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ABSTRACT

Do white teachers learn racial competency from their Black peers? We answer this question using a mixed-methods approach. Longitudinal administrative data from North Carolina show that having a Black same-grade peer significantly improves the achievement and reduces the suspension rates of white teachers' Black students. Open-ended interviews of North Carolina public school teachers reaffirm 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.

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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 (Bartanen et al. 2023). An exception is Bartanen et al. (2023), who show that among novice teachers, school administrators typically identify classroom management skills as an area for improvement. The authors go on to show that poor classroom management skills predict attrition from the teaching profession and that classroom management skills improve for those novice teachers who remain in the classroom. Related 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 (De Grip & 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

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

idea of knowledge spillovers and team learning, these studies typically find that teams whose workers are diverse in 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 that 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; Delhomme 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, teacher's effort could be affected by peers 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 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 administrative data. Sections 3 and 4 describe the identification strategy and quantitative results, respectively. Section 5 describes the qualitative analysis. Section 6 concludes.

2. 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. Test scores 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.

3. Econometric Model

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 a). 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.

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.

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-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 teachers (or teacher-school) FE to identify our estimates from 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 teachers or when we restrict our sample to experienced teachers. This indicates that peer effects are particularly salient for novice teachers.

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.

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 their 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 (Ronfeldt 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

⁵ Results available from authors upon request.

Black peer on Black teacher retention are in the expected directions and largest for novice Black teachers, though they are imprecisely estimated.

5. Qualitative Analysis

5.1 Data and Method

The quantitative results presented in section 4 provide compelling evidence of causal peer effects on white teachers' racial competency, as measured by their effectiveness in teaching Black students, which operate via peer learning. In this section we describe our qualitative data collection and analysis, which generally corroborates the quantitative findings and provides some more nuanced information about how white teachers learn racial competency from their peers.

Specifically, we solicited semi-structured interviews with from a purposive sample of public-school teachers in three racially diverse counties in North Carolina between Spring 2022 and Spring 2023. We successfully interviewed 33 teachers, of whom 22 were white, 6 were Black, and 24 were female. Their tenure in NC public schools ranged from 1 to 34 years. We first sought to determine whether white teachers report having learned from their Black peers, particularly regarding pedagogy and interaction with Black students. After observing that this did occur, we then sought to determine the common means through which white teachers report having learned from their Black peers, be it through observation, direct instruction, or some other mechanism.

We modeled our interview design after the narrative interviewing approach, a well-documented method in urban sociology that employs open-ended questions to elicit natural, long-form responses (e.g., Boyd & DeLuca 2017; DeLuca et al. 2016). By avoiding overly specific probes at the onset, narrative interviewing promotes greater coverage of topics and levels of detail across interviews. When used in combination with encouraging verbal cues and body language, an open-ended question structure encourages the respondent to tell complete stories, without fear of judgment or failure to properly abide by a perceived interviewing protocol. As a result, narrative interviewing yields rich data sets optimal for grounded approach coding.

Coding for the purpose of this analysis designated segments related to the following: teaching approaches, struggles, goals, beliefs, and discipline styles in general; teaching approaches, struggles, goals, beliefs, and discipline styles specifically in regard to teaching students of different races; teachers having learned or developed their teaching style due to influence from students, mentors, peer teachers, and principals; opportunities for learning from teachers of a different race or lack thereof; personal definitions of equity and any influences on understanding of equity; school climate, staff relationships, school practices, and school culture; and formal versus informal learning experiences. Coding also included indicators for any discussions of teaching experiences as novices, their school's racial and socioeconomic composition, experiences during the pandemic, and experiences with parents. A "reflexivity" code encompasses segments related to a teacher demonstrating or failing to demonstrate some sort of reflection on their growth mindset and self-awareness in regard to racism or racial identity.

5.2 Results

Of the 33 respondents for whom we have complete, coded data, nearly all (30) discussed experiences teaching students of different races and almost 80% (26) reported challenges in this regard. About 85% (28) teachers discussed the development of their teaching styles and 90% (30) attributed a nontrivial share of their pedagogical development to learning from peers. About 73% of respondents (24), including all but one of the white respondents, specifically discussed the impact of Black peer teachers on their professional development. For example, a white female teacher explained:

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...

Of the 24 respondents who specifically mentioned the value of discussing teaching Black students with their Black peers, almost half (11) indicated that these interactions occurred during their time as a novice teacher (i.e., three or fewer years of experience). Such discussions provide evidence of “spillover” effects and confirm our quantitative findings that Black peer teachers positively influence the pedagogy and racial competence of novice white teachers, which ultimately results in improved outcomes for their Black students.

Having confirmed that teachers report experiencing and benefiting from conversations about teaching Black students with Black peers, we turn to an inquiry into the mechanisms through which this spillover occurs. As mentioned previously, teachers describe how both formal and informal interactions with their peer teachers influence their teaching practices. In our interviews, we see evidence of spillover operating through both of these channels: nearly all teachers (29 and 30, respectively) reported learning from peers through formal means, like assigned mentorship programs, and through informal means, like casual conversation and friendship. For example, one novice teacher described the following experience with her formal mentor as follows:

In this first year, I would say, I've had a really good mentor at my school. He's an English teacher. He teaches right next door to me. I've gone to him with probably 500 questions this past school year, so he's been influential in having that on-site support of someone that I know that I can go and ask a question to and I can feel comfortable talking about places where I think that I failed has been an excellent influence.

