BLACK K12 FACULTIES:
SUSTAINING, EDUCATING, AND INSPIRING BLACK EDUCATORS

By

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ABSTRACT

Taking the form of three papers, this dissertation seeks to elaborate the role and experience of Black educators by shifting primary research perspective away from the classroom teacher to consider the systemic and organizational roles of racialized faculties. The first paper historicizes the 20th- and 21st-century stories of Michigan's Black teaching corps. This corps emerged as a central feature of the state's civil rights struggle and a critical point of sustaining consensus among the state's ruling political coalition – only to stall and ultimately collapse by half in the decade after 2005. These declines were fueled in part by the substantial relocation of Black-student enrollments away from urban centers of traditional Black-teacher employment with only marginal expansion of Black-teacher employment in receiving districts. Suggestive evidence shows that new Black teachers may modally prefer the traditional contexts – including the presence of substantial extant Black faculties.

Through the lens of comparative Black-student achievement outcomes, the second paper explores the tension of organization-level Black-faculty operations with those of classroom-level Black teachers. This is an extension of the teacher-student ethnic/racial match literature commencing with Dee (2004). I seek to more fully evaluate the conceptual and empirical simultaneity of teacher-student matching, faculty-student match, faculty-teacher matching, and the three-way phenomenon of intersected faculty race, teacher race, and student race as elements of the (even) broader context of school's observable racial structure. I find that the school-level feature of Black-faculty proportion describes moderation effects of the underlying teacher-student match measure, but that more complex school racial features ultimately more robustly characterize comparative levels of Black-student achievement.

The final empirical paper considers the relationship between comparative rates of Black-teacher postsecondary study of teaching and those students' exposure to qualitatively distinct levels of Black K12 faculty. I find significant conditioned enhancements of Black-student teaching choice

vs. non-Black same-school peers among the pool of students entering university study shortly after their high school graduation.

ACKNOWLEDGEMENTS

This work is a response to those who mount the daily struggle with the problems of teaching and learning. These continue to strike me as among the most interesting and valid problems we have as a society and the choices of those who choose to get involved and seek understanding fascinate me. Let me first acknowledge the vast efforts of teachers and students. No one has supported this work more than my wife and daily collaborator Corey Drake. Her clear-headed commitment to children and an arc toward justice infuses integrity in all her efforts. I extend my thanks to my committee, Josh Cowen (advisor), Scott Imberman, Terry Flennaugh, and Anne-Lise Halvorsen. I thank them not just for their support of my work, but for their enduring efforts. A special thanks to Josh for his partnership as a co-author in this and other work.

My sincere thanks to the citizens of North Carolina and Michigan and their representatives for their ongoing support of this and other educational research by providing access to public K12 administrative databases. The North Carolina Educational Research Data Center provided data to this work through their dissertation lending program. My thanks for their review and approval of this manuscript. Any analytical mistakes are my own. Additionally, this research used data structured and maintained by the MERI-Michigan Education Data Center (MEDC). MEDC data is modified for analysis purposes using rules governed by MEDC and are not identical to those data collected and maintained by the Michigan Department of Education (MDE) and/or Michigan's Center for Educational Performance and Information (CEPI). Results, information and opinions solely represent the analysis, information and opinions of the author(s) and are not endorsed by, or reflect the views or positions of, grantors, MDE and CEPI or any employee thereof. All errors are our own.

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INTRODUCTION

Readers of this dissertation's abstract may be considering what Black K12 faculties are and what they might do. Do they provide mutual supports? What do "Black faculties" do that is different from other "faculties"? Are they an administrative organ? Are they simply a probabilistic phenomenon? That is, are they simply representative of the possibility that another teacher of Color – other than one's own classroom teacher – may be both present and sensitive to a subtle, racialized, encounter in the hallway and intervene to enhance the dignity of involved students and of a school? Do they similarly affect interactions among adults?

In the work following, I engage these questions, but I also acknowledge that my methods leave these questions largely unanswered. In this dissertation, I present three empirical studies that can observe the presence of Black teachers and the size of Black faculties (across systems and within schools) but cannot report what happened in a sidebar conversation in the faculty lounge, what happened in that hallway, or what network engaged a prospective new Black educator – or assign any effects to these phenomena. Rather, this work centers on the contexts in which a Black faculty was built, diminished, and sustained; the school contexts in which Black students and (by definition) Black future educators are educated; and the school contexts of new Black teacher emergence. Underlying all this work is an observation that if schools are thought to work – if teaching and teachers succeed – then someone will step forward and teach. It is in this sense that this dissertation is a case study – one of multiple roles of Black educators that bear on the processes which sustain a teaching corps and sustain public education.

More generally then, who teaches and why? In the *Handbook on the Economics of Education* Dolton (2006) observes that teaching supply can be conceptualized as a repeated game where each (prospective) teacher annually reevaluates teaching. Shall I teach or shall I not teach? This framework is effective to the extent that it captures historical patterns of interrupted work associated

with formal and informal educational and family sabbaticals, and, when more broadly imagined, can incorporate the longstanding and substantial rates of teacher turnover. It also, however, can describe an evolution of the K12 labor market – the evolving teaching warrant offered as a function of public policy and the evolving set of prospective teachers as a function of their preferences and opportunities. Quite simply, Dolton allows for teachers to opt out.

Research surrounding prospective teachers' teach/not-teach decisions often centers on pecuniary compensation. Wages and contract structures are observable policy measures which are easily and discretely modified – and they matter. Survey research among university students finds explicit rejection of teaching by those otherwise tempted based upon comparative wage levels (Elfers, Plecki, St John, & Wedel, 2008) and undergraduates have been shown to calibrate major choice to new information about wage conditions (Long, Goldhaber, & Huntington-Klein, 2015). Prospective teachers appear to be responsive to expectations for future demand levels (Zarkin, 1985) and job risk associated with economic downturns (Neugebauer, 2015). Those (e.g., among Latinx immigrant communities) with comparatively less intergenerational prestige and wealth often feel pressure to pursue other occupations (Bowsher et al., 2023; Ocasio, 2014; Valadez, 2008; Will, 2023). Those who choose to study teaching are more risk averse than business and law students (Bowen, Buck, Deck, Mills, & Shuls, 2015). Finally, and perhaps most consequentially, women – especially those at the highest end of academic ability scales – have been broadly responsive to advancing opportunities outside of K12 teaching (Bacolod, 2007; Corcoran, Evans, & Schwab, 2004; Dolton, 2006; Flyer & Rosen, 1997).

My work is foundationally interested in other reasons for teaching. I wonder about the prospective teachers who themselves wonder: What is teaching? What is the job? What are its goals? Does it work? When a parent rhetorically asks their undergraduate prospective teacher, "Do you wish to be poor forever?" (Bowsher et al., 2023; Will, 2023) – I propose that prospective teacher is

not so naïve. The underlying question is, "Do I wish to be poor for this?" In the papers following, I observe that K12 teaching is the one job about which we all know – or think we know – something. These prospective teachers, as students, are proto employees within the enterprise. They observe schools and schooling – teachers and teaching – directly. By comparison, teaching wages, supervisory structures, reasons for teacher turnover – all will be known primarily by reputation. In this vein, I emphasize theories of motivation that hold the pecuniary and non-pecuniary in a symmetric or even (especially in the rich world context) an inverted relationship. Dolton's (2006) framework, for example, acknowledges a "propensity to teach" (i.e, compensating differential (Rosen, 1986)) that modifies the labor supply wage function in relation to implicit non-wage returns to teaching. This model is a reaction to evidence that teaching offered a uniformly inferior conditioned wage for men over large periods of the 20th century, yet was still residually attractive to large numbers of men (Dolton, 2006; Flyer & Rosen, 1997) and is broadly consistent with observations that (especially in the rich world) there are limits to the power of wages and steep incentives (job threat, bonuses, etc.) to motivate work (Bassett-Jones & Lloyd, 2005; Herzberg, 1987; Herzberg, Masuner, & Snyderman, 1959).

The 20th-century project of building universal public education is remarkable. It substantially reconciled and consolidated the complex socioeconomic demands and political impulses of the nation under an umbrella where "school," "teacher," "reading," and "math" are detonations – resolved objects of understanding. We know what they are. We imply the efforts of millions with these terms without qualification or clarification. I am particularly struck by two studies of teacher motivation that have moved substantially beyond survey research. Richardson and Watt's (2006) *FIT-Choice* scale is a comprehensive effort to resolve the psychometric structures of teacher motivation – and ultimately loads against the altruistic, intrinsic, and extrinsic factors thought to be foundational to all human endeavor (Deci & Ryan, 2000) and to career choice in particular (Eccles,

2009; Wigfield & Eccles, 2000). Fascinatingly, their construct divergence between the altruistic and intrinsic is achieved with (what I suggest are) near-tautologies. "I am interested in teaching"; "I've always wanted to be a teacher"; and "I enjoy teaching." These all are empirically meaningful and reliable measures of teacher motivation that load on different factors than those that align with teaching to improves students' lives and our communities. One can inquire as to whether more substantive items that invoke specific qualities of practice might enhance the scale, but this in no way undermines that these items are adequate to define the *work* of teaching as distinct from the "worthwhile social contributions" of teaching. As another example, Lortie's *Schoolteacher* (1977) – researched at what might be described as the period of culmination of the postwar universalism project – develops a thesis of teaching that is already deeply conservative. He offers an embellished framework of attractors to teaching, but one in which there exists no home for pedagogical conception, of deep contemplation of students, and of evolving practice and reform. We find no expression for teachers having become teachers because they sought to know how to teach, to extract intrinsic satisfaction from the struggle of cultivating their own teaching practice, or even to uncover what teaching might be. Among in-service teachers, *to want to teach* is to be qualified as a teacher[1]; a willingness to acquiesce to a set of norms with which we are familiar is thought to be the foremost occupational demand. When in equilibrium, a language of consensus describes the profession.

This dissertation is conceived in the dislocating context of the era post the 2008-2009 Great Recession and the contemporaneous Race to the Top initiative. Both of these events undermined premises of teaching career motivation. The Great Recession and the limited capacity for state-level fiscal response threatened assumptions of public employment. In many parts of the United States,

[1] This need not be a vacuous sentiment. Teachers could, for example, be saying "I am qualified to teach because – unlike others – I recognize and am interested in the problems of teaching and am committed to the continuing learning processes associated with great teaching." Lortie implicitly reports that this is not the case.

Race to the Top led to dismantling of collective-bargaining rights over teacher evaluation (i.e., over definitions of the work of teaching) and teacher tenure protections (attacking a central premise of the long-term teacher contract) (Brunner, Cowen, Strunk, & Drake, 2019). These changes escalated and reimagined the premise of school reform – from one that located systemic failures and inequity in the competencies policy makers and schools – to one that blamed teachers and teaching itself. Reforms were structured to provide administrators maximum leverage to change classroom practice (Kane, 2018). While these reforms were not so acute as to effect substantial spontaneous exit among in-service educators (having already incurred the costs of teaching and invested socially and economically in their places of work and residence) (Brunner et al., 2019), they do appear to have contemporaneously reduced the numbers of new teachers by approximately 15% (Kraft, Brunner, Dougherty, & Schwegman, 2020). For the first time since at least 1969, majorities of both working teachers and the general public indicated they would discourage their own children from becoming teachers (Phi Delta Kappan, 2019). College-bound students' teaching intentions eroded to historical lows (ACT Inc., 2016; Croft, Guffy, & Vitale, 2018). Through Fall 2016 national teacher preparation program completions monotonically declined to 73% of 2008 levels. Enrollments reached a low of 59% of 2008 levels in 2014 (Office of Postsecondary Education, 2023). Oklahoma, Michigan (a state central to the work here), and Pennsylvania led period declines with 2016 enrollments reaching 17%, 29% and 34% of 2008 levels. Black enrollments in Michigan were down 89% (second only to Oklahoma for states with large Black enrollments).

The scale of these supply-side responses led to debate about their structural significance and durability (Cowan, Goldhaber, Hayes, & Theobald, 2016; Sutcher, Darling-Hammond, & Carver-Thomas, 2016a, 2016b). Nationally, teacher preparation enrollments snapped back by 1/3 off lows (to approximate present levels) by 2019, supporting arguments that declines – even if irrationally elastic – were likely responses to supply imbalances. What is clear is that the decade ending circa

2016 was one of acute malaise in expressed teaching intent. Notwithstanding the marginal (and perhaps transitory) policy timing effects found by Kraft et al. (2020), teacher preparation enrollment declines substantially preceded Race-to-the-Top era reforms and extended to Washington DC and forty-six states (Office of Postsecondary Education, 2023). Given the scale of this supply response, I encourage consideration of an alternative phenomenon. Would we be better served to interpret the Obama administration-sponsored Race-to-the-Top reforms as more substantially symptomatic of a broad, national crisis of faith in the efficacy of teachers and teaching? Was it one that finally undermined the trivialized consensus of the related work and objectives of teaching? Was it so profound as to fracture the political coalition within the Democratic party of White liberals, the labor movement, and Black political organs and communities that had substantially built the urban landscape of public education (Mirel, 1999) that reform was primarily targeting? What would so undermine a regime that had been substantially funded and sustained by the wage insensitivities of millions of teachers (Altman, 2005; Dolton, 2006)? …and one deeply understood within our culture among prospective teachers in ways that policy and law may not?

This dissertation centrally explores Black K12 faculties (in both their system-level and school-level incarnations) not just as resources for and evidence of system equity but also as exemplars of the relation between system experience and preferences for teaching. Underlying this work is a contemplation – informed by the preceding context – of how much altruism matters. Paper 1 of this dissertation, previously published with my co-author and advisor (Drake & Cowen, 2022), relates the 20th and 21st century stories and struggles of Michigan's Black teaching corps. What strikes me most now as I subsequently write this introduction is how ultimately conservative the demands of the social justice movement were in the Civil Rights era. Black political organs and leaders (even those like Albert Cleage Jr. most critical of our societal assumptions and forces of assimilation) were centrally focused on securing equitable educational access for Black students and

– explicitly – Black-teacher employment (Kang, 2020; Mirel, 1999). This is to say that the Black community believed in schools and schooling, teachers and teaching. In concert with the broader national expansion of the K12 regime, thousands of Black teachers emerged (from scores) in Detroit and other cities within a generation (Mirel, 1999; Todd-Breland, 2018). These gains all happened in a period of profound discrimination; a civil rights ideology (Kelly, 2007) framed in the context of adversity animated this project. Yet, in Detroit and elsewhere, momentum was lost such that we continue to examine the profound underrepresentation of teachers of Color in public education (National Academies of Sciences & Medicine, 2020). As I will relate, increases in Black-teacher representation in Detroit stopped just as the city's Black community consolidated local power. Ultimately, Detroit's story is not unlike the national Race-to-the-Top era story relayed above. It is deeply confounded with broader economic phenomena. Could they be further related as crises of altruism? Crises in the possibilities of schools? Crises in the ultimate efficacy of (Black) educators to effect positive outcomes – for education to be a vanguard in the effort to dismantle the effects of structural racism?

Paper 2 of this dissertation engages one of the central literatures of Black-teacher efficacy (i.e., how do Black teachers matter?) – the teacher-student ethnic/racial match literature commenced by (Dee, 2004). At one level my work here uncritically embraces achievement score growth as a measure of teaching success despite use of that policy instrument to pressure the teachers and schools where Black educators disproportionately work in patterns that appear to be discriminatory (Drake, Auletto, & Cowen, 2019; Steinberg & Sartain, 2020). Still, I join others working toward enhanced Black-teacher representation who find these matching phenomena relevant to the project of student equity and likely indicative of, and parcel to, broader constructive, racialized phenomena between educators and their students (Bristol, 2018; Gershenson, Hart, Hyman, Lindsay, & Papageorge, 2022). My paper extends this literature by elaborating *classroom-level* Black teacher-Black

student match to include related *organization-level* Black-faculty moderation effects. Where Paper 1 offers suggestive evidence that new Black teachers modally prefer working with other Black educators on predominantly urban, legacy Black faculties (including Detroit where the civil-rights era Black-teacher representation project stalled) despite shifting Black-student enrollment populations to suburban contexts (Drake & Cowen, 2022) – Paper 2 offers suggestive evidence that Black teachers may be incrementally and comparatively advantaged in these same contexts.

Paper 3 opens itself to the broader possibilities about how Black educators may influence their students' career decisions. Using administrative data, it explores whether the operations of Black faculties might influence the decisions of prospective Black teachers – their own students – to follow through with postsecondary study of teaching. This hypothesis can be generated within the narrow parameters of teacher efficacy established in Paper 2. Do prospective teachers (a) detect comparative effectiveness of educator exemplars and (b) update expectations of own their effectiveness and altruistic potential? This work invokes, however, a far broader set of mechanisms. Even if we stipulate to an altruistic motive behind prospective teachers' teach/not-teach decisions, what form of effectiveness is considered? Impact on achievement? On racial climate (Carter Andrews, Castro, et al., 2019)? On the humanization of students and their school experience (Warren, Carter Andrews, & Flennaugh, 2022)? These confounds are substantial. Still, given evidence of an apparently crucial and similar role of altruism in the teaching decision among prospective teachers and teachers of all races (Gordon, 1994, 2002b; King, 1993; Leech, Haug, & Bianco, 2019), I contend that the heterogeneous rates of Black new-teacher emergence that does seem apparent across Black-faculty contexts is informative. It raises alarm in contexts such as Michigan in which Black enrollments are shifting away from centers of Black-teacher employment (Drake & Cowen, 2022). It also suggests the presence of important and perhaps provocative conceptions of teaching and school effectiveness.

Let me be explicit in my proposition that there is much to be learned about the teacher pipeline by examining stand-offs between prospective teachers' needs and the educational system – as appears to have happened in some form in the Race-to-the-Top era and may substantially characterize the enduring struggle to close racial representation gaps among educators. Within its own set of resource constraints, this dissertation has explored these potential stand-offs implicitly. New Black teachers in Michigan are predominantly choosing not to join comparatively White suburban faculties. Black students (as prospective educators) realize, witness, and conceivably discern lower comparative achievement gains in schools with fewer Black faculty. College-going Black students become educators less often when they attend schools with qualitatively lower levels of Black teacher employment. Going forward, our understanding of the mechanisms underlying these phenomena will be enhanced by direct engagement of our prospective teachers.

Seeking to understand low teaching participation rates, Gordon (1994, 2002a, 2002b) interrogates broadly diverse non-White teachers, surfacing evidence of disaffection between potential teachers and the mainstream K12 regime. Gordon's informants believe that teachers and teaching are held in higher esteem when schools are tied to closely held communities of racial character and that teachers of color are discernably of diminished status in predominantly White-faculty schools and that *students' (and their parents') own experiences of disenfranchisement inform low affect for teaching.* King (1993) elicits similar results among pre-service teachers of Color. We have a need for updated studies of prospective teachers' imaginations of the work and possibilities of teaching and how their perspectives on those possibilities inform teaching intent. If prospective teachers of Color were discontent with the capacities of schools 30 years ago, what is the state of altruism in the teacher pipeline now: not only after the sociopolitical turmoil of Race to the Top, but after our broader contemporary crises of social justice? Do teachers and teaching matter now?

Bowsher et al. (2023) and Kyriacou and Coulthard (2000) take a fundamental step and (rather than interrogating the needs of those who persist in teaching or rely on their conjectures about those who do not teach) *shift the research emphasis to prospective teachers who ultimately reject teaching*. This work has been done among undergraduates. Given the profound reproductive tendencies of teachers and teaching – including the conservative workplace preferences of Black teachers described in Paper 1 and the differential rates of Black teacher emergence elaborated in Paper 3 – we should extend this work to the pools of prospective teachers in high schools. In the rich and heterogeneous contexts of own-experience that inform our conceptions of ourselves and the world, how do prospective teachers (who are they? How do their stories structurally converge and diverge?) understand the capacities of schools and teachers and how do those interpretations explicitly inform the teach/not-teach decisions that ultimately shape our schools?

PAPER 1. DEURBANIZATION AND THE STRUGGLE TO SUSTAIN A BLACK TEACHING CORPS: EVIDENCE FROM MICHIGAN[2]

Introduction

A growing literature demonstrates the broad benefits to all students – but especially students of color – working with Black and Latinx teachers (McKinney de Royston, Madkins, Givens, & Nasir, 2020; Redding, 2019). These findings, the United States' uneven progress in racially diversifying the U.S. teaching force,[3] and the notion that a social system's health is in part measured by levels of participation among the communities it serves all have focused attention on the need to recruit and retain Black teachers in American public schools (e.g., National Academies of Sciences & Medicine, 2020). Gaps between the United States' increasingly diverse K12 student population and its teacher corps are growing as student demographic changes outpace those of teachers (National Academies of Sciences & Medicine, 2020). The percentage of teachers who are White declined from 83 to 80% from 2003-04 to 2015-16, but Black teacher share also declined over the period from 8 to 7 (National Center for Educational Statistics, 2019). (Black student population share also declined marginally over the same period such that representation rates only marginally declined.) These same data show that Black teachers continue to work disproportionately in schools with high Black student populations.

On the other hand, student migrations away from cities to suburbs and other locales with primarily White faculties – driven by both socioeconomic change and policy interventions such as school choice—have attenuated historical links between teachers and students of color established through mid-20th century expansion of the Black teaching force in many cities. Though the full diversity of racial-ethnic residential patterns persists and reestablishes itself in new communities,

[2] Co-authored and published as Drake and Cowen (2022). Unorthodox structure of data, methods and other aspects of the work reflect style choices of the authors and the norms of the journal for brevity and focus.
[3]Especially the historic loss of tens of thousands of Black educators post the *Brown* decision (Ethridge, 1979).

population migrations are leading to increased prevalence of White-Black and White-Hispanic "places." These geographies (smaller than metropolitan areas and larger than neighborhoods) may still exhibit "place stratification" where class and race mechanisms such as own-group affinity and other-group aversion result in development of non-urban ethnic communities or enclaves ("ethnoburbs") (Hall, Tach, & Lee, 2016; Martin, Matthews, & Lee, 2017). These may or may not map to school catchment and school choice patterns such that net effects on student segregation are themselves heterogeneous and complex (e.g., Fuller et al., 2019) – even if, on balance, school-level segregation has likely increased since its post-*Brown* nadir (Jackson, 2009; Reardon & Owens, 2014).

In this paper we explore the intersection of racial-ethnic spatial mobility, changes in school-level enrollment patterns, and employment patterns of Black teachers[4] in Michigan. Reversing dramatic 20th century gains tied to increased Black political power, state-level K12 administrative data show that Michigan's Black teaching force declined 48% from autumn 2005 to autumn 2015, compared to a 19% loss among White teachers and a 6% gain among its still small Latinx corps.[5] We find that the declines in Black teaching levels are substantially related to student enrollment losses that reflect large out-migrations of students from districts that employed Black teachers at high rates in 2005. Districts that received these students, on the other hand, did not make compensatory hires. This phenomenon may be influenced by a contemporary precipitous decline in the state's Black teacher preparation candidates; though more recent patterns of Black teacher system matriculation appear to be disproportionately supportive of legacy Black faculties rather than evolving with shifting K12 racial demographics to new schools.

