

Introduction

Despite the clear need for a diverse teacher workforce to serve a diverse student body, American teachers remain predominately White and segregated. Between 2000 and 2016, the proportion of minority students in American public schools rose from 39 percent to 52 percent—a 13 percentage point increase (Figure 1). By contrast, the proportion of minority teachers only rose by four percentage points, from 16 percent to 20 percent minority (Figure 1). Further, teacher race tends to be concentrated across schools. Over 40 percent of American schools exclusively employ White teachers (Bireda & Chait, 2011), and survey data shows that 90 percent of White teachers have no minority colleagues (Frankenberg, 2006). Improving the teacher pipeline for non-White teacher candidates solves America’s teacher diversity problem in the long-run, but the rapid diversification of students and racially stagnant teaching force demands short-run solutions. This study proposes a potential mechanism to improve teacher human capital by estimating spillover effects of racially diverse peers. I focus on whether collaboration between White and non-White teachers improves the effectiveness of White teachers with non-White students.

I leverage a novel dataset from Pennsylvania to describe the extent of teacher segregation and estimate the effect of cross-racial collaboration on White teachers’ effectiveness with non-White students. Specifically, I ask the following research questions to determine whether racial peer effects can improve White teachers’ effectiveness with non-White students:

1. To what degree are Pennsylvania teachers segregated across school contexts?
2. What is the distribution of race among teacher colleagues at the school, grade, subject, and subject*grade levels?
3. Do diverse teaching teams improve the effectiveness (as measured by value-added) of White teachers with non-White students?

My research extends contemporaneous literature on teacher and student race-matching to investigate whether racially diverse colleagues can improve White teachers’ effectiveness with minority students.

Policy Context and Data

Pennsylvania’s minority teacher pipeline is in decline. While Pennsylvania’s teacher pipeline is generally weak—between 2010 and 2017 academic years, the number of new teaching certificates fell from 14,247 to 4,412 (Graham, 2018)—the shortage is more pronounced for non-White teacher candidates. Overall, since 1996, Black teacher candidates has decreased by 60 percent (Stohr et al., 2018). In 2014, there were 8,552 teacher program graduates across higher-education institutions; of those 8,552, only 29 were Black males and 20 were Latino males (Stohr et al., 2018).¹ Taken together, this means that Pennsylvania is experiencing a minority teacher shortage and has no short-run solutions to increasing the minority teacher pipeline but has a diversifying student body. Thus, understanding whether racial peer effects exist serves as a first step to potentially improving outcomes for minority students.

The data for this project comes from the Pennsylvania Department of Education (PDE) and includes restricted-use student and teacher-level data. Access to this data was obtained via a partnership to evaluate a principal induction program and approval for this project was obtained through an application process to align academic research with PDE’s strategic goals. The data

¹ Only available for male teacher candidates of color.

set includes the following observable characteristics for students and staff (i.e., teachers and principals):

1. **Teacher Data.** Teacher data includes: i) unique staff identifiers; ii) unique school identifiers; iii) demographic information (race/ethnicity, gender, date of birth); iv) experience (years of being an educator, both in Pennsylvania and the observed district); v) educational attainment (highest degree earned); vi) staff assignment code (allowing the researcher to identify the type of educational professional)
2. **Student Data.** Student data includes: i) unique student identifiers; ii) unique school identifiers; iii) demographic information (race/ethnicity, gender, date of birth); iv) achievement data (PSSA and Keystone scaled scores and proficiency levels for tested subjects; v) poverty status (either free/reduced price lunch status or TANF/SNAP recipient); English language learner (ELL) status; vi) disability/individualized education plan (IEP) status
3. **Course Enrollment Data.** Course enrollment data includes: i) unique staff identifiers; ii) unique student identifiers; iii) school identifiers; iv) Course identifier (allowing the researcher to identify the course being taught); v) Course section identifier (allowing the researcher to identify classrooms); vi) Course name; v) core subject indicator (allowing researchers to identify if a course is a mathematics or reading course)

Empirical Approach

I employ a series of descriptive and econometric techniques to understand the distribution of teachers, segregation, and teacher effectiveness in Pennsylvania. To construct estimates of teacher effectiveness, I estimate the following model:

$$\begin{aligned}
 [1] \text{ } Ach_{ijsdt} = & \beta_1(Ach_{ijsdt-1}) + \beta_2(Ach_{ijsdt-1}^{other}) \\
 & + \beta_3(\%MinorityColleagues_{jteam} * NonWhite_i * White_j) + \mathbf{X}'_{it}\boldsymbol{\Omega} + \mathbf{Z}'_{st}\boldsymbol{\Gamma} \\
 & + \mathbf{C}'_{ijt}\boldsymbol{\alpha} + \mathbf{P}'_{jt}\boldsymbol{\eta} + \boldsymbol{\theta}_{jteam} + \epsilon_{ijsdt}
 \end{aligned}$$

