers in contained classes.

TABLE 2. Effect of any Black peer on white teachers' Black students' current outcomes

	All	Novice	Experienced	All	Novice	Experienced
	(1)	(2)	(3)	(4)	(5)	(6)
A. Standardized End-of-Grade (EOG) Score						
	MATH			ELA		
1+ Peer	0.004	0.056**	0.004	-0.002	0.062**	-0.011
	(0.006)	(0.028)	(0.008)	(0.006)	(0.031)	(0.008)
Peer VAM	0.052***	0.071**	0.059***	0.020***	0.110***	0.025**
	(0.009)	(0.031)	(0.011)	(0.008)	(0.042)	(0.010)
N	302,954	65,678	200,475	302,304	65,489	200,063
E(Y|D = 0)	-0.43	-0.52	-0.41	-0.39	-0.48	-0.36
B. Student Attendance						
	Absences			Chronic Absence		
1+ Peer	0.042	0.284	0.078	0.002	0.011	0.001
	(0.057)	(0.353)	(0.073)	(0.002)	(0.013)	(0.003)
N	239,165	50,501	160,943	239,165	50,501	160,943
E(Y|D = 0)	4.32	4.07	4.45	0.03	0.03	0.03
C. Annual Out-of-School (OSS) Suspension						
	Days OSS			Ever Suspended		
1+ Peer	-0.002	-0.051	-0.000	-0.009**	0.003	-0.014***
	(0.019)	(0.124)	(0.025)	(0.004)	(0.021)	(0.005)
N	228,513	49,322	153,770	228,513	49,322	153,770
E(Y|D = 0)	0.33	0.38	0.32	0.10	0.11	0.09

Notes. Estimated using data from 2001-2018. OLS estimates of effect of having at least one same-grade Black peer in the current school year. Standard errors clustered by teacher-year. Models condition on full set of student, peer, and teacher characteristics; peers' average value-added and indicator for missing value-added; and grade-year, school-year, and teacher-school fixed effects. Teacher value added is computed via adjusted test score growth models using data from 1995-2000.. Peer VAM is the mean estimated value-added of all other teachers in a teacher's same school-grade-year. Novice and experienced teachers are those who have 3 or less years of teaching experience or 4+ years of experience, respectively. Results are qualitatively similar when treatment is defined as share of same-grade peers who are Black. Null results in columns 1-3 of panels B and C are robust to using a poisson multi-way fixed effects estimator (ppmlhdfe).

*** Significant at the 1 percent level

** Significant at the 5 percent level

* Significant at the 10 percent level

TABLE 3. Falsification Tests: Effect of any Black peer on placebo group's current outcomes

	MATH			ELA		
	All	Novice	Experienced	All	Novice	Experienced
	(1)	(2)	(3)	(4)	(5)	(6)
A. White students and White teachers						
1+ Peer	-0.001	-0.021	0.005	0.005	-0.027	0.009*
	(0.005)	(0.024)	(0.006)	(0.004)	(0.025)	(0.005)
N	821,082	129,559	583,640	820,280	129,418	583,111
E(Y|D = 0)	0.31	0.20	0.33	0.31	0.21	0.33
B. Black students and Black teachers						
1+ Peer	0.005	0.132	-0.029*	0.014	0.093	-0.003
	(0.011)	(0.100)	(0.017)	(0.012)	(0.172)	(0.019)
N	99,183	16,399	65,685	98,985	16,355	65,580
E(Y|D = 0)	-0.53	-0.59	-0.51	-0.46	-0.53	-0.45

Notes. Estimated using data from 2001-2018. OLS estimates of effect of having at least one same-grade Black peer in the current school year. Standard errors clustered by teacher-year. Models condition on full set of student, peer, and teacher characteristics; peers' average value-added and indicator for missing value-added; and grade-year, school-year, and teacher-school fixed effects. Teacher value added is computed via adjusted test score growth models using data from 1995-2000. Peer VAM is the mean estimated value-added of all other teachers in a teacher's same school-grade-year. Novice and experienced teachers are those who have 3 or less years of teaching experience or 4+ years of experience, respectively. Results are qualitatively similar when treatment is defined as share of same-grade peers who are Black.