[4] Classroom teachers are identified within the Michigan administrative data by assignment (job description) codes; we limit our analysis to "lead" classroom teachers and exclude aides, counselors, substitutes and other professional staff. We rely on racial ethnic codes in the data: Black or African American ("Black"), White ("White"), and alternatively Hispanic or Latino and Hispanic of Any Race ("Latinx"). All racial groups are mutually exclusive in available data; 0.8% of teachers in 2018 identify as Two or More Races and are not coded as Black, White, or Latinx in our analyses.

[5] The 2003 and 2011 waves of the Schools and Staffing Survey suggest that Michigan's Black teaching corps losses (adjusted for shifts in underlying K12 population) were exceptional; only Tennessee experienced similar proportionate declines over the period among states where data is available (National Center for Educational Statistics, 2020).

Theoretical framework

Our study is framed by *boundary heightening theory* (Kanter, 1977) , most recently operationalized and extended by Bristol and colleagues (Bristol, 2018; Bristol & B. Goings, 2018; Bristol & Shirrell, 2019). This framework outlines multiple challenges of minoritized members of organizations that are affected by degrees of social isolation and administrative tendencies to essentialize their roles (Bristol, 2018; Mabokela & Madsen, 2003a, 2003b; Madsen & Mabokela, 2000). Per Kanter's taxonomy, this suggests the possibility of distinct socialized experiences for teachers of color in progressively White faculty contexts where one's experience as a Black teacher may be substantially different in a "balanced" (~50/50), "tilted" (~65/35), "skewed" (~85/15), and "uniform" (with very few minoritized group members) context. Progressively tokenized group members may face comparatively acute performance pressures, boundary heightening (where real differences are counter-constructively pronounced), and role entrapment (where, in the present context, Black teachers are instrumentalized (and evaluated) as solutions to problematized Black students (Brockenbrough, 2015; Mabokela & Madsen, 2003b)). Recent research supports a hypothesis that dynamics such as these may affect the teacher labor market by discouraging Black teacher entry and retention in schools with substantially white faculties. Bristol (2018) shows that Black male teachers have higher persistence intentions and are less likely to report negative experiences such as being feared when working as part of larger within-school Black teacher cohorts. Drake et al. (2019) show that higher percentages of Black teachers at a school moderate both Black teachers' disproportionate receipt of low evaluation ratings vs. White peers and Black faculty retention. Analysis of pedagogical and socio-emotional teacher-to-teacher support networks in K12 schools with small Black faculties suggests that these important relationships are indeed partially racialized (Bristol & Shirrell, 2019; J. L. Nelson, 2019). Finally, the quasi-experimental end to federal desegregation orders in Charlotte-Mecklenburg revealed a predominant (but not

complete) preference among Black teachers there to work in schools with comparatively Black student populations and faculties (as teachers exercised their unrestricted rights to school transfer) (Jackson, 2009).

More generally, our work is situated within the large literature that establishes the experience of Black teachers within schools and school systems as historically (e.g., Mirel, 1999) and presently e.g., Bristol and B. Goings (2018) racialized – and that those racialized experiences can be a function of the representation levels of Black teachers in those contexts (Bristol, 2018; Kelly, 2007). Through use of the term Black *faculty*, we acknowledge the group-level, collective efforts of Black teachers to secure and protect fair employment pathways for prospective Black educators, to provide formal and informal mutual professional supports both within predominantly Black and multi-racial contexts, and to advocate for system-level justice for Black and other students (Bristol & Shirrell, 2019; Mirel, 1999; Todd-Breland, 2018; Walker, 2018). It is in this context that we employ the construct of Black faculty as both a quantitative measure of those faculty *members* (i.e., teachers) within a school, district or state that are Black, but also an organ of system-level action and response.

Research objectives, data and methods

Our study has four key elements. First, we seek a baseline understanding of the historical conditions under which Michigan's Black teacher corps emerged. Especially, what roles did racial-ethnic spatial and political structures play in enabling and shaping Michigan's Black teaching corps? Second, we seek to understand the extent to which shifting K12 student enrollments are actually linked to declining Black teacher employment in distinction from a) the dislocation to urban school systems caused by charter schools and b) evolving racial composition of district faculties. Third, we seek to describe evolving exposures of Black students and Black teachers to Black and non-Black teachers as a function of evolving faculty composition and distributed student enrollment. Finally,

we adopt a comparatively forward-looking stance and seek to understand contemporary patterns of new Black teacher employment – to illuminate possible forces shaping future school faculties, including testing whether Black faculties (conditioned on other observable factors) are *predictive* of Black teacher hire in an environment of increasingly disperse Black K12 student populations.

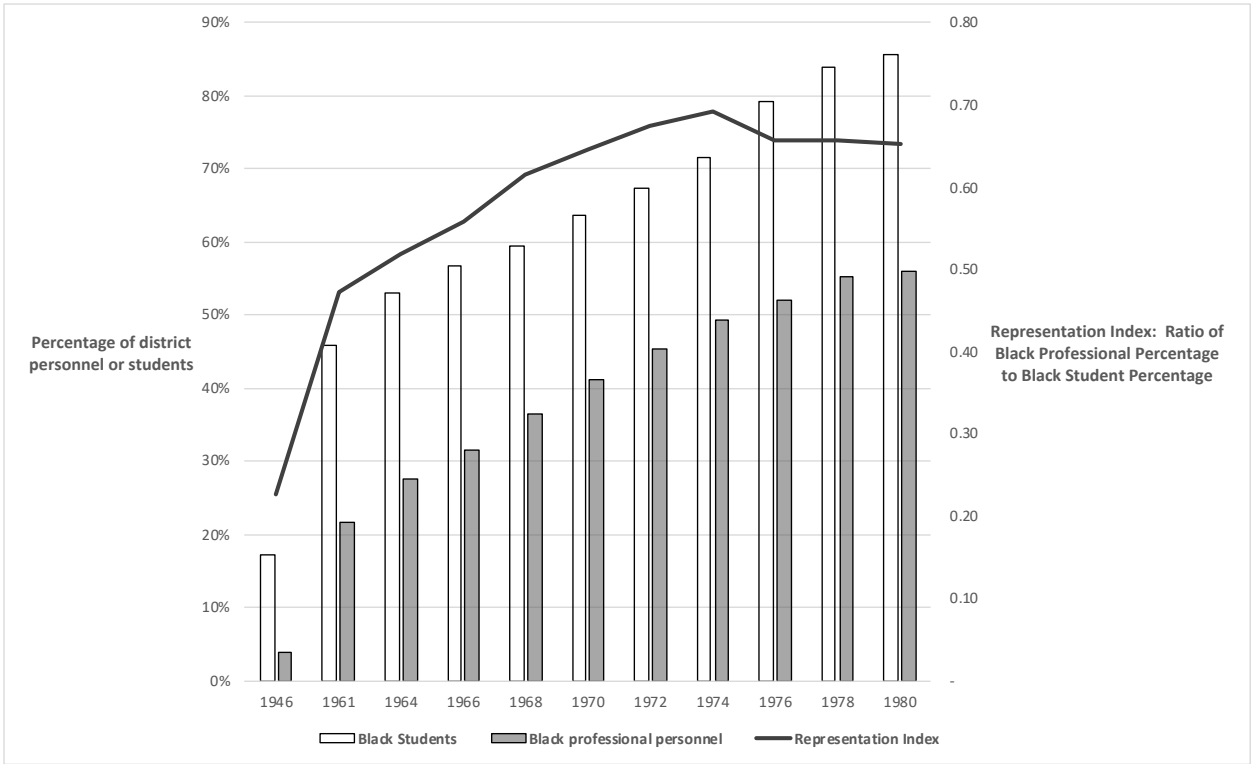
This is a mixed methods study. Our multiple approaches are unified within an umbrella diachronic investigation of one of the United States' key post-war Black faculty traditions. Our retrospective investigation of Black teaching in Michigan draws on historical analysis to contextualize early 21st century patterns within the 20th century story of Black faculty formation and uses administrative datasets to characterize Black faculty employment losses within the frame of de-urbanization, school choice, and changing teacher demographics. We rely on others' histories for the early record – especially Mirel's (1999) 20th century history of Detroit's school system. By the early 21st century, our analysis is primarily supported by K12 administrative data panels of teachers and students provided by the MERI-Michigan Education Data Center (Michigan Education Data Center, 2020). These data (described further in Appendix A) include all traditional public and public charter schools and allow us to track school-by-grade-by-year longitudinal flows of teacher and student populations (but are not so precise as to confirm the race of students' own-classroom teachers). The most recent data support analysis of prospective Black faculty after Michigan's *Race to the Top*-era tenure and evaluation reforms (Brunner et al., 2019; Drake et al., 2019) and the political turmoil in many urban school districts caused by (now expired) state-ordered emergency management, school closures, and school reconstitution initiatives (Arsen & DeLuca, 2016; Kang, 2020). We use logistic regression to analyze patterns of hiring of new Black teachers by Michigan's school districts with growing and declining student enrollment, evolving school-level student racial composition, and distributed rates of legacy Black faculty percentage. More details about our data and methods are provided below as part of the unfolding narrative.

Emergence of a Black faculty

Detroit, as the population center of Michigan's Black community, is an important example of the emergence of large and empowered Black faculties (Mirel, 1999; Todd-Breland, 2018) that contrasts with the enormous setbacks to the nation's Black educator workforce in the post-*Brown* American south (Ethridge, 1979; Walker, 2018). Detroit's Black community grew from a small historical core (about 5% of school enrollments and 40 of 5800 teachers in 1926 in fully integrated schools) to neighborhoods in the central and southern sectors of the city. Neighborhood assignment and student transfer polices were utilized to form the first predominantly Black student high school in 1933, allowing (within district political structures) the emergence of the first Black secondary faculty. Other high schools with significantly Black enrollments continued to have no Black teachers. Emergent disparities in facilities and curricular resources led to broad, student-led racial protests in 1943 – where a central demand was for more Black teachers and the admission of Black teachers in schools that were not predominantly Black (Mirel, 1999).

These challenges partly animated the city's racially complicated municipal politics. Mirel (1999) describes an emergent liberal-labor-Black political coalition that challenged traditional power structures, elected school board members committed to hiring large numbers of Black teachers by the mid-1940s, and consolidated municipal and school board control by the 1960s. Figure 1.1 demonstrates the expansion of Detroit's Black professional education staff that reflects an end to a district moratorium on Black faculty in (those comparatively integrated) high schools and broad success in recruitment in the post-war era. Black student counts peaked only in the early 1970s; still,

Figure 1.1: Historical Black professional personnel representation levels in Detroit 1946-1980



Notes: Adapted from data in Tables 4 and 6 in Mirel (1999). A ratio of 1 of Black professional percentage to Black student percentage would represent representational parity. This value peaked at .69 in 1974. These values are inclusive of teachers and other school professionals (e.g., counselors, principals). The representation index (plotted on right vertical axis) by comparing teacher race percentage to student race percentage suppresses longitudinal differences due to changing student-teacher ratio policies.

the district was able to expand its Black teaching force from 286 in 1946 to nearly 6,000 by 1972.[6] These representational gains, attending curricular changes e.g., Halvorsen and Mirel (2013), and (long-neglected) capital and resource investments in Black neighborhood schools, led Detroit to be considered a (comparative) model within the urban school system reform movement by the 1960s.

This progress would soon stall. Related state, municipal, and school board politics were highly tumultuous in the late 1960s and early 1970s, ultimately fracturing the liberal-labor-Black ruling coalition and accelerating White exit from the city (Mirel, 1999). School desegregation battles

[6] Disaggregated sources and historical reports indicate that the percentage of Black *teachers* tended to be greater than those of other professionals (Kang, 2020; Mirel, 1999). Protracted efforts were required to gain representation in the counselor ranks – responsible for assigning students to college preparatory and vocational tracks.

were especially intense, unresolved by schemes to devolve power (to largely racially aligned) regions within the city and culminating in the 1970-1974 *Milliken v Bradley* saga and the Supreme Court's ultimate acquiescence to *de facto* racial segregation as a function of school district boundaries. Detroit residents elected a majority Black school board in 1973, but this newly consolidated power would yield no incremental gains. Figure 1.1 shows that expansion of Black teacher representation (relative to K12 student populations) ended in 1974 – the same year in which Coleman Young, a resolute advocate for Black educators of Black children, was elected. The Black representation index (described and defined in Figure 1.1) was 0.65 in 1980 would remain 0.66 in 2005[7] – suggesting the possibility that racialized and genderized structural factors and policies thought to constrain present-day Black teaching participation (ACT Inc., 2016; Bacolod, 2007; Carter Andrews, Castro, et al., 2019; Lindsay, Blom, & Tilsley, 2017) may have already slowed Black teacher hiring.

This same period encompassed a fundamental shift in teacher labor movements within the city. Mirel (1999) reports that racism by some White teachers played a significant role in the political crises that led to the post-war emergence of the liberal-labor-Black coalition. The Detroit Federation of Teachers (DFT) – which eventually won a hard-fought campaign to become the district's sole bargaining partner in 1964 – remained a largely White organization for an extended period (Jones, 1964; Mirel, 1999). In the same pattern as the American South (Perry, 1975; Walker, 2018), Black teachers had organized through the Detroit Teachers Association (later Detroit Education Association). This division, however, notably resided within a larger political alliance that was supportive of Black faculty expansion and substantially avoided widespread exploitation of a two-

[7] This statistic is for the Detroit catchment inclusive of the city's charter schools. Mirel's (1999) primary sources documenting district staffing profiles end in the early 1980s. Consultation with regional libraries suggests that records for Detroit public schools in intervening years appear not to have been archived.

tiered system (as in Chicago (Todd-Breland, 2018)) where Black classroom teachers are subordinated within job classifications with lower pay and fewer job protections.[8]

Detroit's total public school enrollment peaked in 1966 with 297,000 students; Black enrollment crested a decade later Mirel (1999). Protracted population declines and a broadly eroding tax base induced fiscal crises, episodes of tax payer revolt, and conflict with the DFT throughout the 1980s (Kang, 2020). The experience of other substantially Black Michigan cities (e.g., Flint, Pontiac, Saginaw, and Benton Harbor) was similar, and were one motivation behind a 1994 restructuring of state school finance away from local property taxes and toward uniform per pupil grants distributed by the state. This restructured system, however, facilitated further fiscal distress in struggling districts through establishment of charter schools and inter-district school choice financed through full student funding portability. This financing structure and sustained reductions in real per student funding levels challenged declining enrollment districts throughout the state, leading to state-sponsored emergency control over Detroit and other predominately Black school districts, and restructuring of Detroit's schools in 2016 (Arsen & DeLuca, 2016; Arsen & Mason, 2013; Kang, 2020). Statewide, however, Black (and White) student populations would continue to grow through 2002. Where Black K12 populations in large and mid-size cities in 2005 were roughly the same as those in 1989, Black enrollment in other locales (i.e., outside of large and mid-size cities) expanded from 58,000 to 129,000. This shift dramatically accelerated in the 2000s as urban K12 populations rapidly declined. In net, the percent of Black students attending public schools (both TPS and

[8] Seniority rights (while broadly enjoyed) remained systemically racialized. The rapid expansion of the Black teaching force left young Black educators predominantly exposed to job loss during frequent district fiscal crises ("1000 Local Negro Teachers Face Loss of Jobs", 1963) and considered by the Black community as a vehicle for perpetuating segregated patterns of teacher assignment ("Negro Teachers Must Be Reached," 1963).

charter) in Detroit and Michigan's mid-size cities declined from 80% in at the end of the 1980s, to 63% in 2005, and 48% by 2018 (authors' analyis; National Center for Education Statistics, 2020).[9]

Michigan since 2005

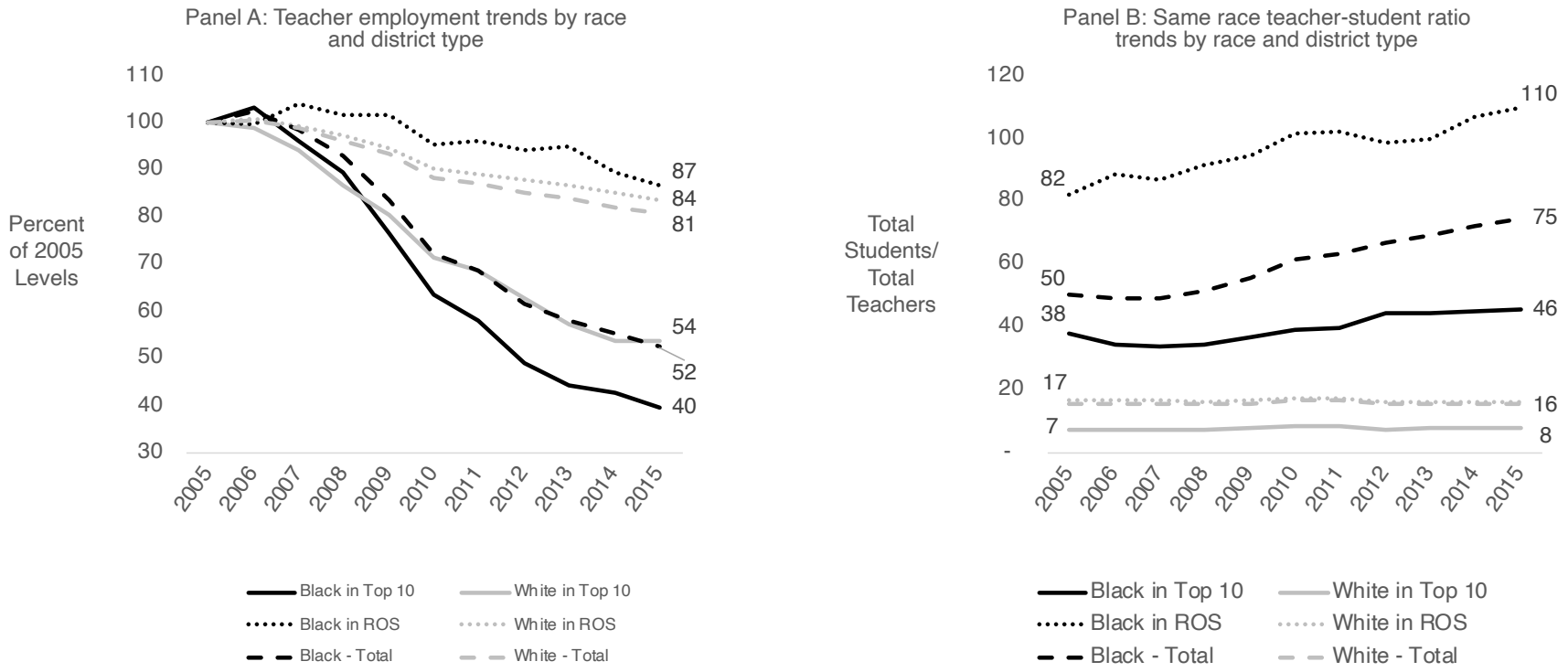
We use rich K12 administrative data to characterize Black faculty losses from 2005 to 2015. In 2005, 73% of the state's Black teachers worked in Detroit and Michigan's other top-10 Black teacher-employing districts (Top 10 districts").[10] Tabulations of these data show an approximately linear decline in Black teacher employment statewide from 2005 to 2015, down 48% in total (while White employment declined 19%). The number of Black students per Black teacher increased from 50 to 75 (while White ratios remained at 16), driven largely by phenomena in non-traditional centers of Black teacher employment (Figure 1.2).

The policy environment was complex throughout this period. State emergency managers effected significant change, intervening in teacher contracts and (especially in Detroit) closing and opening school campuses – part of a broader phenomenon of school closings within the state (Brummet, 2014). Fully 18% of the state's Black teachers left after the 2009-2010 school year in concert with a teacher retirement incentive (Brunner et al., 2019). A package of reforms was passed in the summer of 2011 that included tenure and evaluation restrictions (Brunner et al., 2019; Drake et al., 2019) (Brunner et al., 2019; Drake et al., 2019) that have been linked to declines in new teacher formation (Kraft et al., 2020), but work within Michigan suggests only a moderate policy-induced increase in in-service exits in schools where Black teachers disproportionately work (Brunner et al., 2019).

[9] Analysis uses National Center for Educational Statistics (NCES) enrollment data for all public school students. We apply pre-2006 NCES locale codes as well as a district's first available locale code across all years. This approach avoids redefinition of urbanicity of rapidly shrinking communities such as Flint.

[10] We define the top 10 districts as Ann Arbor, Detroit, Flint, Grand Rapids, Highland Park, Lansing, Pontiac, Saginaw, Southfield and "Greater Inkster" which includes Inkster and several districts over which its catchment was dissolved (Romulus, Taylor, Wayne-Westlund, and Westwood). Detroit includes schools that were carved out by the state-administered Educational Achievement Authority but subsequently returned to the district.

Figure 1.2. Employment and same-race student-teacher ratio trends in the 10 largest employing districts of Black teachers in 2005 ("Top 10") and the rest of state (ROS)



Source: Authors' analysis of MEDC data. ROS refers to districts other than the top 10 Black teacher-employing districts ("Top 10") in the "rest of state." Please keep in mind that both Black and White teachers work in such districts. Same-race student teacher ratio is the simple ratio of total Black students to total Black teachers and White students to White teachers with the category (e.g., total White students in the top 10 (by size) districts employing white teachers in ratio to the number of White teachers in those schools). We define the Top 10 districts as Ann Arbor, Detroit, Flint, Grand Rapids, Highland Park, Lansing, Pontiac, Saginaw, Southfield and "Greater Inkster" which includes Inkster and several districts over which its catchment was dissolved (Romulus, Taylor, Wayne-Westlund, and Westwood). Detroit includes schools that were carved out by the state-administered Educational Achievement Authority but subsequently returned to the district. The specific exposure of students to a teacher of their own race is a function of the distribution of students and teachers and is addressed in Table 1.2. This measure is different from the representation index in Figure 1.1 which suppresses changes in student-teacher ratio. Whereas Figure 1.1 reviews trends inside a single district, our objective here is to feature comparative policy impact between districts from 2005 to 2015. As we elaborate in Table 1.1, student-teacher ratios disproportionately expanded in those districts where Black teachers worked in the highest numbers. White Top 10 ratios are exceptionally low because there are comparatively few White students in the Top 10 districts.

Other work shows that Michigan's Black teachers received greater numbers of low evaluation ratings than their same school White peers (including after conditioning both on prior receipt of a low rating and teacher value added scores) within the resultant high stakes evaluation regime, that receipt of low ratings is strongly associated with teacher exit, but that exits that can be strictly attributed to the evaluation policy (i.e., meeting the criteria for mandated removal) are few (Drake et al., 2019).