She continues, discussing her positive opinion of a specific, organized peer training program:

Also, I would say there were a few things that we learned in MAT (Master of Arts in Teaching program) that I've thought about in my first year that have influenced my practice. We talked a lot about funds of knowledge

and about understanding what students already know, trying to incorporate that and recognizing that they have strengths that they can use in the classroom. That's been a huge thing. Making sure that the talks that we've had about incorporating, especially in an English class, diverse texts because it's really easy, especially this first year of my career, it's been really easy to just stick with what's always been done because there is so much material for it and all the other teachers are teaching those texts and it's like, okay, it's just easiest to stick with that and so, I haven't done it to the extent that I want to, but trying to integrate some diverse texts.

In terms of informal learning from peers, when the interviewer asked a novice white teacher about who she goes to for help, she described her interactions with a peer teacher of a different race:

My first year, it was [name – the teacher she spoke about], just going to him and being like, I need help. And just telling him, I don't know, and I don't know who to ask, and I feel stupid for asking, but I need help because I don't know X, Y, or Z. And he would help me out with whatever I needed to be. And he didn't judge me either. I want to be better. I want to know better and do better moving forward.

This respondent finds value in interracial peer interactions, with her peer teacher's advice contributing to her goal of becoming a better teacher for her students of other races.

The quantitative analysis of administrative data from North Carolina described in section 4 provides compelling evidence of spillover effects, as the presence of at least one Black same-grade peer produces a significant increase in the test scores of Black students of white novice teachers. The qualitative data discussed in the current section allows us to confirm and to better understand the mechanisms through which these spillover effects arise. Evidence from the qualitative data shows how both formal and informal interactions among peer teachers of different races produce positive effects on teacher attitude and performance. These characteristics improve teacher quality, which is understood

to be associated with improved student outcomes (Chetty et al. 2014 a, b; Jackson 2019). These narratives allow us to conclude that spillover effects of Black teachers on the Black students in other classrooms, specifically those of novice white teachers, are the causal result of peer learning through both formal and informal interactions with peer teachers.

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.

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. This would augment the positive impacts Black teachers have on Black students through via their direct interactions with students in their classrooms 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.

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TABLE 1: Summary Statistics

Variable	Observations	Mean	SD
<i>Unit of observation: student-year</i>			
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	
<i>Unit of observation: teacher-year</i>			
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 (1)	Novice (2)	Experienced (3)	All (4)	Novice (5)	Experienced (6)
A. Standardized End-of-Grade (EOG) Score						
	MATH			ELA		
1+ Peer	0.004 (0.006)	0.056** (0.028)	0.004 (0.008)	-0.002 (0.006)	0.062** (0.031)	-0.011 (0.008)
Peer VAM	0.052*** (0.009)	0.071** (0.031)	0.059*** (0.011)	0.020*** (0.008)	0.110*** (0.042)	0.025** (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 (0.057)	0.284 (0.353)	0.078 (0.073)	0.002 (0.002)	0.011 (0.013)	0.001 (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 (0.019)	-0.051 (0.124)	-0.000 (0.025)	-0.009** (0.004)	0.003 (0.021)	-0.014*** (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 (0.005)	-0.021 (0.024)	0.005 (0.006)	0.005 (0.004)	-0.027 (0.025)	0.009* (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 (0.011)	0.132 (0.100)	-0.029* (0.017)	0.014 (0.012)	0.093 (0.172)	-0.003 (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 (0.008)	-0.010 (0.012)	0.007 (0.009)	0.009 (0.017)
Lag	0.012 (0.008)	0.022* (0.012)		0.008 (0.017)
Double Lag		0.031*** (0.011)		0.034** (0.016)
Lead			-0.012 (0.008)	-0.011 (0.015)
N	171,862	100,488	154,206	57,958
B. ELA				
Black Peer	-0.014 (0.009)	-0.014 (0.013)	0.000 (0.010)	-0.001 (0.020)
Lag	0.028*** (0.009)	0.060*** (0.013)		0.071*** (0.019)
Double Lag		-0.021* (0.012)		-0.014 (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 (0.028)	0.643 (0.402)	0.049 (0.041)
Mean	0.65	0.73	0.66
B. Stays in Same School			
Black Peer	0.006 (0.027)	0.300 (0.371)	0.050 (0.037)
Mean	0.71	0.81	0.73
C. Exits NC Public Schools			
Black Peer	-0.008 (0.026)	-0.340 (0.350)	-0.057 (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 (1)	Novice (2)	Experienced (3)	All (4)	Novice (5)	Experienced (6)
A. Standardized End-of-Grade (EOG) Score						
	MATH			ELA		
1+ Peer	0.002 (0.005)	0.037 (0.024)	0.002 (0.007)	0.005 (0.005)	0.054** (0.027)	-0.004 (0.007)
Peer VAM	0.053*** (0.008)	0.070** (0.028)	0.056*** (0.010)	0.017*** (0.007)	0.080** (0.037)	0.023*** (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 (0.047)	0.268 (0.290)	0.058 (0.062)	0.001 (0.002)	0.008 (0.012)	0.000 (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 (0.013)	-0.021 (0.085)	-0.013 (0.018)	-0.005** (0.003)	0.015 (0.015)	-0.011*** (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 (ppmlhdfc).

*** Significant at the 1 percent level

** Significant at the 5 percent level

* Significant at the 10 percent level