*** Significant at the 1 percent level

** Significant at the 5 percent level

* Significant at the 10 percent level

TABLE 4. Effect of past, current, and future peer diversity on current students' test scores for white teachers

	1 Lag	2 Lags	1 Lead	Lead and Lag
	(1)	(2)	(3)	(4)
A. Math				
Black Peer	0.008	-0.010	0.007	0.009
	(0.008)	(0.012)	(0.009)	(0.017)
Lag	0.012	0.022*		0.008
	(0.008)	(0.012)		(0.017)
Double Lag		0.031***		0.034**
		(0.011)		(0.016)
Lead			-0.012	-0.011
			(0.008)	(0.015)
N	171,862	100,488	154,206	57,958
B. ELA				
Black Peer	-0.014	-0.014	0.000	-0.001
	(0.009)	(0.013)	(0.010)	(0.020)
Lag	0.028***	0.060***		0.071***
	(0.009)	(0.013)		(0.019)
Double Lag		-0.021*		-0.014
		(0.012)		(0.017)
Lead			-0.008	0.009
			(0.009)	(0.020)
N	171,463	100,233	153,950	57,830

Notes. Estimated using data from 2001-2018. OLS estimates of effect of having at least one same-grade Black peer in the current school year. Standard errors clustered by teacher-year. Models condition on full set of student, peer, and teacher characteristics; peers' average value-added and indicator for missing value-added; and grade-year, school-year, and teacher-school fixed effects. Teacher value added is computed via adjusted test score growth models using data from 1995-2000. Peer VAM is the mean estimated value-added of all other teachers in a teacher's same school-grade-year. Results are qualitatively similar when treatment is defined as share of same-grade peers who are Black.

*** Significant at the 1 percent level

** Significant at the 5 percent level

* Significant at the 10 percent level

TABLE 5. Effect of any Black peer on Black teachers' retention and turnover

	All	Novice	Experienced
	(1)	(2)	(3)
A. Stays in Same School & Grade			
Black Peer	0.021	0.643	0.049
	(0.028)	(0.402)	(0.041)
Mean	0.65	0.73	0.66
B. Stays in Same School			
Black Peer	0.006	0.300	0.050
	(0.027)	(0.371)	(0.037)
Mean	0.71	0.81	0.73
C. Exits NC Public Schools			
Black Peer	-0.008	-0.340	-0.057
	(0.026)	(0.350)	(0.036)
Mean	0.26	0.15	0.24
N	7,471	152	3,821

Notes. Estimated using data from 2001-2018. Sample includes Black teachers only. OLS estimates of effect of having at least one same-grade Black peer in the current school year. Novice and experienced teachers are those who have 3 or less years of teaching experience or 4+ years of experience, respectively. Models condition on full set of student, peer, and teacher characteristics; peers' average value-added and indicator for missing value-added; and grade-year, school-year, and teacher-school fixed effects. Teacher value added is computed via adjusted test score growth models using data from 1995-2000. Peer VAM is the mean estimated value-added of all other teachers in a teacher's same school-grade-year.

*** Significant at the 1 percent level

** Significant at the 5 percent level

* Significant at the 10 percent level

Appendix TABLE A1. Effect of any Black or Hispanic peer on white teachers' Black or Hispanic students' current outcomes

	All	Novice	Experienced	All	Novice	Experienced
	(1)	(2)	(3)	(4)	(5)	(6)
A. Standardized End-of-Grade (EOG) Score						
	MATH			ELA		
1+ Peer	0.002	0.037	0.002	0.005	0.054**	-0.004
	(0.005)	(0.024)	(0.007)	(0.005)	(0.027)	(0.007)
Peer VAM	0.053***	0.070**	0.056***	0.017***	0.080**	0.023***
	(0.008)	(0.028)	(0.010)	(0.007)	(0.037)	(0.009)
N	445,629	94,791	301,864	444,855	94,566	301,391
E(Y|D = 0)	-0.33	-0.42	-0.30	-0.35	-0.44	-0.32
B. Student Attendance						
	Absences			Chronic Absence		
1+ Peer	0.037	0.268	0.058	0.001	0.008	0.000
	(0.047)	(0.290)	(0.062)	(0.002)	(0.012)	(0.002)
N	368,096	76,325	253,615	368,096	76,325	253,615
E(Y|D = 0)	4.66	4.42	4.78	0.03	0.03	0.03
C. Annual Out-of-School (OSS) Suspension						
	Days OSS			Ever Suspended		
1+ Peer	-0.003	-0.021	-0.013	-0.005**	0.015	-0.011***
	(0.013)	(0.085)	(0.018)	(0.003)	(0.015)	(0.003)
N	363,236	76,928	250,113	363,236	76,928	250,113
E(Y|D = 0)	0.23	0.26	0.22	0.07	0.08	0.07

Notes. OLS estimates of effect of having at least one same-grade Black or Hispanic peer in the current school year. Standard errors clustered by teacher-year. Models condition on full set of student, peer, and teacher characteristics; peers' average value-added; and grade-year, school-year, and teacher-school fixed effects. Teacher value added is computed via adjusted test score growth models using data from 1995-2000. Peer VAM is the mean estimated value-added of all other teachers in a teacher's same school-grade-year. Novice and experienced teachers are those who have 3 or less years of teaching experience or 4+ years of experience, respectively. Results are qualitatively similar when treatment is defined as share of same-grade peers who are Black. Null results in columns 1-3 of panels B and C are robust to using a poisson multi-way fixed effects estimator (ppmlhdfe).

*** Significant at the 1 percent level

** Significant at the 5 percent level

* Significant at the 10 percent level