In this study, working within the constraints of available administrative data, we were interested in assessing the impact of K12 population shifts on Black teacher employment. We formalized a descriptive analysis of faculty race and shifting contexts and locales of K12 enrollment through a decomposition of Black teacher employment. Equation (1) algebraically decomposes total Black teacher employment into key observable component factors: student enrollment, student-teacher ratios resulting from the policy decision of state funding and school-level administrations in both TPS and charter schools, and the respective enrollment market shares of the TPS and charter sectors.

$$TotalBlackTeachers_{jt} = TotalStudents_{jt} * \sum_s \left(\%Students_{jst} * \left(\frac{Teachers}{Students} \right)_{jst} * \%FacultyBlack_{jst} \right) \quad (1.1)$$

Here the index $\boldsymbol{j}$ corresponds to a school *catchment* corresponding to the political boundaries of a traditional public school (TPS) district but also in which multiple charter schools may operate in respective sectors $\boldsymbol{s}$. As described, total enrollment peaked in Detroit in 1966. Our project here was not to unwind the protracted challenges and often racialized conflicts within Michigan's industrial cities that likely led to the decisions of families of all races to relocate over time. A full model of Black teacher employment would account for myriad factors affecting both supply and demand (resolving in localized teacher labor markets) including evolving genderized and racialized preferences to teach (Corcoran et al., 2004; Lindsay et al., 2017) and economic and socio-political forces that may have shaped the interest of both teachers and students to reside and work in locales.

Presently, however, we seek only to approximate the extent to which K12 enrollment migration resultant of such forces is related to Black teacher employment. Equation (1) satisfies our needs in several ways. First, it is structured at the catchment level, allowing a degree of insight into the presence of systemic processes that lead to racialized outcomes. For example, schools may be selected for closure in such a way as to affect those disproportionately staffed by Black teachers. The equation in (1), however, parses the net effect of policy on within-catchment teacher race by tracking both TPS and charter school faculty racial composition and their evolving respective market shares. Since each TPS catchment may be profiled in this way, categorical results (e.g, by locale or district growth level) are easily obtained.

While we make no causal claim, our use of (1) to yield the results in Table 1.1 considers Black teacher employment first as a function of system-wide student enrollment within the catchment. This follows from Michigan's predominant reliance on student-linked school funding and captures the net result of residential and inter-district choice. For example, approximately 20% of Detroit school-age children attend a charter outside their catchment boundary (Edwards, 2020) and 13% of students statewide attend a non-resident TPS (Edwards, 2019). One may imagine a scenario where the causality is reversed – where the act of closing schools and removing teachers from neighborhoods *leads to* declining catchment enrollments when families choose non-catchment options. Within these data, however, we find that such effects (see Appendix A) likely impact few students (~ 1.5%).

Table 1.1 exhibits aggregated results of a simple simulation where catchment-level Black teaching jobs are assumed to evolve over time, $\boldsymbol{t}$, as a function of the elements from (1) and as described in columns 2 to 7. Approximations of the job loss due to each element are attained by progressively substituting 2015 values into 2005 baseline of equation (1). Our first step, for example, is to substitute 2015 enrollment levels into (1) while we assume that student-teacher ratios and sector

Table 1.1. *Ceteris paribus* analysis of Black teaching job losses (2005 to 2015) due to enrollment, policy, and faculty profile change

		Approximate Black teacher job losses (gains) due to…								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
	Black teachers employed in 2005	Enrollment declines (gains) in catchments where Black teachers are employed	Increased charter school market share	Charter-sector increase (decrease) in student-teacher ratio	TPS-sector increase (decrease) in student-teacher ratio	Charter-sector increase (decrease) in non-Black faculty %	TPS-sector increase (decrease) in non-Black faculty %	**Black teachers employed in 2015**	**Total Loss (Gain)**	**Percent decline (increase)**
Statewide	7,233	2,425	240	35	463	212	63	3,795	3,438	48
Percent of loss		*71*	*7*	*1*	*13*	*6*	*2*			
In Top 10 Black-teacher employing catchments (2005)	5,933	2,247	241	24	345	172	112	2,792	3,141	53
Rest of state (i.e., not Top 10 Black)	1,300	178	(1)	11	118	40	(49)	1,003	297	23
Detroit only	4,222	1,708	179	(5)	205	119	(22)	2,038	2,184	52
Top 10 w/o Detroit	1,711	539	62	29	140	53	134	754	957	56
Growing enrollment districts	439	(74)	(29)	12	51	26	(25)	478	(39)	(9)
Growing Black enrollment districts	511	(18)	(51)	15	37	41	(75)	562	(51)	(10)
Growing Black and total enrollment districts	224	(56)	(26)	13	13	27	(26)	279	(55)	(25)

Notes: See Appendix A for full analytical method. Values are approximate only and reflect the assumptions of the analysis. Job loss estimates are derived from progressively substituting 2015 values into equation (1) while holding all other values at 2005 levels. 2015 values are introduced in the (left to right) order of presented job loss components in this table. As a reference, statewide K12 enrollment declined by 15.1% in the schools retained in this analysis over the period. Enrollment declines in catchments disproportionately staffed by Black teachers in 2005 were far more substantial. Charter school market share increased moderately in all scenarios above; share gains range from 5.1 to 0.7 percentage points. While statewide charter-school faculties have a higher percentage of Black teachers than do statewide TPS schools, charter faculties have lower Black faculty percentage than their TPS (and disproportionately urban) catchment peer schools.

market shares remain static at 2005 levels. The difference between actual 2005 Black teacher employment and the number of implied teachers yields an implied change in Black teacher levels associated only with enrollment declines, yielding approximations in column 2 of Table 1.1. We progress in this manner, systematically indexing 2015 actual values for 2005 levels for each element of equation (1) in the order presented in Table 1.1 such that each marginal change in implied Black employment is attained. (See Appendix A for a complete example for the Detroit catchment and further discussion of our assumptions.)

This approach suggests the vast number (~85%) of job losses are associated with enrollment declines and expansion of TPS student-teacher ratios in catchments employing large percentages of Black teachers (Table 1.1). Charter schools employed proportionately fewer Black teachers than their same-catchment TPS peers in 2005, and, *ceteris paribus*, their market share gains correspond to incremental Black job losses. Within Detroit, however, the catchment level data show that Black faculty losses plausibly attributed to market share shifts to a Detroit charter sector with comparatively more White teachers are dwarfed by more than an order of magnitude by the catchment's broader staffing losses. Our analysis suggests that fewer than 10% of the statewide net job losses are associated with longitudinal changes in the race-specific employment rates of charter and TPS faculties (columns 6 and 7).

We emphasize that there is nothing methodologically inevitable about the structure of this job loss decomposition. Other districts could have – in theory – added Black teachers, reshaping their faculty profiles and causing job gains to appear in columns 6 and 7 that would counter the enrollment-related losses in districts disproportionately employing Black teachers. This said, hiring in receiving districts is complicated by multiple factors including the structure of student flows. Statewide, period enrollment losses of 145,000 Black students were concentrated in only a handful of districts, but other districts gained 67,000 Black students over that period. Over 200 districts

(charter or TPS) gained 50 or more Black students; yet those receiving districts often have no net opportunity to hire since new Black populations are often smaller than non-Black enrollment declines. In these cases, hiring Black teachers becomes a question not just of Black teacher supply, but of hiring networks robust enough to opportunistically recruit candidates when, say, a middle school math or high school chemistry position opens. Scenarios presented in Table 1.1 confirm that growing districts increased Black faculty rates, but at trivial levels compared to the broader losses in shrinking catchments. This challenge is elevated by the few new Black teachers in Michigan (discussed below) and the high rates of system exit of teachers leaving Top 10 Black-employing districts. Strikingly few exiting teachers were hired in growing districts. Only 5% of Detroit's (and 8% of other Top 10 districts') Black teachers leaving the jobs between 2005 and 2011, for example, were still working as teachers within Michigan's public schools during 2014 or 2015.[11] (The rates are similar across exiting White and Latinx teachers.) Retention rates for Detroit teachers were far lower than among those exiting recently closed schools in Chicago (Lee & Sartain, 2020). Transfers between Top 10 districts and other locales are also rare; 0.40% of Black teachers working in the Top 10 transfer outside that sector each year (2005 to 2014).

Resultant Black student exposure/isolation

Michigan's K12 administrative data do not provide a systematic link between students and assigned teachers that would allow direct inspection of evolving rates of teacher-student racial match associated with the 2005 to 2015 dislocation of Black faculties and students. Instead, we rely on school-level measures of the net effect on teacher-student racial match if classroom assignments are random. This is conceptually similar to measures of probabilistic encounter used in residential spatial analyses and previously incorporated into the school segregation literature (Reardon & Owens, 2014). Flowing from our growing understanding of the broad benefits associated with partnership

[11] Teacher exit appears to be marginally increased after school closings in these data. See Appendix A.

between Black students and Black teachers, our interest here is in "exposure" of one group to another. Here, approximating Lieberson's (1980) notation, interaction levels can be indexed as

$$ {}^{a}_{b}P = \sum_i (a_i / \sum_i a_i) \left(\frac{b_i}{t_i}\right) \quad (1.2) $$

where ${}^{a}_{b}P$ is the probability of a member of group A interacting with a member of group B, a_i is the number of A in region *i*, b_i the number of B in that region, and t_i the region's population. This measure was conceived within a framework where A and B are part of a defined population, and when we report student-to-student and teacher-to-teacher indexes in Table 1.2, we follow this approach. When comparing (cross-population) student exposure to teachers (and teacher exposure to students), b_i/t_i is adjusted to represent the proportion of the comparison population that is Black.

Comparative 2005 and 2015 mutual rates of exposure of Black and White students and teachers are exhibited in Panel A of Table 1.2. The weighted mean proportion of Black teachers in Black students' schools declined from about a one-third to one-quarter over the period. The exposure of Black teachers to Black students also declined, though by a smaller fraction. This was driven substantially by growing Latinx student populations in urban districts, and exposure of Black teachers to White students remains quite low. Twenty-five percent of the mean Black student's school's teachers are Black, while fully 75% of mean Black teachers' schools' students are Black. Panel B inspects the distributional changes underlying the means in Panel A and reveals the extent to which these traditional metrics of between group interactions can disguise larger phenomena. From 2005 to 2015, 21% of the Black K12 population shifted away from schools with at least 25% Black faculty and redistributed across other categories. Additional tabulations by the authors show

Table 1.2. Cross-exposure rates among Black teachers, Black students, White teachers and White students

	Panel A				**Panel B**				
	Weighted mean proportion of same-school teachers who are…		**Weighted mean proportion of same-school students who are…**		**Proportion (students or teachers) attending or working in a school with a faculty that is at least…**				
	Black	White	Black	White	50% Black	25% Black	10% Black	5% Black	>0% Black
Black students									
2005	0.36	0.61	0.71	0.23	0.39	0.57	0.72	0.79	0.95
2015	0.25	0.72	0.62	0.25	0.22	0.36	0.55	0.67	0.92
Black teachers									
2005	0.51	0.47	0.81	0.12	0.59	0.77	0.89	0.93	1.00
2015	0.45	0.52	0.75	0.14	0.46	0.64	0.82	0.90	1.00
White students									
2005	0.01	0.98	0.06	0.86	0.00	0.01	0.04	0.07	0.54
2015	0.01	0.97	0.07	0.80	0.00	0.00	0.03	0.06	0.50
White teachers									
2005	0.04	0.95	0.13	0.78	0.03	0.06	0.12	0.16	0.60
2015	0.03	0.95	0.13	0.71	0.01	0.03	0.08	0.14	0.57

Notes: Panel A values uses school-level measures of student and teacher race and follows the method of Lieberson (1980) in calculating a population weighted mean rate of exposure (e.g., between Black students and Black teachers). District-level measures for Panel A are substantially similar and suggest low levels of within-district school segregation. Higher value indicate higher rates of exposure to comparison group. Note that (with respect to Panel B) that there are many schools with no Black teachers. For example, 8% of Black students and 50% of White students attended such a school in 2015.

that slightly over half of that sub-population migrated to schools with between 0 and 5% Black faculty.

New teachers and new faculties

Within the broad decline in teacher preparation enrollments nationally, Michigan has had exceptional losses – down 69% from fall 2008 to fall 2017 vs. 34% nationally across traditional and alternative programs. Black enrollments were down 85% over that period in Michigan, significantly outpacing the same-period 68 point White decline (authors' tabulations; Office of Postsecondary Education, 2020). (In the rest of the nation, Black enrollment declines are *lesser* than White, down only 11% vs. 41%.) Broader declines preceded Michigan's statewide 2011 tenure and evaluation reforms and showed no visual signs of acceleration after information about high rates of low evaluation ratings issued to Black teachers (Drake et al., 2019) may have entered prospective teacher networks.[12] Additionally, college-age population levels declined at similar levels across student races – all suggesting other underlying causes of racial difference in teacher preparation enrollment rates.

Michigan's accumulated losses in Black and total enrollments plausibly created conditions that one suburban Flint superintendent suggested allow new Black teachers to go "pretty much anywhere they want, because [districts] are all trying to diversify their workforce" given that there may be only one teacher of color in a university job fair (Wisely, 2019) – though in the absence of comprehensive application data we cannot be sure. Employment restrictions may well persist (e.g., Boyd-Swan & Herbst, 2019) – especially given enrollment declines in many districts – but limited teacher supply, coupled with mobile Black student populations inspiring districts to seek faculty diversity, may indeed allow new teachers a high degree of agency in selecting the region, locale, and characteristic features of their school work environment.

[12] There is no sign of *linear* acceleration; under constant linear declines the proportionate rate *is* increasing. We also emphasize that the counterfactual condition may have been one where Black teacher preparation rates rebounded from disproportionately low levels.

It is within this contextual frame that we investigate Black new-teacher hiring over the period 2013 to 2018 – a period after both the state's tenure and evaluation reforms and patterns of state interventions into district governance had been established. Our analysis is centered on the logistic model:

$$P\left(Black_{ij} \middle| New\ Hire_j\right) = \alpha + D_j\beta + Z_j\gamma + T_i\eta + \varepsilon \quad (1.3).$$

That is, using the pool of all new-teacher hiring events ("*New Hire*" above) evidenced in the statewide administrative data by the presence of a new teacher (i.e., with no prior position as a classroom teacher in Michigan public schools), we model the probability that a hired teacher ***i*** is Black. By construction, our approach is fully conditioned on school **j** 's exhibited need and capacity to hire. ***D*** is a normalized set of district-specific measures of geographically proximal Black teacher preparation candidates as measures for labor supply (see Appendix A). ***Z***, indexed by school, is simply an additional set of district descriptors as characterized in Table 1.3 (also see Appendix A). These include our predictors of primary interest: Black enrollment percentage, *growth* in Black enrollment, and faculty and administrator race. Our central concern is the extent to which teacher hiring appears to be characteristically described by school-level racial phenomena – especially *shifting* Black K12 student populations and the racial composition of schools' faculties.

Odds ratios resulting from (3) can be found in Table 1.3.[13] Here, we alternately specify linear measures of proportion of schools' staff that are Black (as in column 1) and categorical measures of teacher and administrator race (as in column 2). Measures of student population growth – (once lagged) three-year percentage point change in Black student population and an indicator of whether a district's student population recently became majority Black – are introduced in columns 3 and 4. Odds ratios for both legacy 2011 Black student percentage and three-year change in Black student

[13] Results in Table 1.3 are substantially similar for partitioned analyses of TPS and charter sectors and when modeling *any* new district hire, rather than new teachers only.

Table 1.3. Logistic model of Black teacher hiring from 2013 to 2018. (Odds ratios.)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	All new hires		**All new hires**		**Exclude top 10 Black employing districts (2011)**		**Black student body growth only**		**Black and total student body growth only**	
Measures of student body race										
Proportion of students Black in 2011	18.98***	14.08***	23.20***	16.80***	21.58***	16.35***	25.16***	14.91***	25.97***	16.61***
3-year change in proportion students Black			13.15***	12.86***	12.86***	11.70***	7.15*	5.48	1.95	1.82
School ever became >50% student Black			1.02	0.96	1.18	1.13	1.13	1.11	0.93	0.91
Linear measures of personnel race										
Proportion of teachers Black	7.50***		7.65***		6.03***		5.47***		4.06***	
Proportion of administrators Black	1.43**		1.43**		1.59***		1.70**		1.85***	
Categorical indicators of personnel race										
School faculty is (0/1)…										
> 0% Black <= 5%		1.63***		1.61***		1.57**		2.03***		1.96**
> 5% Black <= 10%		1.82***		1.82***		1.68***		1.95**		1.97**
> 10% Black <= 25%		2.35***		2.43***		2.15***		2.58***		2.11**
> 25% Black <= 40%		3.21***		3.27***		2.87***		4.40***		3.77***
> 40% Black <= 60%		4.27***		4.36***		2.91***		4.72***		3.70***
> 60% Black <= 75%		5.55***		5.63***		5.09***		6.05***		4.62***
> 75% Black <= 90%		6.86***		7.00***		7.55***		5.13***		3.59**
> 90% Black		9.49***		10.49***				9.00**		12.62**
School administration is (0/1)…										
> 0% Black <= 5%		†		†		†		†		†
> 5% Black <= 10%		2.31		2.38*		3.32**		2.16		3.25
> 10% Black <= 25%		1.09		1.00		0.94		1.28		1.32
> 25% Black <= 40%		1.48*		1.47*		1.44		1.42		1.29
> 40% Black <= 60%		1.14		1.16		1.28		1.26		1.49
> 60% Black <= 75%		1.41**		1.41**		1.51**		1.52*		1.77**
> 75% Black <= 90%		1.17		1.18		1.41		1.35		1.51
> 90% Black		1.46***		1.46***		1.64***		1.67**		1.86**
Observations	22,223	22,133	21,875	21,791	19,585	19,498	10,256	10,216	6,177	6,152

Notes: Parameters predict whether a new hire is Black. More formally, we predict the joint outcome of (1) whether a Black teacher candidate qualified for a position exists, (2) applies for the position, and (3) is hired. Odds ratios are presented here. Estimation sample is limited to first year teachers. Results are similar when modeling *any* district hire, rather than exclusively new teachers. Partitioned analyses of TPS and charter sectors are also qualitatively similar. Covariates for all models include: TPS/charter sector indicator; an indicator for districts located next to the Detroit catchment; measures of proximate Black teacher preparation enrollees (as proxy for teacher supply); priority and focus school status in 2012; city and suburb locale indicators; ELL, economic disadvantage, and special education percentages; frequencies for high and low teacher evaluation ratings; indicators for teacher gender, grade band, and subject taught; and year fixed effects. Time varying school measures are lagged one year. Teacher and administrator race are constructed to approximate the qualitatively distinct levels of minoritization described by Kanter (1977). †Low frequency condition omitted due to collinearity. As a consequence, the reference category for school administration race is 0 to 5% Black administrators, while the reference category for teacher race is 0% Black faculty. School-level cluster-robust standard errors specified. *** p<0.01, ** p<0.05, * p<0.1

percentage are large and significant. The three-year change effect fades per intuition as we progressively partition our analyses on schools with growing Black student bodies in columns 5 to 10 and parameter variation is lessened, even if this still suggests that schools with the *most* Black-student growth are not hiring at disproportionate rates. Our results are consonant with recent findings that the presence of Black administrators increased the odds of Black teacher hire (Bartanen & Grissom, 2019), but in these data these marginal effects are significantly smaller than those associated with large Black faculties in hiring schools. Further, the categorical specifications of administrator and teacher race suggest a highly reproductive pattern where schools with progressively larger Black faculty percentage more successfully hire new Black teachers. This pattern persists in scenarios confined to schools where Black student populations are growing. Increasing levels of Black administrator percentage, however, have a far less discernable relationship to Black teacher hire.[14] We also emphasize that odds ratio point estimates for student economic disadvantage parameter (not shown) are consistently less than one (and non-significant). To the extent that Black teachers enjoy agency to work in these traditionally underserved contexts, our result offers a refinement to other work suggesting a differential preference by prospective teachers of color for these contexts (Ronfeldt, Kwok, & Reininger, 2014). Once one accounts for race-related confounds with poverty rates, Black new teacher preferences to serve poor children may be similar to White. We again emphasize that these results are conditioned on the dramatic declines in Michigan's Black teacher preparation enrollment; caution is required in extrapolating suggestive evidence from Table 1.3 to *prospective* Black teachers who may have differentiated preferences and access different employment networks.

[14] See Table A.2 in Appendix A for analogous results for a model estimated over the pool of inter-district transfer hires. We prefer an analysis of new teacher hires because of possible differences in underlying preferences of teachers and districts and the comparatively prospective perspective it gives on building future Black faculties. In general, the results are similar – but with much more consistent evidence of an association of Black administrators with teacher hire among transfer teachers vs. first-year teachers.

The use of lagged parameters in Table 1.3 analyses inherently exclude new schools and their new faculties. Using 2011 as a baseline, 105 new charter school districts were formed through 2018 – part of 215 charter districts hiring their first Black teacher. Seventy-two TPS districts were able to do the same. These statistics reside with a broader phenomenon of outsize charter importance in hiring new teachers. Of the 1700 Black new teachers analyzed in Table 1.3, 55% were hired in the charter sector. This rate outpaces charters' in-service percentage of statewide Black teachers (28%) – reflecting not just the sector's emphasis on urban Black student populations, significantly higher teacher turnover levels, and marginal market share gains, but also a clear capacity to attract new Black teachers.

Discussion

Michigan offers a striking example of the challenges of highly mobile student populations and comparatively static teacher employment patterns. Mirel (1999) shows that Detroit's Black teaching corps – still 55% of all Black teachers in the state in 2018 – emerged in the post-war era in a period of widespread racial discrimination, but one where Black teachers entered the workforce with approximately equal access to collective bargaining protections, an expectation of enduring need for teachers within the system, a (strictly enforced) expectation that they would be joining Black faculties serving Black children in stable geographies, a teachers' organization in which they were broadly active and held leadership, and a policy environment in which the Black community writ-large was an essential partner in a multi-racial ruling coalition with broad ties to state-level power organs. We cannot know if these were either necessary or collectively sufficient conditions for the rapid post-war expansion of the Black teaching force, but all these elements would have helped address and compensate for the acute experiences of entering a broader teaching institution that was predominantly White. We also emphasize the broader (then) contemporary context. Racism within school practice and policy, on the one hand, was the foil to a (motivating) civil rights ideology

among educators, on the other (Kelly, 2007). Further, the ability to attract Black teachers – as was the case with the highest achieving White women (Corcoran et al., 2004) – may have been contingent on broader patterns of discrimination that have lessened over time.