Where Ach_{ijsdt} is the test score (either mathematics or reading) for student i , taught by teacher j , in school s , in district d , during year t . I control for student's past performance on the same subject (mathematics or reading) test, $Ach_{ijsdt-1}$, and the other subject test (mathematics or reading) $Ach_{ijsdt-1}^{other}$. Further, I control for time-varying student characteristics, \mathbf{X} , time-varying school-level characteristics, \mathbf{Z} , and time-varying student peer characteristics at the classroom level, \mathbf{C} . Following Jackson and Bruegmann (2009), I include a vector of teachers' peers' average characteristics (including years of experience, level of education, and value-added scores), \mathbf{P} . Further, I include a teacher*team fixed effect, $\boldsymbol{\theta}_{jteam}$. I vary this fixed effect based on the level of teacher interaction I want to estimate—either at the school, grade, subject, or grade*subject levels. The coefficient of interest, β_3 estimates if the percentage of minority colleagues improves a White teacher's effectiveness with minority students.

Contribution

This work allows researchers, policymakers, and practitioners gain insight into the racial dynamics of the teaching workforce. Particularly, this knowledge will be helpful in creating teacher teams and training new teachers. For example, if this research shows that having diverse teacher colleagues improves White teachers' effectiveness with minority students, district

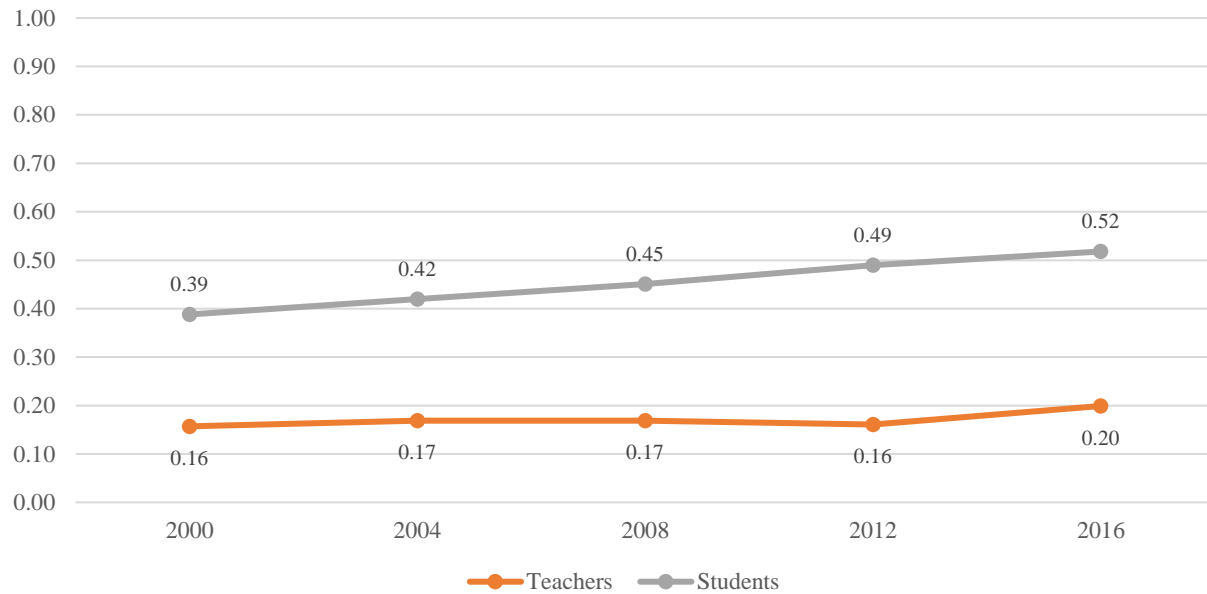
Teacher Segregation and Effectiveness: Evidence from Pennsylvania
Haisheng Yang

officials would want to assign White teacher candidates to non-White teacher mentors to induce racial spillover effects.

Works Cited

- Bireda, S., & Chait, R. (2011). Increasing Teacher Diversity: Strategies to Improve the Teacher Workforce. *Center for American Progress*.
- Frankenberg, E. (2006). The segregation of American teachers.
- Graham, K. (July 12, 2018). *The teacher supply is plummeting. Pa. will spend \$2M to stem the tide*. The Philadelphia Inquirer.
- 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.
- Stohr, A., Fontana, J., & Lapp, D. (2018). Patching the Leaky Pipeline: Recruiting and Retaining Teachers of Color in Pennsylvania. A PACER Policy Brief. *Research for Action*.

Figure 1. Teacher and Student Demographics, by Year



Notes. Each data point is the proportion of non-White teachers or students in a given school year. Data comes from the National Center for Education Statistics' 2017 Digest of Education Statistics, which can be accessed at: https://nces.ed.gov/programs/digest/current_tables.asp