We emphasize that more recent Black-teacher employment losses in Michigan both preceded and continued after the state's 2011-era interventions that diminished the political power of teachers and the labor movement and fully coincide with a broader decline in student enrollment in the districts in which Black teachers traditionally worked. Michigan's own history highlights the feasibility of large-scale diversification of school faculty, but it is one where new teachers entered with peer supports that acknowledged the racialization of their professional lives. Michigan's present context is more challenging. Black student populations are migrating to smaller districts where concentration of Black faculty within schools (as historically in Detroit) is neither viable nor acceptable as a form of (enforced) mutual support – or as a vehicle for reducing negative events associated with tokenized status. Our results here show that hire of new Black teachers into these contexts is unusual (even when growing). These events, though circumstantial, are consonant with calls for contemporary strategies for understanding the racialized experiences of educators and adopting appropriate supports (e.g., El-Mekki, 2021). They also remind us that new Black teachers are just that – *new teachers* – who will be sensitive to seniority-based preferences and practice that will be inherently racialized in a rapidly diversifying faculty.

This said, even though results from Table 1.3 suggest predominantly conserving effects – where new Black teachers are hired overwhelmingly by schools with large legacy Black faculties and student bodies, the evidence presented here is in some ways encouraging to those seeking to diversify faculties. Districts with new Black student populations *are* able to hire Black teachers. Even modest levels of Black faculty and Black administrator presence are associated with disproportionate rates of new Black teacher hire, and (if a causal relation exists) aggressive early investment in

recruiting will yield compounding results as faculties grow. Yet even with the acquisition of a fully representational teaching force in fully integrated contexts (e.g., 15% Black students and 15% Black teachers), Black-student exposure to Black teachers – and the long list of attending benefits – will decline from the norms established in Michigan's earlier era. Given our understandings of the broad benefits of teacher-student ethnic-racial match, this phenomenon demands an enhanced understanding of actual mechanisms underlying matched teacher-student (and faculty-student) outcomes and cause us to look for institutional compensations that complement on-going efforts to seek new teachers of color.

Finally, the substantial contemporary declines of Michigan's Black student participation in teacher preparation and those students' own rapidly evolving K12 contexts may require that we broaden our conceptions of generational reproduction (e.g., Jacinto & Gershenson, 2019) of teachers and teaching. Researchers have consistently pointed to the present challenges of building Black faculties tied to educational systems that produce lower Black secondary and postsecondary attainment and lower rates of study of education (Lindsay et al., 2017) – a phenomenon that may also be attributed to racialized institutional norms (Ladson-Billings, 2014; Sleeter, La Vonne, & Kumashiro, 2015). Still, in highly segregated contexts, the generational phenomenon has been self-evident: Black teachers emerge from schools with substantial Black faculties serving predominantly Black communities. Where K12 populations migrate to (and in many cases deliberately select) new residential and school choice enclaves where the teaching corps may be White, the exemplified tradition of Black teaching is disrupted even if we stipulate that perceptions of the capacities of teaching and schools could improve. In diverse suburban contexts we should consider whether Black students' racially complicated and psychically costly relations with school peers and faculty (Carter Andrews, Brown, Castro, & Id-Deen, 2019) affect teaching intent. Can young Black prospective educators schooled in these K12 context imagine a system (present or reformed) in

which they wish to participate? Do anti-racist efforts to mitigate these experienced harms (Diem, Welton, Frankenberg, & Jellison Holme, 2016) affect students' experience in ways that are supportive of teaching intent? Or, in the urban charter sector where Black faculty recruitment has recently been most successful, do more stringent performance evaluation regimes and high rates of exit among both successful and unsuccessful teachers (Drake et al., 2019) shape teaching affect among those schools' young prospective educators? At its core, Michigan's present challenge is the same as the national one: too few Black teachers. Traditional or alternative certification routes aside, from which K12 experiences and traditions will tomorrow's Black teachers emerge and where will they hope to teach?

PAPER 2. ETHNIC/RACIAL MATCHING EFFECTS IN CONTEXT: BLACK TEACHERS, BLACK FACULTIES AND BLACK STUDENT ACHIEVEMENT OUTCOMES

Introduction

A now extensive empirical literature has demonstrated broad effectiveness of *teachers* of Color for all students, with additional gains accruing to students of Color (Gershenson, Hansen, & Lindsay, 2021; Redding, 2019). This paper investigates the possibility of a simultaneous role for Black *faculties* and is inspired by the long tradition of Black educators' organized professional support for their peers, demands for vital Black-teacher representation, and advocacy for equity in resources and pedagogy for students (Drake & Cowen, 2022; Mirel, 1999; Walker, 2018). I am sensitive that the experience and impact of Black faculties – and the individual educators within them – may be qualitatively different as Black-teacher proportion changes (Bristol, 2018; Kanter, 1977; Kelly, 2007). While the potential operations for Black faculties are vast, my scope here is to extend existing frameworks that explore the relationship between Black-student achievement outcomes and within-school exposure to Black educators. I centrally explore the three-way interaction of Black students, Black teachers (as classroom-level actors), and Black-faculty proportion (as a school-level phenomenon). This work closely extends the framework considered by Nicholson-Crotty, Grissom, Nicholson-Crotty, and Redding (2016) when they investigated racialized patterns of gifted and talented student referrals. Most significantly it subsumes observed ethnic/racial match between individual teachers and students (hereafter also "teacher-student match" or "race match")[15]

[15] I adopt a conception of teacher-student and faculty-student classroom and school match that is presumably operative through (and is minimally associated with) shared ethnic, language, and racial mechanisms. "Ethnic/racial match" is used interchangeably by others with terms such as cultural isomorphism, race match and racial match (Redding, 2019). In this paper, I attend specifically to Black teacher-Black student ethnic/racial match which I will contextually refer to as simple a teacher-student or faculty-student match. Many studies investigate and refer to a generalized phenomenon of "own-

predominantly considered within the literature commenced by Dee (2004) into a more comprehensive evaluation of simultaneous racialized phenomena in K12 schooling. I am especially interested in the extent to which teacher-student match in the related achievement effects literature is moderated by faculty race and whether our understandings of this phenomenon need to evolve to include a more systematic investigation of the conditions on which Black-teacher effectiveness may by contingent.

My interest in Black faculties as a school-level phenomenon is centrally tied to an expectation that "external" factors originating outside the classroom are in fact embedded in learning as co-produced by teachers and students (Cohen, Raudenbush, & Ball, 2003). In particular, these actors may bring socialized understandings to classroom-level relationships and learning processes that reflect cumulative family, community, and school-level experience (Bristol, 2015; Cohen et al., 2003) that may, in fact, be contingent on – or at least associated with – the racial structure of school faculties. A faculty-level extension of the teacher-student ethnic/racial match literature simply emphasizes that classroom-level processes that primarily mediate teaching and learning are themselves a function of student and family relationships to schools and curriculum and of educators' relationships to the resources present within those schools. Grissom, Kern, and Rodriguez (2015), for example, emphasize the plausible mechanisms of "representative bureaucracy" in the K12 context, contemplating an important role for educators from minoritized groups not just in providing points of institutional access for minoritized students and families but also in effecting institution-level (school-level) transformation that broadly resocializes other educators and systemically marginalized clients (students and families).

race" match which consolidates matching effects across all administratively defined ethnic/racial groups. I distinguish between contextually defined Black teacher-Black student "race match" and the generalized or confounded "own-race match."

This emphasis on relationships between organizations and their clients – students and their families – is encouraged by research describing the recession of systemic antagonisms between Black students and all levels of schooling when *consistent* humanizing (and demanding) educator-student bonds are present (J. D. Nelson, 2016; Warren et al., 2022). Student respondents in Warren et al. (2022), for example, describe crucial educator relationships in ways that suggest that they are formed and endure beyond specific classroom experience. Students value both affirming and demanding relationships with their own current and former teachers as well as the broader experience of Black peers within their schools when evaluating the validity of their school experience, making decisions about engagement and effort, and finding intellectual and social-emotional sustenance. Importantly, these relationships are not construed by participants (or Warren et al. (2022)) as inherently dependent on educator race – and are at least partially distinct from considerations of teaching practice tied to advantages of person-level cultural isomorphism that are often offered as potential mechanisms underlying teacher-student match effects (Redding, 2019; Yarnell & Bohrnstedt, 2018). My interest here, then, is the residual empirical question of whether Black faculties are associated with institution-level effects that may reflect the selection or resocialization of non-Black teaching peers, enacted school policy – and/or the formation of, or spillover from, Black teacher-Black student relationships beyond the classroom. School-level relationships between Black-faculty measures and Black-student achievement would be racialized in a similar sense to the broader "teacher-like-me" literature (Dee, 2004, 2005; Redding, 2019), but may also point to the presence of policy conditions that may be susceptible to analysis and replication. Within this motivational frame, is there a relationship between student achievement outcomes and qualitatively distinct levels of Black-faculty representation? Further, similar, institutional-level mechanisms may also include the effects of teaching peers on individual teacher practice. In particular, recent research has found evidence that Black teachers' own networks are partially racialized, are sensitive to quantity of other

school-level Black peers, and provide feedback into the capacities and resources of individual teachers (Bristol, 2018; Bristol & Shirrell, 2019; J. L. Nelson, 2019). How may the effectiveness of Black educators be affected by their participation in different faculty contexts?

Research questions

More formally, my attending research questions are then:

1. Are Black teacher-Black student ethnic/racial match achievement effects apparently moderated by the proportion of a school's faculty that is Black?
2. Is there evidence of *organization-level,* faculty-race moderation of Black-student learning outcomes? Are teacher-student match estimates robust to inclusion of these faculty-level measures of interacted teacher race?
3. Do organization-level measures of faculty race moderate Black-teacher effectiveness with all students?
4. To the extent that any organization-level, Black-faculty relationships exist, are these phenomena non-linear, such that benefits accrue disproportionately when Black faculties are larger? Is there evidence of a threshold effect?

Framing and literature

Heterogeneous effects

Many studies have indicated achievement gains in the presence of teacher-to-student racial/ethnic match (e.g., Egalite, Kisida, & Winters, 2015; Hanushek, Kain, O'Brien, & Rivkin, 2005). These fall within a broader set of findings that, on balance, suggest benefits to student outcomes including increased expectations, fewer disciplinary actions, and materially enhanced

student attainment (Redding, 2019). Within this literature, racialized experience has usually been conceptualized as a racial identification match at the level of the individual teacher and student. Studies of the effects of teacher-student ethnic/racial match on achievement have revealed heterogeneous and sometimes complex achievement outcome effects. These have been substantially positive, but are inconsistent, frequently small, and sometimes negative (Goldhaber, Theobald, & Tien, 2017).

Redding (2019) offers the most recent comprehensive review. He shows that these inconsistencies extend into evaluation of behavior, incidence of exclusionary discipline, and teachers' evaluations of students' academic ability (which is decidedly mixed, especially in early grades). Evidence of matching effects and achievement appears stronger for Black students than for Latinx; and, within Black-student studies, emerges far more consistently in reading than in math. Even here, however, there are multiple studies with point estimates of a negative match effect, with one (Fryer Jr & Levitt, 2004) even significantly so. The range of achievement growth estimates in the literature ranges from negative ~.20 standard deviations to positive ~.40 standard deviations in math and from negative ~.10 to positive ~.50 in reading.[16] Redding (2019) points to informal evidence of a possible regionalism – with the most significant positive race match findings all occurring in southern states that can be speculatively linked to regionalized forms of racialized school and community structure (Clotfelter, Ladd, & Vigdor, 2007b; Dee, 2004; Egalite et al., 2015; Hanushek et al., 2005), though (as with much of the empirical education literature) the locales of existing datasets have guided opportunities for study rather than any stratified design. Joshi, Doan, and Springer (2018) find mediation by teacher quality, where only moderate level teachers are associated with a match effect. On balance, match results appear stronger for elementary students than

[16] Studies have been more consistent is failing to establish consistent difference in achievement effects across gender (Redding, 2019) – though these studies (e.g., Yarnell & Bohrnsted, 2018) usually evaluate gendered match differences by indexing only the students' gender in the teacher-student match condition.

secondary (Redding, 2019), and Egalite et al. (2015) reveal stronger matching effects among lower achieving students. Gershenson (2019) analyzes grade 3 to 5 North Carolina administrative data and finds suggestive evidence of higher own-race effects in charter schools whose operations are weighted to urban socioeconomic contexts. Relatedly, Carruthers (2009) finds that North Carolina Black-student charter school achievement increases with Black-faculty percentage. Finally, Dee's Dee (2004) seminal results reanalyzing Tennessee STAR class-size experiment data are themselves highly contingent on school context. Both White and Black matching effects on achievement are identified, yet Black effects were only robust in high-poverty (free and reduced lunch) schools with high percentages of Black students (i.e., above the respective medians for those measures).

The teacher-student ethnic/racial match conceptualization, while important, ignores the broader complexity of racial structures within schools. Both teachers and students operate within important group structures, faculties, student bodies and synthesized school-wide organizational systems that can be racialized – affecting both Black teachers (e.g., Bristol, 2018; Bristol & B. Goings, 2018; Bristol & Shirrell, 2019) and Black students (e.g., Carter Andrews, 2012; Carter Andrews, Brown, et al., 2019; Carter, 2007). Yarnell and Bohrnstedt (2018) offer an important first contribution to engaging this complexity, emphasizing within a hierarchical framework that there structurally exist both teacher-student interactions *and* (purely at the classroom, rather than student level) teacher-*student body* interactions, and find evidence of each phenomenon, though organization-level effects are small. Racialized student peer effects have also been identified (Angrist & Lang, 2004; Hoxby, 2000). These effects are hierarchically similar to, and in U.S. K12 contexts will often be highly collinear with, the classroom-level to student-level teacher-by-student ethnic/racial matches emphasized in the achievement effects literature. Administrator race is also theoretically operative and recent work finds principal-student match effects in Black-student mathematics achievement (Bartanen & Grissom, 2019).

Intertemporal mediation effects are also possible. Black administrators appear to be more successful in hiring new Black teachers (Bartanen & Grissom, 2019; Drake & Cowen, 2022) and retaining Black teachers (Bartanen & Grissom, 2019; Grissom & Keiser, 2011). This suggests a likely indirect pathway for achievement effects, when teacher-student matching effects are operative – though the Bartanen and Grissom (2019) investigation finds no such evidence in Tennessee and Missouri data. Finally, even broader apparatuses of school race can be considered. Client-counselor relationships, for example, are sometimes racialized (Parham & Helms, 1981; Townes, Chavez-Korell, & Cunningham, 2009); or, as recently shown, parental relationships with schools are also moderated by teacher race (Markowitz, Bassok, & Grissom, 2020). The ethnic/racial match literature has long acknowledged the coincidence of Black educators and Black students – that is they predominantly work together in the same predominantly Black schools (Hanushek, Kain, & Rivkin, 2004; Jackson, 2009). I simply emphasize here that schools' broader racial structures coincide and often follow this same pattern.

Black faculties and their operations

As indicated, I conceive of *Black faculty* as a group-level phenomenon that foundationally emerges within the racialized history of K12 education in the United States and the related, collective efforts of Black educators to organize and advocate for policies that secure and maintain Black representation within school staffs, provide professional supports, and to deliver system-level justice through allocation of resources and pedagogical design (Drake & Cowen, 2022; Ethridge, 1979; Halvorsen & Mirel, 2013; Mirel, 1999; Todd-Breland, 2018; Walker, 2018). My use of Black faculty within this paper envisions similar (formal and informal) policy actions at the school level associated with the collective actions or presence of Black teachers – and, further, hypothesizes that these system-level efforts may be moderated by the proportion of teachers who are Black. This organization-level emphasis is important. While on the one hand any distinct Black-faculty

relationship with achievement may simply reflect the existence of Black teacher-Black student relationships that are formed outside of formal classroom assignments, Black-faculty effects also suggest the possibility of policy-level change that is not insistently linked to culturally isomorphic, person-level relationships – but rather to more systemic considerations of pedagogy and learning environment. In particular, I envision that Black faculties may be associated with school-level practice that consistently enacts itself inclusively within in the dignity, humanity and community of Black students (Ladson-Billings, 2009, 2014; J. D. Nelson, 2016; Warren et al., 2022).

Within the empirical work here, I emphasize that faculty race – especially as operationalized as proportion of a school's teachers who are Black – is both a feature and a measure of school context, describing the racial character of a school's teachers but also broadly characterizing the schools (in the present case) where Black teachers work at a given frequency. In the United States, a 75% Black-faculty school is likely to have a predominantly Black-student body, high rates of economic disadvantage, and an urban locale (e.g., Drake et al., 2019; Drake & Cowen, 2022; Jackson, 2009). This is to say that to the extent outcomes are associated with faculty race, these effects are descriptive – and conceptually distinct from teacher race and student race as cultural phenomena that are immutable to the individual and are substantially generatively exogeneous to school context. This said, lived (and empirical) interactions of students and teachers (e.g., Carter Andrews, Brown, et al., 2019) will very much depend on *who those students, teachers and their peers are* (Warren et al., 2022). We should expect that both teachers and students are actively selecting against school contexts and that, for example, Black teachers working in schools with larger and smaller Black-faculty proportion may be qualitatively different even within the same district (Bristol, 2018; Jackson, 2009), that Black teachers working in White suburban contexts do so with intention (Kelly, 2007), or that heterogeneous race match results can be a function of underlying between-school variation in both White and Black-teacher quality (Dee, 2004).

Underlying racial structures in the organizational behavior of schools are commonly framed within an extension of Kanter's (1977) *boundary heightening* hypothesis where the experience of minoritized groups in organization settings can be qualitatively affected by their numbers by affecting their degree of social isolation and organizational tendencies to essentialize their roles (Bristol, 2018; Mabokela & Madsen, 2003a, 2003b; Madsen & Mabokela, 2000). Per Kanter's own environmental taxonomy, this suggests the possibility of distinct socialized experiences for teachers of Color in progressively White faculty contexts where one's experience as a Black teacher (in a binary context) may be substantially different in a "balanced" (~50/50), "tilted" (~65/35), "skewed" (~85/15), or "uniform" (with very few minoritized members) context.[17] Progressively tokenized or minoritized groups are then likely to face escalating performance pressures, boundary heightening (where real person-level differences are counter-constructively pronounced), and role entrapment (where, in the present context, Black teachers are construed as instrumentalized as solutions to problematized Black students (Brockenbrough, 2015; Mabokela & Madsen, 2003b)).

Where Kanter's boundary theory engages the structural conditions in which progressive levels of tokenism or marginalization of workplace minorities are likely to manifest, Lim's (2006) cultivation of *representative bureaucracy* theory (as featured by Grissom et al. (2015)) outlines mechanisms of organization change effected by representation among minoritized street-level bureaucrats. *Representative* bureaucracy inherently operates within and derives its power from the informal sphere where bureaucracies deviate from the feasibilities of policy. Active bureaucrats *advocate* and exhibit *shared beliefs* and *empathetic understanding* with minority clients. Perhaps more powerfully, passive minoritized bureaucrats induce change in others. Majoritarian bureaucrats *restrain* their own biases due to threat of *check* by minority bureaucrats – a process with the possible longer-

[17] Symmetric, White-teacher experience is also implied – though, broader hegemonies and social norms of White women as teachers, or, say, White men as corporate executives, may mitigate role-skepticism and dynamics.

term effect of bureaucratic *resocialization*. Minoritized clients escalate their claims on the bureaucracy (*demand inducement*), and in sustained relationships (such as teacher and student) engage in *coproduction* of bureaucratic outcomes. In the present case, these theories reinforce the notion that Black teacher representation may help to transform faculties at large – re-orienting school-level engagement of Black students and Black students' and families' demands on the school. Over time, these processes may be reinforced by the hiring and retention preferences of school participants and the school choice behaviors of families.

Black faculty interactions

Within a reduced frame of student race, teacher race, and faculty race, it the latter that characterizes variation across schools. Faculty race is descriptive of school context that may moderate (1) Black-student outcomes (Black faculty -by- Black student effects), (2) Black-teacher effectiveness across all students (Black faculty -by- Black teacher effect), and (3) the traditional "race match" condition itself (i.e., the three-way Black faculty -by- Black teacher -by- Black student effect). Marginalization or isolation of teachers within the broader faculty will directly affect teacher effectiveness if faculties in fact have pedagogical impact through mechanisms of pedagogical coordination (e.g., curricular choice), intra-faculty professional cultivation, and supports that lead to retention and related improvement of practice. Indeed, research suggests such phenomena exists. Jackson and Bruegmann (2009) show student-achievement spillover effects among teaching peers (where teachers benefit from strong faculties) and work led by Bristol has shown that Black teachers working in White faculties indicate lower persistence intentions and are in fact more likely to be isolated from pedagogical support networks (Bristol, 2018; Bristol & Shirrell, 2019). Working explicitly within a frame of representative bureaucracy, Nicholson-Crotty et al. (2016) find little evidence that Black faculties at the organization level moderate classroom-level teacher gifted referrals. Alternatively, in school-level, aggregated data, Grissom, Rodriguez, and Kern (2017) find

evidence of gifted and talented placement in association with *faculty*-student match effects and Cheng (2019) finds analogous effects in reduced discipline outcomes in Wisconsin. Drake et al. (2019) demonstrate that Black-faculty percentage substantially moderates assignment of low-effectiveness ratings to Black teachers vs. same-school peers in a teacher evaluation system that is at least nominally tied to student achievement outcomes. That phenomenon may be indicative of either reduced levels of systemic bias in these faculty contexts *or* of objective comparative increases in Black-teacher effectiveness.[18] Less ambiguously, qualitative and social network analysis has established clearly racialized intra-faculty pedagogical and emotional networks as well as job affect and persistence intentions (Bristol, 2018; Bristol & Shirrell, 2019; J. L. Nelson, 2019) – all of which are logical mediators of teaching effectiveness.

Inspection of the multiple two-way interactions of teacher race, student race, and faculty race raises questions of distinct organization features. With the notable exceptions of the previously mentioned Yarnell and Bohrnstedt (2018) and Nicholson-Crotty et al. (2016), the educator-to-student ethnic/racial match literature commencing with Dee (2004) has centered on the **teacher-student interaction**. While this paper offers a critique of that narrow specification, the logic of these relationships is supported by evidence of related mechanisms. Teachers' assessments of student competencies and possibilities are greater in a racial-match condition (Ehrenberg, Goldhaber, & Brewer, 1995; Gershenson, Holt, & Papageorge, 2016; Ouazad, 2014) as are referrals to gifted programs (Grissom & Redding, 2015). Symmetrically, disciplinary outcomes – which often

[18] The Drake et al. (2019) study illustrates the ambiguities of Black faculty moderation effects. There, Black faculty percentage moderation effects can operate in *at least* three ways. First, they may reflect mechanisms of representative bureaucracy that check actual tendencies of evaluation bias within the administration. Second, Black faculty percentage may be correlated to objective underlying Black teacher "quality"; that is Black teacher pedagogical capacity is (comparatively) aligned to school performance objectives in schools where Black teachers work in greater proportion. Third, Black faculty percentage may, in fact, be operatively tied to the underlying efficacy of individual Black teachers as a function of organizational dynamics; Black teachers may have greater capacity when working in a comparatively Black organization.

originate in the classroom – are less severe in a racial match condition (Holt & Gershenson, 2015; Lindsay & Hart, 2017).

The ethnic/racial match literature (e.g., Egalite et al., 2015; Yarnell & Bohrnstedt, 2018) has often theorized role model phenomena where students of Color are passively inspired by teachers of Color (Clewell & Villegas, 1998) and also reduced stereotype threat for Black students in the presence of Black teachers (Steele & Aronson, 1995). I have already noted other literatures that advocate humanizing pedagogies for Black students enacted through authentic and trusting relationships (e.g., Warren et al., 2022). One does not have to foreclose the possibility of meaningful teacher-student relationships to argue that these phenomena can easily happen within the school more broadly. I postulate that a sizable Black faculty may convey different and possibly more substantial possibility than a single teacher, operating through discernable mechanisms of power and opportunity rather than exclusively through personal relationships. Similarly, active mechanisms attributed to teachers of Color – heightened expectations, capacity for cultural sustenance, and so forth – each have a potential for heightened potency when coordinated through school-level action. In this sense, a **student-faculty interaction** may support achievement gains due to policy-level instruments associated with the presence of Black teachers – even though those policies are not inherently enacted through features of person-level cultural isomorphism or shared racial experience. Boundary heightening theory would suggest that these benefits will be increasing with increases in Black-faculty percentage (though not necessarily linearly) as Black-teacher marginalization within a faculty is attenuated by an increasingly enfranchised Black teaching corps.

A **teacher-faculty interaction** between Black teachers and Black faculties may also present and may be tied to processes of marginalization and inclusivity of teachers within faculties (though I also emphasize evidence of a mean preference among Black teachers to join higher proportion Black faculties (Drake & Cowen, 2022)). As indicated, we know that faculty spillover processes exist,

including evidence showing teachers' value-added efficacy is enhanced by strong peers (Jackson & Bruegmann, 2009; Sun, Loeb, & Grissom, 2017; Sun, Penuel, Frank, Gallagher, & Youngs, 2013). Representative bureaucracy rigidly interpreted would suggest that the first minority bureaucrat would commence productive representative processes. Boundary heightening theory – as a theory of marginalization – would not necessarily agree. Kanter (1977, p. 971) extends the observation that quantitative changes in group membership effect qualitative changes in respective member experience (Simmel, 1950), showing that "for tokens… as individuals of their type come to represent a *smaller* numerical proportion of the group, they potentially capture[s] a *larger* share of the group members' awareness." This notion that racial differences of Black teachers on White faculties will be interpreted as a source of difference from institutional pedagogical mission and faculty professional culture/inclusiveness/persistence is supported by recent work (Bristol, 2018; Bristol & Shirrell, 2019; Kelly, 2007; Kohli, 2018). These counter-constructive experiences of Black faculty, directly affecting access to pedagogical supports and limiting organizational influence, might even suggest diminished effectiveness of Black teachers in these contexts vs. a "race-neutral" counterfactual. The same literature supporting Kanter's theorization, however, supports an expectation of reduced group irrationality as minority representation increases (Taylor & Fiske, 1976).

It is through this conception of the teacher-faculty interaction that I find the interpretation of the ultimate **three-way interaction of teacher race, student race, and faculty race** most conceptually tractable. If the teacher-faculty interaction describes qualitative action of the faculty on the teacher's own effectiveness, then a conceptual two-way interaction replaces the three-way racial interaction. That is, I argue that our literatures most easily describe racialized, faculty-enabled teacher effectiveness incrementally interacted with student race. This interaction postulates that Black teachers will be most effective when they are non-tokenized members of diverse (or substantially

Black) faculties and that the often-demonstrated Black teacher-Black student pedagogical benefits persist within this broader conceptualization of racial dynamics within the school. As an alternative, this effect can be conceived simply within the framework of heterogeneous effects of Black teacher-Black student match where, for example, school context may simply index comparative innate teaching capacity differences between White and Black teachers as speculated by (Dee, 2004).

Data

In this study, I reanalyze North Carolina K12 administrative data (Duke Sanford Center for Child and Family Policy, 2019) where a teacher-student match exists as exploited by Clotfelter, Ladd, and Vigdor (2007a) and, more recently, by Gershenson (2019). The North Carolina data are attractive for several reasons. Moderate teacher-student match effect sizes are known to exist. More importantly, the longitudinal statewide panel in a state with significant school diversity provides variation in the key parameters of interest while providing the high levels of statistical power required to manage multicollinearity emergent in moderation analyses (e.g., Nicholson-Crotty et al., 2016).[19]

I follow Gershenson (2019) and use data from academic years ending 2007 to 2013. The most reliable teacher-student administrative links are not available earlier[20] and reporting compliance (primarily by charter schools) declines substantially in the period following. Achievement scores become available in grade 3 and student academic pathways are well-defined and similar through

[19] I have performed similar analyses to those described here on the Tennessee STAR dataset used by Dee (2004) (N ~= 26,000). Results are unstable and highly sensitive to covariate structure, especially when the layered three-way interactions of faculty race, teacher race, and student race are specified.

[20] Earlier work such as Clotfelter et al. (2007a) relied on end of year test proctor IDs and an assumption of self-contained classrooms to infer teacher-student linkages. The more recent panel used in this paper allows careful inspection of student assignment patterns and reveals that even in grades 3 to 5 students frequently have multiple teachers.

grade 8.[21] Conceptually, the main exercises in creating the data panel are to (a) determine who is a student's math and reading teacher from a course-level dataset and then (b) to merge that set of teacher IDs on a student-by-year panel maintained by NCERDC. In the elementary grades, students have many courses (spelling, writing, reading, etc.) even when they are apparently in self-contained classrooms. In grades 3 to 5, I prioritize "precise" courses over "general" courses. That is, in ascending order of preference I would choose a (1) self-contained classroom, (2) a multi-subject block course inclusive of math or ELA, and (3) a subject-specific course (e.g, "reading" or elementary math). This process eliminates teacher conflicts. (Fewer than 50 student-by-year observations with residual teacher ID conflicts were dropped.) In grades 6 to 8, ELA courses have been administratively consolidated, significantly reducing ambiguity. Mathematics courses (e.g., grade 8 math vs. algebra) are hierarchically coded. I impose a logic of selecting a student's highest level math course as the official math course – though as a practical matter, students very rarely have multiple math courses. I cull all observations where this approach implies a class size < 10 students or > 45 students.

The net result of these efforts is a panel with 4.0 million matched mathematics and reading student-years, accounting for 82.0% of Black students and 84.6% of White students in the NCERDC master student file (after culling to students taking the general education achievement test). This is consistent with broader administrative teacher-student match rates claimed by NCERDC. The charter sector in this period was still small in NC, substantially capturing a period before state charter caps were lifted in 2011 (Hui, 2019). Only 2.8% of all observations are from

[21] There is essentially no evidence of tracking in reading and low-frequency tracking (e.g., into algebra, etc.) in mathematics through grade 8 *as evidenced by administrative course codes* – even while course codes have the precision to capture accelerated tracks and courses. Informal tracking may well exist. I evaluate a sensitivity of results to students in low, medium, and high achievement score ranges to evaluate if differential processes may be occurring.

charter schools, and Black students are barely overweighted (only 2.9%). Charter schools account for 10,830 Black teacher-Black student ethnic/racial matching events, or 4.1% of total.

Prior findings

Clotfelter et al. (2007a) use 1995-2004 data for grades 3 to 5 and a generalized specification of own-race match where a single indicator is used to indicate a matched condition to teacher race across students of all races. This approach yielded own-race marginal growth estimates of ~0.017 standard deviations ($p < .01$) in math and ~0. 007 ($p < .01$) in reading. Gershenson (2019) examines North Carolina data 2007-2013 data for grades 3 to 5. In contrast with Clotfelter et al., system-wide results suggest own-race effects only in mathematics. Those estimates are of similar magnitude .018 ($p < .01$) in the presence of less restrictive school-grade-year fixed effects and fall to .007 ($p < .01$) for within classroom-year estimates. While this reduction in effect is small, it is directionally consistent with organizational-level effects such as interactions of teacher and student body race or teacher and faculty race (as well as unobserved teacher quality differentials).

Gershenson's central finding is that these consolidated North Carolina results disguise heterogeneous effects by sector – with results from the then emergent charter sector consistently larger than traditional public schools. This same sensitivity analysis to school-level vs. classroom-level reductions in variance continues to show reduced estimates. Math TPS estimates decline from .016 ($p < .01$) to .006 (p, .05) and (less so) in charters from .030 ($p < .05$) to .027 ($p < .10$). Gershenson also systematically analyzes all teacher race-student race pairs (e.g., White teachers paired with Latinx students). Within the less restrictive school-level FE frame, he shows that TPS Black-student math growth is largely the same for Black students with Black and White teachers, but that among charters the difference is ~.07 standard deviations. While school-level FE control for faculty race main effects, they do not attend to possible interactions of faculty race with teacher and student race. Importantly, however, and partially counter to my hypotheses, Gershenson also

exhibits a partitioned sensitivity analysis showing that own-race effects appear similar in schools that are both < 20% White student body and > 80% White student body. However, TPS results of generalized ethnic/racial match (mean effects across races) increase from .01 to .015 standard deviations in highly segregated schools (following the pattern of Dee (2004)). Charter results are similar across conditions but are not significant even though point estimates are larger, suggesting large (but unreported) standard errors due to the small available charter sample.

Method

Prior literature has sought to identify unbiased estimates for teacher-student matching effects. I retain this interest while exploring the possibility and interplay of simultaneous school-level Black-faculty effects. Within the common teacher-student matching frame, Fairlie, Hoffmann, and Oreopoulos (2014) draw attention to two classes of selection problems. The first includes selection on characteristics associated with the match condition. For example, within schools, teachers of Color are often disproportionately assigned to students with lower achievement scores and higher rates of school discipline or other factors tied to student outcomes (Clotfelter, Ladd, & Vigdor, 2006; Gershenson, Hart, Lindsay, & Papageorge, 2017; Lindsay & Hart, 2017). Conceptually similar is the between-school phenomenon of Black-teacher employment where not only do Black teachers frequently work in predominantly Black-student schools (Hanushek et al., 2004; Jackson, 2009), but they work in schools predominantly serving students with other characteristics linked to reduced academic outcomes (Drake et al., 2019; Steinberg & Sartain, 2020). For this class of selection problem, simultaneous school and student fixed effects are adequate to insure internal validity.

A second class of estimation bias potentially occurs because of the high degree of visibility and operation of race in our society and the possibility of interplay of own-ability – or discerned pedagogical affinity – for the race match condition itself. Fairlie et al. (2014, p. 2574), working in a community college context, offer that simultaneous student and school fixed effects "cannot directly

control for differential sorting that may arise if, for example, highly motivated minority students sort systematically into minority-taught classes, while highly motivated nonminority students sort systematically into nonminority-classes." Within North Carolina itself, for example, we have evidence that Black teachers actively select in favor of working with Black students and teachers and that the Black teachers preferring to work in comparatively White-enrollment contexts have differentiated value-added scores from those working in comparatively Black-enrollment contexts (Jackson, 2009). Drake and Cowen (2022) find evidence consistent with a preference among new Black teachers in Michigan to work both with larger Black faculties and Black students. Given teachers' altruistic motivation and preferences for effectiveness (Eccles, 2009; Watt, Karabenick, & Richardson, 2014; Watt & Richardson, 2007, 2014; Wigfield & Eccles, 2000), one can reasonably anticipate related teacher selection toward school contexts that reinforce student outcomes (if teachers are able to discern their own type and retain agency in their workplace choice). This selection process could be viewed as synergistic to – and inherently confounded with – the bureaucratic phenomena discussed above. Specification of a Black-faculty moderation of the teacher-student effect (in the presence of controls for other racial features of the school) may help characterize these phenomena.

The Black faculty-Black student and Black faculty-Black teacher interactions of interest here also demand reconsideration of standard analytical frameworks. Prior literature has addressed residual concerns about the distribution of teacher quality not captured by school fixed effects. Egalite et al. (2015) include a simultaneous teacher-level value-added score such that matching effects can be viewed as a differential effect from that mean. More restrictive classroom fixed effects (that is teacher-by-year-by-hour) (Dee, 2004; Gershenson, 2019) subsume teacher-by-year fixed effects and residual teacher quality differentials. My preferred approach in this paper is a less restrictive, "school-level" – specifically, *school-by-grade-by-year* – fixed effect. This decision is supported

by prior findings. Estimates in Egalite et al. (2015) are unperturbed by inclusion of a value-added control. Dee (2004) and Gershenson (2019) have demonstrated that core own-race matching effects are robust to classroom FE – with the important caveat that Gershenson's estimates over these same data are attenuated by the inclusion of the classroom control. This is of interest since Black faculty-Black student and Black faculty-Black teacher interactions are correlated within-school phenomena to the teacher-student match. My approach explores this sensitivity.

Classroom FE are also extremely costly for the purposes of this study. Where school-level FE as specified still inherently exclude from analysis schools where there exists no variation in a metric – e.g., a school-grade where some Black students attend but which has an exclusively White faculty – classroom FE further exclude all classrooms with homogeneous class race. For example, in a school that has a predominantly Black student body, but which has a multi-racial faculty, all classrooms that have 100% Black students will be excluded. This is unacceptable in my research context which interests itself in variation in faculty racial composition. Moreover, classroom effects subsume the two-way interaction (of interest) between teacher race and student body race.[22]

Within this context of a partial set of controls, I emphasize that my approach is intentionally descriptive – where I prioritize investigation of the moderating effects of faculty race on the system of teacher and student race as predictors of achievement. My preferred model is as follows:

$$A_{ijgst} = \beta_1 X_{it} + \beta_2 Z_{jgst} + \beta_3 J_{jt} + \delta_2 TS_{ijt} + \delta_2 SF_{ist} + \delta_3 TF_{jst} + \delta_4 TSF_{ijgst} + \omega_{gst} + \epsilon_{ijgst} \quad (2.1)$$

[22] As an alternative, using mean teacher value addition as a covariate technically preserves all within- and between-school variation and is far more parsimonious than classroom FE. However, as with classroom fixed effects, if no variation exists in student race, then there is no basis for estimating a distinct, race-specific value-added effect and the VAM control is (in this partial respect) endogenous even as it persists in a multiple regression. Finally, both a VAM covariate and classroom FE do little to address the threat of student and teacher selection on racialized school features – on their expectation of working with own-race students and teachers.

Here *i, j, g, s,* and *t* index students, classroom, grades, schools, and years. *X* are time-varying student characteristics (e.g., economic disadvantage status). *Z* are a set of school- and classroom-level measures (e.g., percent of class that is economically disadvantaged). *J* is a set of teacher-by-year controls. *TS, SF, TF, and TSF* are a set of two-way and three-way interactions of teacher race, *T,* student race, *S,* and faculty race, *F*. I confine my analysis to an investigation of own-race phenomena of Black students, Black teachers, and Black faculties. *TS* interacts the Black-teacher indicator with Black student. *SF* is the Black student-Black faculty interaction, where in the main specification, Black faculty is parameterized in both linear and non-linear forms as discussed below. *TF* includes only the interaction of a Black-teacher indicator and the Black-faculty measure. Main effects for student, teacher, and faculty race are included in *X, J,* and *Z*.

A student fixed effect is alternately introduced. This effect is included in sensitivities, but my preferred specification is to instead include in *X* a lagged achievement score. This reflects my research interest in describing the authentic project of effecting achievement gains for particular students with specific experience-based academic priors; though, in any case, I ultimately rely on the bracketing properties of alternative fixed effect and lagged score specifications as described by Angrist and Pischke (2008). Per the discussion above, ω, an elaborated "school" fixed effect – that is actually a school-by-grade-by-year fixed effect – is included.[23] The effect is meant to account for the interaction of school-level selection, year-to-year grade-level achievement test idiosyncrasies, and within-school operational idiosyncrasies (e.g., faculties operating more or less successfully in a "middle school model" of coordinated and collective faculty responsibility for a cohort of students.)

[23] The indexing of school by year in the FE also has the effect of insuring that Black teacher proportion, or categorical indicators of Black teacher proportion, are strictly "between" parameters such that their standard interactions with teacher race and student race are well-defined and unbiased. Without indexing by year, both race-match (i.e., teacher Black X student Black) and Black teacher proportion would be time varying and require special treatment when interacted (Giesselmann & Schmidt-Catran, 2020).

Parameterizations of Black faculty proportion

Only Nicholson-Crotty et al. (2016) (while investigating racialized gifted program placement outcomes) specify a three-way interaction of faculty, teacher, and student race as described here. They primarily employ a linear parameterization of Black faculty – i.e., the proportion of a school's teachers that are Black. I adopt this parameterization, but also explore non-linear effects. Other research (also evaluating gifted placement) that relies exclusively on school-level data suggests a threshold for Black-faculty proportion where bureaucratic activity begins to affect student outcomes (Grissom et al., 2017). As I have emphasized, however, Black-faculty proportion – in the absence of a systematic set of school-level covariates – broadly differentiates school-types and conditions, not just faculty race and any attending bureaucratic effects. One might plausibly anticipate conditions under which, for example, bureaucratic processes accelerate (perhaps discontinuously) in lower ranges of Black-faculty proportion, but perhaps plateau or deteriorate as Black-faculty proportion approaches 1 – where school conditions can be highly stressed by economic disadvantage and student and teacher turnover in ways that interact with selection preferences and other mechanisms. Further, non-Black-faculty proportion necessarily moves inversely to Black-faculty proportion. In this respect, Black-faculty proportion is a measure of an *entire* school faculty. We can hypothesize that faculty operations or school-level recruitment might deteriorate if non-Black faculty are symmetrically tokenized (as anticipated by Kanter, 1977). Quadratic and categorical parameterizations of Black-faculty proportion and its interactions with teacher and student race are employed to explore these possible relationships.

Categorical levels of Black-faculty percent were identified within the structural context of the data and I ultimately parse the data to establish "quintiles" where teacher-student matching events are evenly parsed as Black-faculty proportion increases over ordered observations. Kanter (1977) suggests qualitatively distinct levels of minoritized group experience: uniform (majority-minority

100:0), skewed (15:85), tilted (65:35), and balanced (50:50). These categories were conceived (and experimentally evaluated) in the context of small groups, however, where the minoritized and tokenized persons in a "skewed" group are likely to be of only one or two members of a group. Mechanistically, these individuals remain in a poor position to form or create personally and organizationally meaningful alliances. Tilted groups are those where alliances are able to emerge, tokenization processes are degraded, and organizational change is more likely to occur. K12 faculties are larger than those groups described by Kanter (1977) and a solo Black teacher is likely to be 1 in 25 or 1 in 50, rather than 1 in 8. Perhaps for these reasons, Grissom et al. (2017) conceptually distinguish between 0 to 5% and 5 to 10% Black-teacher percentage. They find, however, a threshold effect only at the 20-30% interval. Further, where Grissom et al. seek to describe only a Black-faculty percentage main effect, my interest is in Black-faculty percentage as a moderator of teacher race, student race, and matching effects. Black teacher-student matching is extraordinarily rare in low Black-faculty percentage schools, challenging reliable estimation of moderation effects with extreme categorical precision. In an attempt to balance all of these concerns, and the substantial power problems induced by estimation of interactions of highly correlated phenomena (see following), I define coarser-grained Black-faculty categories that incorporate equal Black teacher-Black student matching events and which are responsive to the threshold levels given by Kanter (1977) and Grissom et al. (2017). These categories are further described in Table 2.3.

Covariates

I employ student-level indicators for student race, economic disadvantage, gender, and whether a student attended a testing school for less than 100 days, and separate indicators for autism, learning disability, physical disability, and other low-frequency health conditions. (A small number of students with comparatively profound conditions are excluded). I also include indicators for LEP status, section 504 designation, migrant status, and Title 1 status (routinely available only in

traditional public schools). Classroom-by-year measures include number of students, class means for the student-level measures above, and means of lagged math and reading scores. Available teacher controls include a constructed measure of years of experience since 1995, that term's square, a novice teacher indicator (if less than 2 years of experience), master's degree attainment, "more than" master's degree attainment, gender, and teacher race. Of these teacher measures, only race and gender are well-reported in the charter sector. As a consequence, other measures are omitted from reported analyses. Traditional public school-only results are similar when these covariates are included.

While this paper emphasizes the three-way interaction of student race, teacher race, and faculty race, other simultaneous racialized phenomena may exist. Hoxby (2000) and Angrist and Lang (2004) examine racialized student peer effects. Yarnell and Bohrnstedt (2018) differentiate between the conventional, within-classroom effect of teacher-student ethnic/racial match and the between-classroom teacher-student *body* matching effect. In this spirit, I evaluate the robustness of my results to inclusion of a Black-student by proportion-of-classmates-who-are-Black interaction as well as a Black-teacher by proportion-of-students-who-are-Black interaction.

A growing literature suggests a racialized relationship between teachers and administrators. Black administrators appear to be successful in hiring new Black teachers (Bartanen & Grissom, 2019; Drake & Cowen, 2022), retaining Black teachers (Bartanen & Grissom, 2019; Grissom & Keiser, 2011), and possibly effecting Black-student achievement gains (Bartanen & Grissom, 2019). In addition to school-by-grade-by-year fixed effects, as discussed above, I include interactions of Black administrators with teacher and student terms in model sensitivities.

Black-student achievement is systemically lower even after conditioning on observable student and school measures in this work. Further we know Black students' within school experiences can be substantially different (Carter Andrews, 2012; Carter Andrews, Castro, et al.,

2019; Carter, 2007; Leath, Mathews, Harrison, & Chavous, 2019) and that (often segregated) residential patterns relate to school outcomes (Carlson & Cowen, 2014). One empirical approximation of this phenomenon is to conceive a "school-within-a-school" by constructing not school-level, but rather, school-by-race level fixed effects, that accounts for race-specific within school and residential neighborhood context. This approach allows evaluation of the robustness of teacher-student level matching effects while controlling for the full array of interacted "school-within-a-school" factors that may differentially affect Black students including faculty-level race, administrator race, counselors' and aides' race, and overtly racialized school policy, climate, or curricula. Teacher-student matching effects are robust to these scenarios. The results following are for those less restrictive model scenarios where interactions of student race and school-level features like faculty and administrator race are not suppressed by this fixed effect strategy.

Results

Tables 2.1 and 2.2 confirm broad cross correlation and simultaneity of the racial constructs discussed here. The correlation with Black teacher-Black student match with the construct percent of faculty that is Black -by- Black teacher – which is notably not subsumed by either school or classroom-level fixed effects – is 0.66 within the full multi-racial pool of student observations (Table 2.1) and 0.86 in a Black-student-only estimation pool (Table 2.2). Similarly, the correlations between the common teacher-student match term and the Black faculty-Black teacher interaction are also high across the two tables – confirming significant levels of structural interplay of other racial constructs that, though manageable with standard teacher-student match specification strategies, deserve further investigation.

Table 2.1. Linear correlations among select school racial constructs. All student observations.

	Own-race teacher (any race)	Black student-Black teacher match	Black student	Black teacher	Percent of school faculty Black	Percent of classmates Black	Percent of faculty Black X Black student	Percent of faculty Black X Black teacher	Percent of faculty Black X Black teacher X Black student	Percent of classroom students Black X Black teacher	Percent of classroom students Black X Black student
Own-race teacher (any race)	1.00										
Black student-Black teacher match	0.23	1.00									
Black student	-0.38	0.45	1.00								
Black teacher	-0.05	0.69	0.22	1.00							
Percent of school faculty Black	-0.17	0.49	0.38	0.55	1.00						
Percent of classmates Black	-0.30	0.42	0.56	0.39	0.67	1.00					
Percent of faculty Black X Black student	-0.07	0.66	0.68	0.41	0.74	0.61	1.00				
Percent of faculty Black X Black teacher	0.03	0.70	0.26	0.83	0.72	0.46	0.59	1.00			
Percent of faculty Black X Black teacher X Black student	0.21	0.88	0.40	0.61	0.59	0.43	0.77	0.81	1.00		
Percent of classroom students Black X Black teacher	0.05	0.79	0.30	0.88	0.62	0.53	0.56	0.89	0.77	1.00	
Percent of classroom students Black X Black student	-0.24	0.55	0.86	0.31	0.53	0.74	0.81	0.39	0.54	0.45	1.00

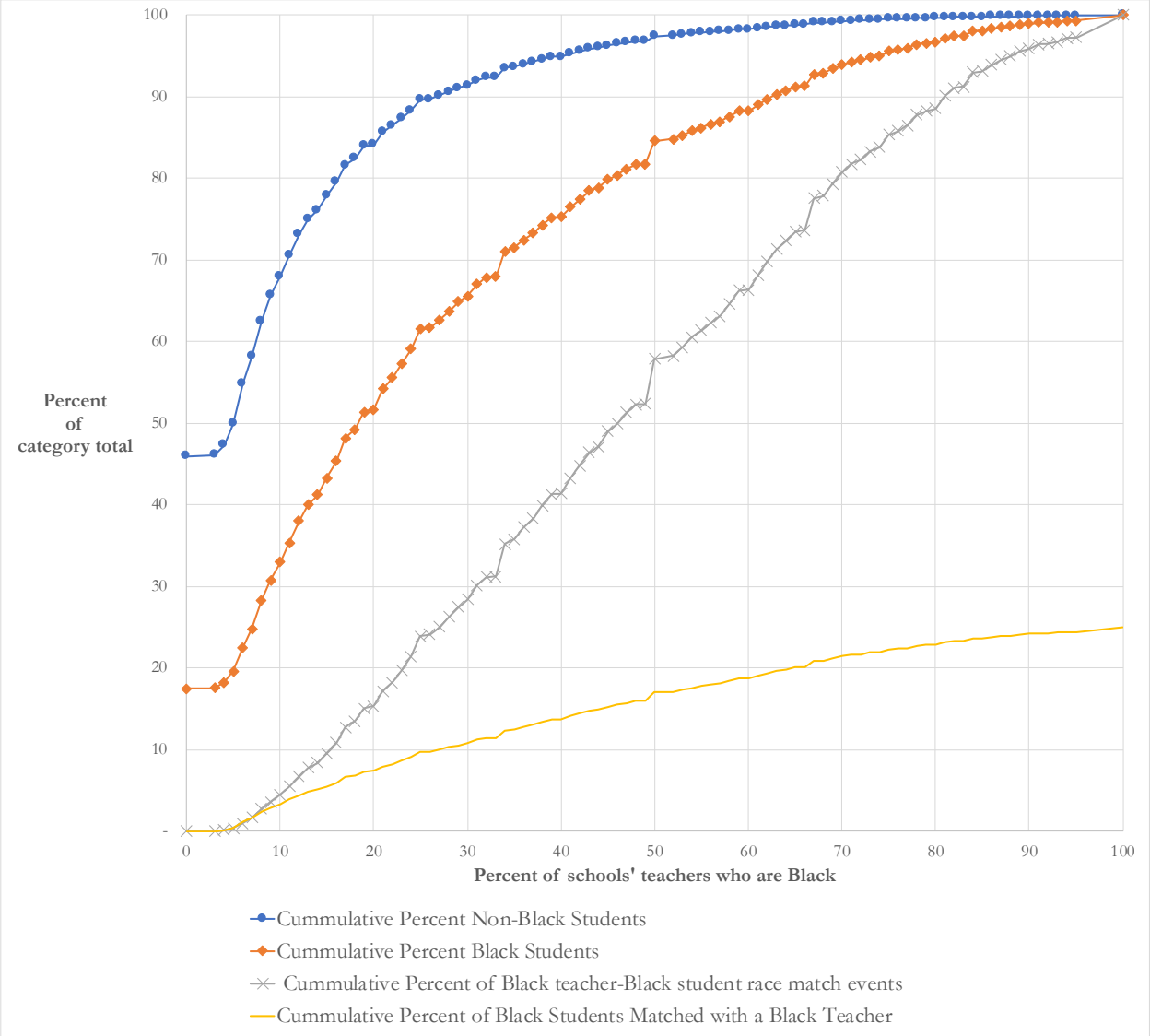
Notes. Pearson correlations over student-by-year observations. All statistics significant at $p < .01$. Own-race teacher indicates any match between administrative match between teacher and student race and ethnicity.

Table 2.2. Linear correlations among select school racial constructs. Black students only.

	Black Student-Black teacher match	Black teacher	Percent of school faculty Black	Percent of classmates Black	Percent of faculty Black X Black student	Percent of faculty Black X Black teacher	Percent of faculty Black X Black teacher X Black student	Percent of classroom students Black X Black teacher	Percent of classroom students Black X Black student
Black student-Black teacher match	1.00								
Black Teacher	1.00	1.00							
Percent of school faculty Black	0.55	0.55	1.00						
Percent of classmates Black	0.36	0.36	0.61	1.00					
Percent of faculty Black X Black student	0.55	0.55	1.00	0.61	1.00				
Percent of faculty Black X Black teacher	0.86	0.86	0.74	0.43	0.74	1.00			
Percent of faculty Black X Black teacher X Black student	0.86	0.86	0.74	0.43	0.74	1.00	1.00		
Percent of classroom students Black X Black teacher	0.93	0.93	0.61	0.50	0.61	0.90	0.90	1.00	
Percent of classroom students Black X Black student	0.36	0.36	0.61	1.00	0.61	0.43	0.43	0.50	1.00

Notes. Pearson correlations over student-by-year observations. All statistics significant at $p < .01$.

Figure 2.1. Cumulative distributions of Black teachers, Black students, and Black teacher-Black student classroom match over increasing percentage of school faculty that is Black



Notes. Based upon mathematics observations only. Reading classrooms are similar. Graphed statistics are the cumulative percentage (by category) of student-by-year observations across schools ordered by (integer value intervals of) Black teacher percentage. For example, schools with 20 percent or fewer Black teachers educate approximately 84% of non-Black students and 52% of Black students, account for ~16% of total Black-teacher Black-student matching events, and cause around 7% of Black students to have a Black teacher.

Table 2.1 also shows that the correlation between the percent of school faculty that is Black is correlated with Black teacher-Black student match at a comparatively low level of ~0.5. Figure 2.1 helps to elaborate this phenomenon by characterizing the broad array of Black-faculty school

contexts in which Black teacher-Black student matches occur. Cumulatively, 24.9% of Black-student observations are matched with a Black teacher. These matches accrue approximately linearly in relation to schools' underlying Black-faculty percentage (from 0 to 100 percent), exhibiting almost no weighting of observations to one school context over another. This occurs, in part, because Black students (like non-Black students) disproportionately attend schools with lower rates of Black-teacher employment such that, though matching rates are low in these schools, absolute numbers of matching events are similar to those in predominantly Black-faculty schools. This dynamic is further illuminated by the tabulations presented in Table 2.3. Here, I have partitioned the sample into five ordinal levels of Black-faculty proportion such that the number of Black teacher-Black student matches is equivalent. One-third of Black teachers are found in Level 1 schools with the lowest rates of Black-faculty participation, but their presence is tied to a category Black teacher-Black student match rate of only 9% – in spite of disproportionate rates of matching with Black students in these schools. Black teacher-Black student matching rates closely approximate within-level Black-teacher employment rates in Levels 2 to 5. These matches transition from the exception to the norm across levels, yielding wide disparity in teacher and student expectations of ethnic/racial match across these contexts.

Tables 2.4 and 2.5, 2.6 and 2.7, and 2.8 and 2.9 implement the methodological framework described in equation (2.1) with, respectively, linear, quadratic, and categorical (at the levels given in Table 2.3) parameterizations of the proportion of faculty Black. Within these tables, Model 1 incorporates my preferred student control of lagged student achievement. Model 2 substitutes student fixed effects. Results are substantially similar. Model 3 uses a lagged student achievement control *and* incorporates additional racialized interactions between teachers, classroom peers, and school administrators. Model 1 and Model 2 results are presented in panels with models (a), (b), (c), and (d) corresponding to progressive implementations of the three-way interaction of Black teacher,

Black student, and proportion of faculty Black. Column (a) provides a baseline teacher-student match parameter.

Table 2.3. School characteristics for five even partitions of Black teacher-Black student match events within the ranked distribution of schools' Black teacher percentage

	Level 1	Level 2	Level 3	Level 4	Level 5
Category partitions					
Min. proportion teachers Black	0.00	0.23	0.38	0.53	0.70
Mean proportion teachers Black	0.06	0.30	0.45	0.62	0.81
Max. proportion teachers Black	0.23	0.38	0.53	0.70	1.00
Number of Black teacher-Black student matches	52,547	52,547	52,547	52,547	52,547
Category characteristics					
Pct. of all Black students	58%	17%	11%	8%	6%
Pct. of category students who are Black	19%	46%	56%	65%	75%
Pct. of Black teachers	33%	21%	17%	15%	14%
Pct. of Black students matched with a Black teacher	9%	30%	44%	62%	79%
Pct. of Black teachers' students who are Black	31%	49%	58%	66%	75%
Pct. of all students with own-race teacher	59%	35%	36%	45%	61%
N (Black)	607,769	176,960	118,175	85,168	66,920

Notes. Based upon mathematics classroom only. Reading partitions are similar. Levels are constructed by sorting observations by school Black-teacher percentage and partitioning the sample by equal absolute numbers of Black teacher-Black student teaching events within those school categories.

Table 2.4. Math achievement effects of the Black-teacher, Black-student and Black-faculty interactions within a linear framework.

	Model 1				Model 2				Model 3					
	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)	(e)	(f)
Black teacher X Black student	0.035***	0.021***	0.027***	0.027***	0.032***	0.021***	0.026***	0.027***	0.033***	0.018***	0.023***	0.023***	0.017***	0.016**
	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)	(0.006)	(0.007)	(0.006)	(0.007)
Proportion faculty Black [0,1] X Black student			0.016**	0.017*			0.019**	0.021**			0.025***	0.025**	0.024**	0.022*
			(0.007)	(0.009)			(0.009)	(0.010)			(0.009)	(0.011)	(0.009)	(0.011)
Proportion faculty Black X Black teacher			0.058**	0.059**			0.045**	0.047**			0.050**	0.049*	0.029	0.027
			(0.023)	(0.026)			(0.019)	(0.022)			(0.024)	(0.027)	(0.026)	(0.028)
Proportion faculty Black X Black teacher X Black student		0.036***		-0.001		0.032**		-0.004		0.038***		0.002		0.004
		(0.012)		(0.016)		(0.014)		(0.016)		(0.012)		(0.017)		(0.017)
Proportion admin. Black X Black student											-0.004	-0.003	-0.004	-0.004
											(0.005)	(0.005)	(0.005)	(0.005)
Proportion admin. Black X Black teacher											0.005	0.005	0.002	0.003
											(0.012)	(0.012)	(0.012)	(0.013)
Proportion admin. Black X Black teacher X Black student											0.003	0.003	0.004	0.003
											(0.009)	(0.009)	(0.009)	(0.009)
Black teacher X Proportion classroom students Black													0.036**	0.036**
													(0.015)	(0.015)
Black student X Proportion classroom students Black													0.008	0.008
													(0.007)	(0.007)
Observations (000)	2,992	2,992	2,992	2,992	3,458	3,458	3,458	3,458	2,992	2,992	2,823	2,823	2,823	2,823
R-squared	0.74	0.74	0.74	0.74	0.89	0.89	0.89	0.89	0.74	0.74	0.74	0.74	0.74	0.74
School FE	Yes				Yes				Yes					
Student FE	No				Yes				No					
Student lagged score	Yes				No				Yes					
Lagged classroom score mean	No				No				Yes					

Notes. (School) cluster robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Estimation sample includes students and teachers of all races in grades 3 to 8. All models rely on school-by-grade-by-year fixed effects which subsume time variant school-level Black faculty proportion as a main effect. Covariates include described varying student and classroom controls. Teacher education and experience controls are omitted in order to include charter school observations where these measures are missing. Traditional public school only results are highly similar when these measures are included and excluded. Administration race is the proportion of school-level principals and assistant principals (when present) who are Black. Charter school reporting of administrative race is low, causing a small shift in the estimation sample. Columns (a) and (b) are similar in Models 1 and 3 are similar except Models 3 includes classroom-level lagged scores as predictors. Reported observations are net of fixed effect singletons.

Table 2.5. Reading achievement effects of the Black-teacher, Black-student and Black-faculty interaction within a linear framework.

	Model 1				Model 2				Model 3					
	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)	(e)	(f)
Black teacher X Black student	0.012***	0.008*	0.011***	0.008	0.009***	0.009**	0.011***	0.007	0.011***	0.006	0.013***	0.008	0.009**	0.005
	(0.003)	(0.005)	(0.003)	(0.005)	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
Proportion faculty Black [0,1] X Black student			0.000	-0.004			-0.031***	-0.036***			0.012	0.002	0.028***	0.020*
			(0.008)	(0.009)			(0.008)	(0.009)			(0.009)	(0.010)	(0.009)	(0.011)
Proportion faculty Black X Black teacher			0.006	-0.001			0.004	-0.004			0.004	-0.010	-0.011	-0.024
			(0.013)	(0.014)			(0.010)	(0.012)			(0.013)	(0.015)	(0.013)	(0.015)
Proportion faculty Black X Black teacher X Black student		0.010		0.013		-0.002		0.015		0.012		0.028*		0.025*
		(0.010)		(0.013)		(0.010)		(0.012)		(0.010)		(0.015)		(0.015)
Proportion admin. Black X Black student											-0.003	-0.001	-0.001	0.001
											(0.005)	(0.005)	(0.005)	(0.005)
Proportion admin. Black X Black teacher											0.001	0.005	-0.000	0.003
											(0.007)	(0.008)	(0.007)	(0.008)
Proportion admin. Black X Black teacher X Black student											-0.009	-0.016*	-0.010	-0.016*
											(0.008)	(0.009)	(0.008)	(0.009)
Black teacher X Proportion classroom students Black													0.026***	0.027***
													(0.009)	(0.009)
Black student X Proportion classroom students Black													-0.029***	-0.028***
													(0.007)	(0.007)
Observations (000)	2,988	2,988	2,988	2,988	3,449	3,449	3,449	3,449	2,988	2,988	2,818	2,818	2,818	2,818
R-squared	0.69	0.69	0.69	0.69	0.87	0.87	0.87	0.87	0.70	0.70	0.70	0.70	0.70	0.70
School-by-grade-by-year FE			Yes				Yes				Yes			
Student FE			No				Yes				No			
Student lagged score			Yes				No				Yes			
Lagged classroom score mean			No				No				Yes			

See notes in Table 2.4.

Column (b) incorporates the three-way interaction of terms, or in the present context, evaluates whether Black-faculty proportion appears to moderate simultaneous teacher-student matching effects. Column (c) drops this term and simultaneously evaluates race match in the presence of the two-way Black teacher-Black faculty and Black student-Black faculty interactions. Column (d) is the full three-way specification. This progression is presented in abbreviated form for Model 3.

As is expected from prior results in these data, I find a baseline teacher-student match effect of around .03 standard deviations (sd) is present in math and a lesser ~.01 sd effect in reading (Tables 2.4 and 2.5). These are consistent with the range found in this literature (Redding, 2019) and are similar magnitude to those of Gershenson (2019) in his re-analysis of grades 3 to 5 of these substantially same data. In math (Table 2.4), I find a highly significant Black-faculty proportion moderation estimate (column (b)), resulting in an attenuated baseline teacher-student match point estimate. This descriptive effect suggests that mean teacher-student matching effects are materially heightened in schools with higher levels of Black-faculty proportion – nearly doubled in a school with 50% Black faculty over a predominantly White-faculty context. Apparent Black-faculty moderation of teacher-student match, however, disappears when other two-way interactions are introduced (columns (c) and (d)). This phenomenon renders moot the ultimate interpretation of the three-way interaction effect shown in (b) (i.e., whether it is an interaction of a Black faculty -by-Black teacher with Black student or, rather, Black-faculty proportion moderation of the teacher-student match effect). Results suggest Black-faculty proportion positive interactions with both Black-teacher and Black-student indicators. (Recall that these effects are scaled to Black-faculty proportion from 0 to 1.) These effects are robust to the inclusion of Black-administrator interactions (Model 3), but the Black faculty X Black teacher interaction loses significance as its magnitude becomes lesser (though still positive) in the presence of the classroom-level interaction of *student body* race and teacher race postulated by

Table 2.6. Quadratic effects of Black-faculty proportion on math achievement.

	Model 1				Model 2				Model 3					
	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)	(e)	(f)
Black teacher X Black student	0.035***	0.011	0.027***	0.021**	0.032***	0.010	0.026***	0.017**	0.033***	0.009	0.024***	0.017*	0.018***	0.011
	(0.004)	(0.009)	(0.004)	(0.010)	(0.004)	(0.008)	(0.004)	(0.008)	(0.004)	(0.009)	(0.006)	(0.010)	(0.005)	(0.010)
Proportion faculty Black [0,1] X Black student			0.010	-0.011			0.042**	0.027			0.025	0.012	0.022	0.008
			(0.018)	(0.023)			(0.018)	(0.021)			(0.021)	(0.026)	(0.021)	(0.026)
Proportion faculty Black X Black teacher			0.052	0.020			0.033	0.004			0.026	0.001	-0.009	-0.034
			(0.077)	(0.081)			(0.064)	(0.069)			(0.076)	(0.080)	(0.077)	(0.081)
Proportion faculty Black X Black teacher X Black student		0.096**		0.058		0.102**		0.064		0.094*		0.053		0.053
		(0.048)		(0.052)		(0.045)		(0.047)		(0.050)		(0.056)		(0.056)
Squared proportion faculty Black X Black Student			0.010	0.055			-0.035	-0.007			-0.000	0.026	0.003	0.029
			(0.023)	(0.039)			(0.025)	(0.036)			(0.026)	(0.042)	(0.026)	(0.042)
Squared proportion faculty Black X Black teacher X Black Student			0.009	0.062			0.017	0.055			0.033	0.069	0.051	0.087
			(0.097)	(0.103)			(0.080)	(0.086)			(0.094)	(0.100)	(0.094)	(0.100)
Squared proportion Faculty Black X Black teacher X Black student		-0.067		-0.089		-0.082*		-0.079		-0.063		-0.070		-0.070
		(0.049)		(0.062)		(0.048)		(0.058)		(0.051)		(0.068)		(0.068)
Proportion admin. Black X Black student											-0.004	-0.003	-0.004	-0.004
											(0.005)	(0.005)	(0.005)	(0.005)
Proportion admin. Black X Black teacher											0.006	0.006	0.003	0.004
											(0.012)	(0.012)	(0.012)	(0.012)
Proportion admin. Black X Black teacher X Black student											0.003	0.001	0.003	0.002
											(0.009)	(0.009)	(0.009)	(0.009)
Black teacher X Proportion classroom students Black													0.037**	0.037**
													(0.015)	(0.015)
Black student X Proportion classroom students Black													0.008	0.008
													(0.007)	(0.007)
Observations (000)	2,992	2,992	2,992	2,992	3,458	3,458	3,458	3,458	2,992	2,992	2,823	2,823	2,823	2,823
R-squared	0.735	0.735	0.735	0.735	0.886	0.886	0.886	0.886	0.738	0.738	0.738	0.738	0.738	0.738
School-by-grade-by-year FE			Yes				Yes				Yes			
Student FE			No				Yes				No			
Student lagged score			Yes				No				Yes			
Lagged classroom score mean			No				No				Yes			

Notes. (School) cluster robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. See also note from Tables 2.4 and 2.5. Results here reflect quadratic form for proportion of faculty Black; all other racialized effects are similar to Tables 2.4 and 2.5.

Table 2.7. Quadratic effects of Black-faculty proportion on reading achievement.

	Model 1				Model 2				Model 3					
	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)	(e)	(f)
Black teacher X Black student	0.012***	0.002	0.011***	0.002	0.009***	-0.002	0.011***	-0.005	0.011***	0.001	0.014***	-0.001	0.010**	-0.004
	(0.003)	(0.007)	(0.003)	(0.007)	(0.003)	(0.006)	(0.003)	(0.007)	(0.003)	(0.007)	(0.005)	(0.008)	(0.005)	(0.008)
Proportion faculty Black [0,1] X Black student			-0.030	-0.045**			-0.048***	-0.071***			-0.019	-0.036	0.004	-0.011
			(0.019)	(0.023)			(0.019)	(0.021)			(0.021)	(0.026)	(0.022)	(0.026)
Proportion faculty Black X Black teacher			0.070*	0.042			0.018	-0.028			0.050	0.010	0.027	-0.011
			(0.042)	(0.045)			(0.036)	(0.039)			(0.040)	(0.045)	(0.041)	(0.046)
Proportion faculty Black X Black teacher X Black student		0.046		0.064		0.068**		0.109***		0.045		0.103**		0.100**
		(0.037)		(0.044)		(0.034)		(0.040)		(0.036)		(0.047)		(0.047)
Squared proportion faculty Black X Black Student			0.047*	0.075**			0.027	0.065*			0.048*	0.069*	0.037	0.055
			(0.025)	(0.038)			(0.026)	(0.034)			(0.028)	(0.041)	(0.028)	(0.041)
Squared proportion faculty Black X Black teacher X Black Student			-0.088	-0.049			-0.019	0.039			-0.062	-0.020	-0.050	-0.011
			(0.056)	(0.060)			(0.047)	(0.051)			(0.050)	(0.058)	(0.050)	(0.059)
Squared proportion Faculty Black X Black teacher X Black student		-0.041		-0.081		-0.081**		-0.128**		-0.037		-0.107*		-0.102*
		(0.041)		(0.056)		(0.040)		(0.051)		(0.040)		(0.059)		(0.059)
Proportion admin. Black X Black student											-0.002	-0.001	-0.000	0.001
											(0.005)	(0.005)	(0.005)	(0.005)
Proportion admin. Black X Black teacher											0.001	0.004	-0.000	0.002
											(0.007)	(0.008)	(0.007)	(0.008)
Proportion admin. Black X Black teacher X Black student											-0.011	-0.018**	-0.012	-0.018**
											(0.008)	(0.009)	(0.008)	(0.009)
Black teacher X Proportion classroom students Black													0.025***	0.025***
													(0.009)	(0.009)
Black student X Proportion classroom students Black													-0.028***	-0.028***
													(0.007)	(0.007)
Observations (000)	2,988	2,988	2,988	2,988	3,449	3,449	3,449	3,449	2,988	2,988	2,818	2,818	2,818	2,818
R-squared	0.694	0.694	0.694	0.694	0.869	0.869	0.869	0.869	0.695	0.695	0.696	0.696	0.696	0.696
School-by-grade-by-year FE			Yes				Yes					Yes		
Student FE			No				Yes					No		
Student lagged score			Yes				No					Yes		
Lagged classroom score mean			No				No					Yes		

Notes. See notes in Table 2.6.

Yarnell and Bohrnstedt (2018). Table 2.1 shows that these separate interactions are correlated at 0.89, foregrounding the simultaneity of racial features of schools. I find no evidence in these North Carolina data that administrator moderation effects are present.

Reading effects (Table 2.5) are less consistent and demonstrate sensitivity to covariate structure – even if they are ultimately structurally similar to those of math. Teacher-student matching effects are consistently smaller across scenarios than those in math. Notably, the proportion faculty Black -by- Black student interaction is negative in the presence of student fixed effects (Model 2), but is then positive in the presence of lagged student scores *and* the full suite of school race covariates (Model 3). In this fully specified model, the teacher-student matching main effect is close to zero and insignificant with the Black-faculty proportion matching effect dominating ($p < .10$). As in math, teacher match with classroom-level race is positive and highly significant ($p < .01$). As further evidence of the simultaneous complexity and interplay of school race measures, I also observe a similar magnitude negatively signed classroom peer effect.

Tables 2.6 and 2.7 report results where I free the Black-faculty proportion parameter to take on a quadratic form. As can be seen in column (b) in all Model 1 and Model 2 math and reading scenarios, the squared term for Black-faculty moderation of teacher-student match is consistently negative and often significant despite large standard errors. These estimates suggest maximal matching effects in the center of the Black-faculty proportion distribution. For example, the mathematics effects (Table 2.6) in Model 2b would suggest a maximal teacher-student matching effect of .032 standard deviations in a school with 62% Black teachers – which is large in comparison to a highly attenuated baseline point estimate of .01 sd. This basic moderation structure of teacher-student match persists in the fully specified (Model 3f) scenario, though this narrative is complicated by the (not statistically significant) positive point estimates for the quadratic Black-faculty proportion -by- Black student term which are generally positive, suggesting that Black

students as a class (not only those with Black teachers) perform comparatively better in schools with either the largest or smallest Black faculties. Reading results (Table 2.7) are similar – though baseline teacher-student match effects fully disappear in some scenarios – and apparent quadratic Black-faculty moderated estimates are well defined. In the fully specified Model 3f scenario, for example, the three-way interaction of teacher, student and faculty race suggests a maximal achievement effect of 0.04 sd within schools with ~49% Black faculty on top of a baseline matching effect estimated close to zero. As is evident, results remain sensitive to covariate structure, but also continue to point to the likelihood that teacher-student match and other racialized phenomena are indeed sensitive to school context.

Tables 2.8 and 2.9 substantially confirms the non-linear phenomena in Tables 2.6 and 2.7. Here, Black-faculty proportion is categorized as described in Table 2.3 across five levels of Black-faculty proportion. This approach incrementally frees the parametric structure of Black-faculty phenomena and, especially, allows for discontinuous threshold effects to emerge. Results suggests that such threshold phenomena exist. The school context-dependent moderation of teacher-student match described in Tables 2.6 and 2.7 is evidenced here again by significant effects in Category-3 (mean 45% Black faculty) and Category-4 (mean 62% Black) interactions with the match effect. Positive moderation point estimates are lesser in Level 5 and, notably, near zero in Level 2. (Level 1, with mean 6% Black faculty rate, is the reference.) Within the math results, positive faculty-race moderation of Black-teacher and (separately) Black-student estimates are located within Categories 3 and 4. Ultimately, point estimates for teacher-student match effects are roughly halved from .033 sd to .018 sd in the presence of the full suite of racialized covariates, including the persistent Black-teacher -by- proportion of students Black effect (Model 3f). In reading, the full specification attenuates the teacher-student match effect such that it is insignificant. In both reading and math, it is the inclusion of the teacher interaction with proportion of classroom students who are

Table 2.8. Black-faculty proportion (BFP) categorical level effects on <u>math</u> achievement.

	Model 1				Model 2				Model 3	
	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)	(a)	(b)
Black teacher X Black student	0.035***	0.025***	0.028***	0.028***	0.032***	0.024***	0.027***	0.025***	0.033***	0.018***
	(0.004)	(0.005)	(0.004)	(0.006)	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)	(0.006)
Category 2 BFP (Black faculty proportion) X Black student			0.000	-0.001			0.003	0.001		0.002
			(0.004)	(0.004)			(0.003)	(0.003)		(0.005)
Category 3 BFP X Black student			0.007	0.005			0.007	0.005		0.007
			(0.005)	(0.006)			(0.005)	(0.006)		(0.007)
Category 4 BFP X Black student			0.014**	0.018**			0.013**	0.014*		0.014*
			(0.006)	(0.007)			(0.006)	(0.008)		(0.008)
Category 5 BFP X Black student			0.011	0.029**			0.007	0.019		0.034**
			(0.006)	(0.012)			(0.009)	(0.013)		(0.013)
Category 2 BFP X Black teacher			0.001	-0.001			-0.002	-0.005		-0.007
			(0.009)	(0.009)			(0.007)	(0.008)		(0.009)
Category 3 BFP X Black teacher			0.020*	0.018			0.019*	0.016		0.007
			(0.012)	(0.013)			(0.010)	(0.011)		(0.014)
Category 4 BFP X Black teacher			0.034**	0.038**			0.028**	0.029*		0.019
			(0.015)	(0.018)			(0.013)	(0.016)		(0.019)
Category 5 BFP X Black teacher			0.024	0.041			0.014	0.024		0.027
			(0.025)	(0.026)			(0.018)	(0.019)		(0.025)
Category 2 BFP X Black teacher X Black student		0.004		0.004		0.004		0.006		0.003
		(0.008)		(0.007)		(0.007)		(0.007)		(0.007)
Category 3 BFP X Black teacher X Black student		0.018**		0.003		0.019**		0.006		0.005
		(0.009)		(0.009)		(0.008)		(0.008)		(0.010)
Category 4 BFP X Black teacher X Black student		0.026***		-0.006		0.024***		0.000		0.002
		(0.010)		(0.011)		(0.009)		(0.010)		(0.011)
Category 5 BFP X Black teacher X Black student		0.015		-0.023		0.010		-0.013		-0.022
		(0.010)		(0.015)		(0.011)		(0.015)		(0.016)
Black teacher X Proportion classroom students Black										0.037**
										(0.015)
Black student X Proportion classroom students Black										0.009
										(0.007)
Proportion Admin. Black X Black student										-0.003
										(0.005)
Proportion Admin. Black X Black teacher										0.004
										(0.012)
Proportion Admin. Black X Black teacher X Black student										0.001
										(0.009)
Observations (000)	2,992	2,992	2,992	2,992	3,458	3,458	3,458	3,458	2,992	2,823
R-squared	0.735	0.735	0.735	0.735	0.886	0.886	0.886	0.886	0.738	0.738
School-by-grade-by-year FE			Yes				Yes		Yes	
Student FE			No				Yes		No	
Student lagged score			Yes				No		Yes	
Lagged classroom score mean			No				No		Yes	

Notes. (School) cluster robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. PFB == Proportion faculty that is Black. Categorical breakpoints are as those described in Table 2.3, such that the Black-faculty proportion break is at ~ 0.23 between categories 1 and 2, ~0.38 between categories 2 and 3, ~0.53 between categories 3 and 4, and ~.70 between categories 4 and 5.

Table 2.9. Black-faculty proportion (BFP) categorical level effects on reading achievement.

	Model 1				Model 2				Model 3	
	(a)	(b)	(c)	(d)	(a)	(b)	(c)	(d)	(a)	(b)
Black teacher X Black student	0.012*** (0.003)	0.008* (0.004)	0.011*** (0.003)	0.008* (0.004)	0.009*** (0.003)	0.006* (0.004)	0.010*** (0.003)	0.005 (0.004)	0.011** (0.003)	0.006 (0.005)
Category 2 BFP (Black faculty proportion) X Black student			0.001 (0.004)	0.000 (0.004)			-0.004 (0.003)	-0.005 (0.003)		0.006 (0.005)
Category 3 BFP X Black student			0.001 (0.004)	-0.001 (0.005)			-0.006 (0.004)	-0.014*** (0.005)		0.007 (0.006)
Category 4 BFP X Black student			0.000 (0.006)	-0.004 (0.008)			-0.015** (0.006)	-0.018*** (0.007)		0.008 (0.009)
Category 5 BFP X Black student			0.009 (0.007)	0.019* (0.010)			-0.017** (0.008)	-0.003 (0.011)		0.040*** (0.013)
Category 2 BFP X Black teacher			0.004 (0.005)	0.002 (0.006)			0.001 (0.004)	-0.001 (0.005)		-0.004 (0.005)
Category 3 BFP X Black teacher			0.001 (0.006)	-0.002 (0.007)			0.002 (0.005)	-0.009 (0.006)		-0.010 (0.007)
Category 4 BFP X Black teacher			0.002 (0.008)	-0.003 (0.009)			0.004 (0.007)	-0.001 (0.008)		-0.015* (0.009)
Category 5 BFP X Black teacher			-0.011 (0.011)	-0.003 (0.013)			-0.004 (0.009)	0.008 (0.010)		-0.009 (0.014)
Category 2 BFP X Black teacher X Black student		0.007 (0.006)		0.006 (0.007)		0.002 (0.005)		0.004 (0.006)		0.010 (0.007)
Category 3 BFP X Black teacher X Black student		0.004 (0.006)		0.005 (0.007)		0.010* (0.005)		0.022*** (0.007)		0.011 (0.008)
Category 4 BFP X Black teacher X Black student		0.006 (0.007)		0.011 (0.009)		0.003 (0.006)		0.012 (0.008)		0.019* (0.011)
Category 5 BFP X Black teacher X Black student		0.002 (0.008)		-0.010 (0.012)		-0.010 (0.008)		-0.016 (0.012)		-0.009 (0.015)
Black teacher X Proportion classroom students Black										0.028*** (0.009)
Black student X Proportion classroom students Black										-0.028*** (0.007)
Proportion Admin. Black X Black student										0.000 (0.005)
Proportion Admin. Black X Black teacher										0.004 (0.007)
Proportion Admin. Black X Black teacher X Black student										-0.016* (0.009)
Observations (000)	2,988	2,988	2,988	2,988	3,449	3,449	3,449	3,449	2,992	2,818
R-squared	0.694	0.694	0.694	0.694	0.869	0.869	0.869	0.869	0.738	0.696
School-by-grade-by-year FE		Yes				Yes			Yes	
Student FE		No				Yes			No	
Student lagged score		Yes				No			Yes	
Lagged classroom score mean		No				No			Yes	

See notes for Table 2.8.

Black (Model 3f) that most notably perturbs both baseline estimates of teacher-student match and Black-faculty moderated match effects.

Within-teacher effects

The collective results from Tables 2.4 to 2.9 suggest teacher-student matching effects which are characteristically moderated by Black-faculty proportion and are attenuated by, but largely robust to, more comprehensive parameterizations of school racial structure. Faculty-teacher level effects on teachers that seemed to be apparent in Table 2.4 recede in the presence of other school race covariates. In particular, the faculty-teacher effect is significantly attenuated and loses significance. This result does not preclude the presence of Black-faculty main effects (which are subsumed by school fixed effects); rather, I find little evidence that Black faculty acts differentially on Black-teacher effectiveness either across students of all races or with Black students in particular (through the three-way interaction). The model specification, however, is designed to exploit cross-sectional variation across teachers who, themselves, may be exposed to little change in faculty racial composition. As postulated, individual teachers' capacities may be enhanced or degraded by becoming members of a given school faculty. Here I primarily anticipate spillover effects and synergy effects of Black teachers having access to racialized pedagogical and other support networks. Table 2.6 presents results from attempts to isolate evidence of this phenomenon that may be masked by cross-sectional phenomena and pooling all teachers. Model 1 is similar to that in Tables 2.4 and 2.5 except that I now introduce teacher fixed effects such that all parameter estimates are comparative within teachers' own experience.[24] The reader will notice that baseline Black teacher-Black student effect sizes are attenuated in math by 1/3 versus those in Tables 2.4 and 2.5; reading effects are erased. This phenomenon contrasts with the negligible impact of introduced teacher

[24] These static teacher fixed effects are meaningfully different than the classroom-level fixed effects used by Gershenson (2019) or Dee (2004). Those effects are teacher-by-year-by-hour of day and effectively exclude any classroom without student variation in race. Those classrooms are retained in my analysis.

valued-added scores by Egalite et al. (2015). To the present point, however, point estimates of faculty race moderation of the Black teacher term are *negative*. Estimates for the three-way effect –

Table 2.10. Within-teacher mathematics and reading effects when longitudinally exposed to qualitatively different levels of Black-faculty proportion.

	Full Sample				**Estimation sample include only teachers with exposure to greater than 20 point change in Black-faculty percent**			
	(a)	**(b)**	**(c)**	**(d)**	**(a)**	**(b)**	**(c)**	**(d)**
Panel A: Mathematics								
Black teacher X Black student	0.025***	0.019***	0.020***	0.020***	0.032***	0.027***	0.033***	0.036***
	(0.004)	(0.005)	(0.005)	(0.006)	(0.005)	(0.008)	(0.009)	(0.010)
Proportion faculty Black [0,1] X Black student			0.030***	0.029***			0.034***	0.040**
			(0.009)	(0.011)			(0.013)	(0.017)
Proportion faculty Black X Black teacher			-0.054	-0.055			-0.110	-0.103
			(0.039)	(0.039)			(0.068)	(0.069)
Proportion faculty Black X Black teacher X Black student		0.016		0.001		0.011		-0.013
		(0.011)		(0.015)		(0.015)		(0.023)
Black teacher X Proportion classroom students Black			0.035**	0.035**			0.011	0.011
			(0.014)	(0.014)			(0.021)	(0.021)
Observations (000)	2,990	2,990	2,821	2,821	527	527	493	493
R-squared	0.751	0.751	0.751	0.751	0.744	0.744	0.745	0.745
Panel B: Reading								
Black teacher X Black student	0.006*	0.000	0.010**	0.006	0.015***	0.008	0.012	0.008
	(0.003)	(0.005)	(0.005)	(0.005)	(0.006)	(0.009)	(0.009)	(0.010)
Proportion faculty Black [0,1] X Black student			0.035***	0.027**			0.028**	0.022
			(0.009)	(0.011)			(0.013)	(0.017)
Proportion faculty Black X Black teacher			0.003	-0.009			-0.062	-0.070
			(0.028)	(0.030)			(0.051)	(0.054)
Proportion faculty Black X Black teacher X Black student		0.016		0.024		0.017		0.015
		(0.011)		(0.015)		(0.015)		(0.023)
Black teacher X Proportion classroom students Black			0.005	0.005			0.001	0.001
			(0.011)	(0.011)			(0.022)	(0.022)
Observations (000)	2,986	2,986	2,816	2,816	508	508	476	476
R-squared	0.701	0.701	0.702	0.702	0.706	0.706	0.707	0.707

Notes. (School) cluster robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Models are similar to Model 3 in Tables. 2.4 and 2.5 with the addition of teacher fixed effects. All models estimated using school-by-grade-by-year and teacher fixed effects. Student *and* classroom lagged achievement scores are specified. Administrator and classroom race covariates (as in Model 3, Tables 2.4 and 2.5) are specified in columns (c) and (d), though only the Black teacher X Proportion classroom students Black is shown.

interpretable as proportion faculty-Black -by- Black teacher interacted with Black student – are near zero for the teacher-student interaction). When I confine the estimation sample to only teachers with exposure to qualitatively large changes in Black-faculty proportion (greater than 20 percentage points such that Black teachers will have transferred between school contexts and crossed qualitative levels within Kanter's (1977) framework), the proportion Black faculty -by- Black teacher math point estimate becomes more negative (while remaining not significant). The reading point estimate for this same term is also negative. I remind the reader that these results are in the presence of school-by-grade-by-year fixed effects such that the broader set of school features across any teacher transfer are managed. Table 2.10 results, then, suggest that Table 2.4 to Table 2.9 Black-faculty proportion moderation of Black-teacher phenomena (and perhaps also the Black teacher-Black student match) are more likely the result of selection phenomena than bureaucratic transformations of teacher-level capacity.[25]

Heterogeneous results

Gershenson (2019) offers evidence that teacher-student matching effects may be larger in the charter sector in similar data. My grade-3 to 8 panel expands on that grade-3 to 5 sample. I follow Gershenson's example of partitioning (and therefore fully interacting) models by sector as I attempt to elaborate his finding within my framework. Because of the then contemporary student enrollment dominance of the traditional public school (TPS) sector, TPS-only results are essentially the same as

[25] I further hypothesized that organizational transfer effects may take time to accrue and that the mean effects in Table 2.10 may be weighted toward teachers' early years in a school. For example, if Black teacher effectiveness is enhanced by pedagogical social networks, these may not immediately manifest when a teacher joins a faculty. In order to test this possibility, I added the (fully specified) three-way interaction of a categorical measure of cumulative years a teacher has spent in a particular school, an indicator from Table 2.10 of whether a teacher is working in a high (relative to one's own experience) Black faculty condition, and the Black teacher indicator to the baseline linear model (Model 1 from Table 2.3) in the presence of teacher fixed effects. Because cumulative years in a school is time variant, the effects of interest are not subsumed and residuals to static teacher fixed effects may be explained. (An overall quadratic teacher experience control was included.) I found no evidence of changing Black teacher achievement effects within high (or low) Black faculty contexts over time; such effects are consistently estimated at or near zero.

those reported in the tables above. When I evaluate a linear parameterization of Black-faculty proportion and incorporate the full suite of interacted racialized effects (as per Tables 2.4 and 2.5 Model (f)), point estimates for charter matching effects are larger than those in Tables 2.4 and 2.5 (~0.04 sd in math and reading), but are statistically insignificant (and therefore indistinguishable from TPS effects). I note, however, charter point estimates of teacher-student match become directionally larger (not smaller as in TPS) as other race parameters are added. When I approximate Gershenson's use of student fixed effects (rather than a lagged achievement score) *and* classroom level effects, point estimates for the matching effects become large (~0.10 sd, $p < .05$, in math; ~.07, $p < .10$, in reading) but are still not statistically different from TPS scores. These large effects are compensated by Black-faculty moderation effects that tend to be negatively signed (consistent with the teacher fixed effects findings in Table 2.10) and are sporadically marginally significant ($p< .10$). I note, however, that these classroom effects are estimated over a still nascent NC charter sector in this period, and by construction, exclude all classrooms with uniform student race (which introduces significant external validity concerns given predominantly Black enrollments in many charter schools). These combined factors, exacerbated by variance inflation factor concerns, inhibit any firm inference from these results.

Per work by Bristol and Shirrell (2019) showing that racialized teacher networks may operate within subject area, I considered whether Black-faculty proportion *-by- subject area* may offer a comparatively tractable measure of faculty race. One interpretation of differential results in math and reading (for example, the faculty-student effect in Table 2.4 and 2.5) may be that schools with different Black-faculty proportion index patterns of cooperation that impact Black-student achievement differently across math and reading. Subject-area specific relationships are less strictly defined in an environment of self-contained classrooms, so I re-estimated my analysis over grades 6 to 8. Narrative differences across subjects are similar when compared within this reduced estimation

sample. I also hypothesized, analogously to the exercises for teachers in Table 2.10, that apparent Black-faculty effects may be different if evaluated over only students with exposure to large differences in Black-faculty proportion. Here, the concern is that the marginal changes that typify the within-student variation in Black-faculty proportion due to subtle within-school faculty changes may be bureaucratically insignificant (i.e., null) *and* dominate mean estimated effects. A simple partition of the sample to students who have experienced at least at 25-point change in Black-faculty percent yields results similar to those presented here.

Multicollinearity

A literature has addressed the frequent concerns about multicollinearity that can arise in moderation analyses when complex interaction terms are introduced – especially when other underlying measures are already highly correlated as in the K12 sector (Disatnik & Sivan, 2016; Shieh, 2010). This work has emphasized that concerns are generally overstated and that, in particular, standard errors of the most complex interaction term (in this case the three-way interaction of Black faculty, Black teacher, and Black student) are structurally unaffected. The results I report here conform to the norm of a VIF statistic less than or equal to ~10 except for the three-way effect where VIF statistics in some scenarios range to ~15.

Still, the related distributions of teacher race and student race ultimately incrementally complicate parameterization and estimation choices. Black-faculty proportion and Black-student proportion are not only highly correlated but can simultaneously converge to 1 or 0. This creates the condition in which, when Black-faculty proportion is high, all or nearly all students will be matched with own race teachers (and vice versa). Further, the high correlations of school racial structures ensure that their two- and three-way interactions are also highly correlated, leading to concerns about multicollinearity and significantly increasing dataset power demands. These concerns logically accelerate in the context of categorical assignment of Black-faculty proportion – where categorical

indicators for predominantly Black or non-Black faculties are equivalently descriptive of teacher race, student race, and their interactions. As a sensitivity, I confined the estimation sample to the center of Black-faculty proportion such that Black-faculty proportion is > 0.1 and < 0.85. This has the net effect of reducing the estimation sample by a factor of ~2.5. Despite intended reductions in structural multicollinearity, this substantial loss of power has the net effect of significantly increasing VIF statistics to unacceptable levels for most parameters of interest. Comfortingly, coefficient estimates are similar to the full sample.

Discussion

Nicholson-Crotty et al. (2016) offer the key precedent for this work, evaluating the role of Black-faculty proportion on gifted and talented placement distinct from, and as a moderator of, Black-student and Black-teacher -by- Black-student match effects. They find little evidence supporting the representative bureaucracy theory at the organization level – though teacher-student effects are themselves consistent with theories of street-level bureaucratic action. In this paper, I contemplate an achievement outcome that is arguably a function of a more comprehensive and complex set of school processes than the discrete gifted-and-talented placement decision. Peer effects, for example, can have a primary impact on student achievement, but they are inherently mediated by teachers (and other policy makers) in a gifted placement referral. This relation between achievement and broad school context and policy invokes the full education production function – including, in the present context, the complexities of race in schools.

Traditionally, the literature has sought to suppress this complexity using econometric methods that progressively isolate and privilege investigation of within-classroom teacher-student ethnic/racial match. Selection against teacher-student matches has been most convincingly managed by classroom fixed effects (Dee, 2004; Gershenson, 2019) that control for teacher quality and teacher-classroom level phenomena, but eliminates matching scenarios where classroom race is

uniform or (depending on specification) exclusively Black/non-Black, White/non-White, or another constructed binary. This approach serves to structurally shift estimated matching effects away from predominantly Black, White, Latinx (or similar) school enrollment contexts where matching between Black educators and Black students will be alternatively predominant and rare. While the literature has long been sensitive to heterogeneity of results across contexts (Dee, 2004; Redding, 2019), given these results and the policy relevance of external validity concerns, I encourage researchers to consider the interplay of model specification and residual estimation context in their balance of concerns.

The work reported here has sought to embrace the core assumption of this literature – that students' relationships with their schools are likely racialized – and to extend it into a broader investigation of the contexts in which Black students and Black educators work together. As with Nicholson-Crotty et al. (2016), I confirm (most convincingly in mathematics) the robustness of individual teacher-to-student effects – even when simultaneous within-school effects (e.g., the interaction of individual teacher race and organization-level faculty race) are considered. This phenomenon supports theory within the literature that individual-to-individual level mechanisms (e.g., through individualized expectations (Gershenson et al., 2021; Ouazad, 2014)) are persistent vehicles for improving comparative outcomes of minoritized students across school contexts. Unlike prior work, however, the estimates reported here unambiguously suggest that Black-faculty proportion descriptively moderates Black teacher-Black student match effects in these North Carolina data, that apparent effects are likely discontinuous across school contexts (Tables 2.8 and 2.9), and that realized Black-student benefits are approximately twice as large in schools with faculties that are ~40 to ~70 percent Black than school contexts with lower rates of Black-teacher employment. This finding joins the broader heterogeneity observations within the literature and are

notably similar to Dee's (2004) finding that Black teacher-Black student effects are present only in low-SES and high Black-student proportion contexts.

This paper pursues this heterogeneity by seeking to incrementally decompose observable racialized phenomena. As evidence of the underlying sensitivity of results, the substantial moderation effects described immediately above substantially disappear (especially in math) in the presence of other racialized constructs. I emphasize that, though results are complex, organization-level constructs adjacent to teacher-student match seem to be most persistent. *Black-faculty proportion*-Black student and Black teacher-*proportion of classroom students Black* emerge as important covariates to teacher-student match (see especially the results in Table 2.4). These simultaneous phenomena (though less apparent in the quadratic specification) lead to attenuation of the teacher-student estimate and are the most substantial suggestive evidence in the achievement literature to date of organization-level Black-faculty effects and, also, of the simultaneous classroom-level teacher-classroom matching effects hypothesized by Yarnell and Bohrnstedt (2018). Collectively, these results support those who argue that Black students comparatively prosper when inside schools with Black teachers (Gershenson et al., 2021) and point to Black-faculty proportion as an intriguing barometer of (if not necessarily cause of) one dimension of school equity.

On the other hand, this work – combined with Gershenson's (2019) finding that effect size is attenuated when restrictive classroom-fixed effects are employed – further emphasizes the frequently limited underlying achievement effect sizes associated with Black teacher-Black student match. This has been especially true for the work executed over the largest state-wide panels (Redding, 2019). While Redding's (2019) meta-analysis shows mean results across the literature to be highest in reading, results from North Carolina (this work and Gershenson, 2019) and Florida (Egalite et al., 2015) suggest that math results are ~0.01 to 0.02 sd while reading results are no larger than ~0.005 sd (and are not reliably statistically significant). These differentials (and variability in

effect size across other studies) may simply reflect differential psychometric measurement challenges and policy choices in achievement test instruments, but they also challenge us to revisit considerations of underlying mechanisms. Are theories of benefits due to cultural isomorphism more likely to effect results in math or reading? Is stereotype reduction more important in math than reading? Are teacher and student selection biases likely to be different across these contexts? Are evolving, subject-specific teacher preparation experiences (Youngs et al., 2022) likely to interact with practice and matching phenomena – and/or lead to differential patterns of faculty coordination?

In his call for future research, Redding (2019) points to Yarnell and Bohrnstedt's (2018) focus on the simultaneity of teacher-classroom race and teacher-student race effects as an important example of enhanced structural investigation of racialized school effects. Egalite (2018) emphasizes the crucial role of heterogeneous effects and the existence of broad racial complexity in our schools in a call for future work. My work here is responsive to their analysis and uncovers descriptive contexts in which Black-student achievement is comparatively enhanced. Still, what are researchers' goals in this work? If our goals are to further understand into which contexts Black teachers should be recruited, then we must confront the broad teacher selection phenomena that may be embedded in at-scale workplace patterns that current data and methods have not been able to untangle. The apparent insensitivity of Black-teacher measures to qualitative change in Black-faculty proportion (Table 2.10) – coupled with the absence of material attenuation of the teacher-match term by introduction of these same Black-faculty proportion measures (see Table 2.10 and compare to Tables 2.4 and 2.5) – supports a hypothesis of an interplay between matching effects and the strong selection preferences known to exist among many Black educators for higher rates of Black-faculty and Black-student proportion (Drake & Cowen, 2022; Jackson, 2009). This phenomenon complicates the equity arguments for recruitment of Black educators into the suburban contexts into

which Black enrollments are shifting (Bristol & Shirrell, 2019; Drake & Cowen, 2022; Hall et al., 2016).

Alternatively, more tractable policy solutions may emerge from renewed attempts to understand mechanisms underlying the matching literature and to move past implicit policies that rely on Black educators as instrumentalized (but poorly understood) solutions to structural biases against Black students. If this is the case, however, then this study raises the question of how much further this work can go relying on administrative data panels. For example, if we stipulate to the results in Table 2.4 (Model 3f), then there exist three key, cumulative synergies between Black educators and Black students in mathematics education: an attenuated teacher-student effect, an enhanced Black-student effect (no matter teacher race) in high-Black-faculty proportion schools, and enhanced Black-teacher effectiveness (for all students) in classrooms with comparatively high levels of Black students. The work here serves to remove a partial confound with the teacher-student match effect, yet we are left with no further gains in understanding and replicating the productive aspects of those persistent person-to-person dynamics. Identification of a proportion Black faculty-by-Black student effect is similarly problematic. One can argue that teacher selection on Black-student achievement goals and self-efficacy should be predominantly captured by the teacher-student level effect. An *additional* organization-level effect is then intriguing and possibly invokes policy impact in the form of, say, culturally affirming curricula. Just as easily, however, both the organization-level and person-level effects may simply reflect humanizing and demanding relationships between students and educators that spill outside of the classroom into hallway encounters, clubs, family outreach, and projects of community building and inclusion. Formal curricula may be invariant. Finally, consider the Black-teacher interaction with proportion of classroom students who are Black. If this is more than a descriptive result, is this further confirmation of teacher selection processes – or of racialized, student-driven dynamics that

ultimately benefit all students? If so, how do racialized synergies inculcate broadly productive (classroom-level) pedagogical environments? Can these environments be tied to learning gains?

Quantitative methods are not fully exhausted. Survey work and other measures of school environment can seek to unwind the association between educator race and other contextual factors from observed differences in student achievement. This approach, however, requires anticipation and instrumental discrimination among many potential mechanisms about which we have poor understanding. I would advocate, instead, for next steps that (conceptually) embrace two-by-two qualitative designs that explore the operational and cultural tensions in schools that are differentially successful in enacting Black-student achievement (or other gains) across school contexts. Quite simply, what differentiates schools with high and low (comparative) Black-student achievement in high-Black-faculty (and, probably simultaneously, urban and low-SES) contexts? Do students differentially describe relationships with educators, school culture, curricula, relationships with peers, and teaching quality? How do students, teachers and administrators differentially describe and define school effectiveness? Then, what analogous differences can we find across Black-student achievement differentials in suburban contexts? The broad heterogeneity in the match literature to date suggests that these emergent models of difference are likely to be rich and complex. (Tensions among between-school and within-school variation are also of interest.) I especially encourage the recent strain of work seeking to understand racialized faculty dynamics as a function of specific school contexts. On balance, evidence here suggests that Black-faculty proportion moderation of Black students is more robust than Black-faculty moderation of Black teachers. Again, I find no evidence of comparatively high levels of within-in teacher improvement as teachers move across qualitatively distinct Black-faculty conditions. These findings, then, do little to elaborate evidence of racialized teacher support networks (Bristol, 2018; Bristol & Shirrell, 2019; J. L. Nelson, 2019) – but

comparative analysis of racialized faculty structures across school context has shown promise elsewhere and may lead to productive policy ideation (Bristol, 2018).

Lastly, I would argue that it can be illustrative to turn the implicit policy argument within the matching literature on its head. Rather than an exclusive research orientation toward contexts to which Black and other teachers of Color might be recruited, might we also consider the intergenerational effects of school effectiveness? In particular, if expectations of effectiveness are a primary motivation to teach, are the same K12 descriptive contexts of intertwined Black-teacher and Black-student advantage described here predictive of new Black-teacher emergence? Are the context-specific, small-to-moderate achievement effects here discernable to prospective Black educators and do they in fact inspire decisions to teach? It is in this respect that ongoing studies of racialized school outcomes are related to the broader ecology of Black faculties – such as Black-teacher retention and performance (Bristol, 2018; Drake et al., 2019), Black-teacher workplace preferences (Drake & Cowen, 2022), and the pipeline of future Black teachers (Drake, 2023).

PAPER 3. PROSPECTIVE EDUCATORS' OWN SCHOOLS – BLACK K12 FACULTIES AND BLACK TEACHER EMERGENCE

Introduction

This paper is intended to elaborate our understandings of the teacher pipeline. It is inspired both by the accumulated literature that establishes the multiple, constructive effects of Black teachers on Black (and other) student outcomes through classroom-level teacher-student working relationships (Gershenson et al., 2021; Redding, 2019) – and an emerging set of findings suggestive of additional school-level effects of Black faculties shaping the pedagogical networks, social networks, persistence, work-place choices and evaluated effectiveness of Black educators (Bristol, 2018; Bristol & Shirrell, 2019; Drake, 2023; Drake et al., 2019; Drake & Cowen, 2022; J. L. Nelson, 2019). The present effort seeks to further extend our understanding of the operations of Black faculties on a different outcome – the emergence of Black K12 teachers. Put simply, working with state-level administrative data from Michigan, I investigate whether institutional relationships between Black K12 teachers and Black students predict subsequent teaching career choice by those students.

Drake and Cowen (2022) document substantial declines in the exposure of Black K12 students in Michigan to Black teachers from 2005 to 2015, most substantially as a phenomenon of the migration of the state's Black K12 enrollment away from the traditional urban centers of Black teacher employment to suburban contexts with far less substantial Black-teacher traditions.[26] Similar examples of demographic change are found and projected throughout the United States (Bristol & Shirrell, 2019; Hall et al., 2016; Turner, 2020). Contemporaneously, as part of a broad, national

[26] More recent data show that Black teacher employment in Michigan stabilized and began to grow slowly after 2015. Ratios of Black students to Black students have declined (Hopkins, Kilbride, & Strunk, 2021).

phenomenon, Michigan experienced protracted and substantial declines in teacher preparation enrollments (Drake & Cowen, 2022; Sutcher et al., 2016a). These declines have, in part, been tied to teacher evaluation and other collective bargaining reforms enacted in many states (including Michigan) after 2010 in relation to incentives incorporated within the federal Race to the Top program (Kraft et al., 2020). Michigan's own declines precede these reforms, however; and, more importantly, are distinguished from national trends by higher levels of teacher preparation attrition in Black versus White enrollments. Where, nationally, White enrollment declines significantly outpaced Black declines, the opposite occurred in Michigan. Could this differential, at least in part, be explained by the evolving K12 geography of Michigan's Black students and their attending exposure to Black teachers and faculties?

Research Questions

My research questions are then:

(1) Do Black K12 faculties differentially influence the decision of their Black K12 students to study teaching as compared to students identifying as of other races/ethnicities?

(2) How are any suggested effects apparently structured? Specifically, given the theoretical foundation for (and apparent presence of) discontinuous effects in organization-level racial phenomena (Grissom et al., 2015; Grissom et al., 2017), are there important non-linear or threshold effects associated with qualitative differences in Black-faculty proportion?

Conceptual frame and related literature

I posit that our own K12 experiences influence our conception of the possibilities and experience of K12 teaching and inform the postsecondary choices to teach and not to teach that we make after high school. In simplest terms, this conjecture is founded in the fact that K12 teaching is the singular profession to which almost all Americans are universally exposed. We know – or at least

we might think we know – something about the profession based upon our collaboration with teachers (as students) in a proto-occupational environment. At a minimum, we can, if prompted, describe much about both the public face of teaching – its operational culture, its reputation, and its apparent opportunities – as well as our affect toward prospective colleagues based upon our own school attendance. Indeed, new teachers' orientation has been classically conceived as predominantly conservative – structurally inviting those with goals of reproduction of one or more attractive elements of their own experience as students and (therefore) struggling to find impetus for professional reform (Lortie, 1977).

This work is also informed by a formal career decision literature that emphasizes a dispositive effect of anticipated *efficacy* on occupational choice (Eccles, 2009; Wigfield & Eccles, 2000) and a teacher motivation literature that demonstrates a modal and possibly predominant altruistic motivation (i.e., an occupational need for efficacy – Brookhart & Freeman, 1992; Watt & Richardson, 2007). Of primary concern to my hypothesis is *how* individuals acquire occupational knowledge and occupational self-concept. Trait-based theories as most prolifically cultivated by Holland posit (at least in their foundations) innate person and vocational environment types (Spokane, Luchetta, & Richwine, 2002). Normatively, prospective teachers (elementary, middle and secondary) will latently identify as "social, artistic, and enterprising" and are thought to be occupationally similar to clergy, missionaries, counselors (school and vocational), therapists (music and couples), childcare workers and food inspectors (Chronical Guidance Inc., 2019; G. D. Gottfredson & Holland, 1996). Within trait-based career-decision regimes, then, career affect is conceived as an element of personality.

However, even if we stipulate to a personality-based approach, how and why do these vocational personalities develop?[27] Social constructions, in particular one's formative contexts, seem highly likely to influence career personality and vocational affect (Brown, 2002). Johnson and Mortimer (2002) argue that any model that emphasizes unidimensional or hierarchical concepts of occupational prestige ignores patterns of intergenerational mobility, recurrent family professions (as at least historically in teaching (Jacinto & Gershenson, 2019; Phi Delta Kappan, 2019)), and the myriad ways that sociological structures such as parents, gender, race, and class affect orientations toward career options. These phenomena are embedded into formative experiences within our schools and are both expressed and mediated by overt and covert tracking, fundamentally shaping our conceptions of our intellectual selves (Lee & Bryk, 1988; Schmidt, Burroughs, Zoido, & Houang, 2015). This is to say that they are highly contingent – and that *these formative experiences elicit not just our occupational affect but also our sense of self*. Within this elaborated vocational model, K12 experience would help to determine both our understanding of teaching as vocation *and* to shape us as potential teachers or "not-teachers" vis a vis any given conception of teaching (conservative or reformist).

Operatively, Lent, Brown, and Hackett (2002) emphasize iterative and episodic experiences – especially those social and proto-vocational ones within the school. People form enduring interests when they – through learning processes conditional on their own priors or cognitive frames – come to view themselves as competent and develop an expectation of desired outcomes. They acknowledge that career theory's typical interest in aptitudes, abilities, and work values is important, but emphasize that they are constructed through cognitively mediated learning processes which are themselves subsumed by social process and episodes. Within Parsons' (1909) frame then, self-

[27] I follow the career decision making literature here. See Spillane, Reiser, and Reimer (2002) for deeper explication of primary research on cognitive processes and social cognitive processes.

knowledge, knowledge of occupations, and the ability to relate them are all bounded by information and our own cognitive, sense-making capacities (Peterson, Jr., Lenz, & Reardon, 2002).

Central to my thesis of a central role of K12 experience within prospective K12 teachers' career decision is what vocational psychologists effectively characterize as a parallelism of superficiality and duration in the career decision. On the one hand, they describe acquired occupational stereotypes (L. S. Gottfredson, 2002) ultimately approximate to emotions (Barak, 2001). (In this regard, students' interpretations of teachers and teaching need not be more sophisticated than for other occupations in order for their lived experiences to bear on affect and ultimate decision making.) On the other, these stereotypes and attending self-knowledge are elaborated over time and exhibit durability. Self-knowledge requires contemporaneous interpretation and subsequent reconstruction of events, where interpretation is an act of matching sensations of present proto vocational events with episodes in long term memory. Occupational knowledge is thought to develop throughout childhood and adolescence within a bifurcated hierarchical process that resolves the enormous complexity of the occupational world. On one hand *schema specialization*, a top-down construct, involves exploiting consolidated vocational concepts such as "teacher" to accumulate information through iteration. Peterson et al. (2002) offer the example of a "construction workers" coming to subsume "carpenters" subsuming operational concepts such as "uses saw." On the other, *schema generalization* is a bottom-up process where "elementary teacher," "social worker," and "counselor" might be linked together by perceptions of their underlying nurturing [or perhaps feminized] qualities.[28] Spillane et al. (2002) broadly caution that school leaders and teachers will inevitably engage any school reform through sense-making (or interpretative) activities fully contingent on their own *prior* schemata which are themselves resolved former states of complexity

[28] This example is from Peterson et al. (2002) in the career decision literature; it is largely the same list that (Ingersoll, 2001) and Harris and Adams (2007) appeal to on largely intuitive grounds when they look for comparable professions.

and dissonance – and, in particular, that self-schema (or conceptions of the nature and parameters of own strength and success) are closely held (Markus, 1977). The sociological and constructivist critiques of narrowly construed trait-based career theory (i.e., one that holds that some of us are innately teachers, soldiers, or computer scientists) advance this same point; career choice is a matter of matching one's own occupational stereotypes – personalities of those who do work, the work they do, the lives they lead, rewards, and appropriateness of work for different types of people – to our conceptions of self. These conceptions reflect social and cognitively resolved problems of gender, class, intellect, power, and public/private personae cultivated throughout individuals' developmental lives (L. S. Gottfredson, 2002).

The empirical teaching motivation literature (in distinction from the more general career decision literature; see Watt, Karabenick, et al., 2014; Watt & Richardson, 2007, 2014) shares many of these themes and is substantially predicated on Eccles' expectancy-value framework (Eccles, 2009; Watt & Richardson, 2007). This theory elaborates an individual self-concept that is bifurcated between an individual's expectation for success (belief system 1) and the *value* an individual assigns to various available tasks (belief system 2). Since Eccles' theory's foundations are in achievement related choices – and of interrogation of gender differences in secondary mathematics enrollment patterns, in particular – any occupational knowledge must be consequently embedded within these two self-concept schemata. Expectations for (occupational) success are grounded in an intertwined ability self-concept and assessed task difficulty. Expected (occupational) task value is derived from a calculus across one's predicted intrinsic interest, future utility in having realized goals, attainment value vis a vis self-image, and costs (in terms of self-image, social status, psychic costs of attainment and economic feasibility). As with Lent et al. (2002), Eccles emphasizes contingent – and even longitudinally malleable – individual beliefs resultant from the respective norms and opportunities of shifting cultural and social environments. Exploiting a longitudinal panel of 1,000 southeastern

Michigan adolescents, Eccles establishes a strong relationship between both personal efficacy /expectations of success and occupational values in predicting occupational entry. This importantly includes both positive *and* negative predictive power – where, for example, valuing helping others predicts *non*-entry into physical science-related professions, business, or law and valuing occupational prestige is associated with *non*-entry in human service occupations. Ultimately, expectancy-value factor analytic work has established three high-order motivational constructs: expectancy/ability beliefs, subjective/socialized task value (attainment-related, future utility related, and intrinsic), and perceived task cost/difficulty (Watt & Richardson, 2007; Wigfield & Eccles, 2000).

It is my goal to elaborate the empirical literature on teacher characteristics that has predominantly attended to gender, race, and ability characteristics of *in-service* teachers or the relation of K12 school characteristics with teacher *retention* (Guarino, Santibañez, & Daley, 2006) but has paid little attention to K12 contexts of teacher *emergence*. Podgursky, Monroe, and Watson (2004), for example, are interested in the qualitative pooled characteristics of emergent teachers – in this case ACT scores – rather than to cross-context comparative supply levels of teachers (perhaps conditioned on student characteristics like ACT). Boyd, Lankford, Loeb, and Wyckoff (2005), in contrast, shift orientation to the locales of teacher emergence and show that a confluence of lower teaching participation rates in urban areas and a preference for working close to one's own high school together yield disparities in the SAT scores of new teacher supply in urban schools. Yet in some respects their orientation is ultimately similar. Left confounded is the extent to which urban shortages of high-SAT score teachers are a function of (a) between locale differences in high-SAT score student frequency or (b) differences in teaching participation rates among high-SAT students across locales. Lindsay et al. (2017) similarly show that Black teaching participation rates are lower than White among respective college-going populations, but their work does not extend to how these rates are moderated by geography and other attributes of school and community.

The teacher motivation and labor supply literatures are also substantially an analysis of preservice or in-service teacher characteristics (e.g., a frequent service-orientation (Richardson & Watt, 2006; Watt & Richardson, 2007; Watt, Richardson, & Wilkins, 2014) and pooled wage sensitivities (Dolton, 2006)) with less attention to how these effects are heterogenous across contexts. As such, these studies do not engage career decision models that emphasize the centrality of our broader K12 experiences as students, peers, and proto-employees in occupational choice. These experiences shape key socialized learning processes and outcomes central to our understanding of occupations and – especially – of our own class- and gender-mediated comparative capacities and interests (Barak, 2001; Eccles, 2009; Lent et al., 2002; Wigfield & Eccles, 2000).

Some insight into the formative or dispositional role of students' personal and school contexts can be located in the survey literature. It suggests the decision to teach is often made during student's K12 years, as early as in elementary school and that gender differences in the teaching force are reproduced in early years as students form career preferences. Women and girls are far more likely to report having planned a teaching career as early as elementary school and at substantially greater rates than men upon entering college (Montecinos & Nielsen, 1997). While we know of significant intergenerational processes (Jacinto & Gershenson, 2019), surveys have shown only around one-third of pre-service and in-service teachers crediting a family member for inspiring their own careers (Montecinos & Nielsen, 1997; Rentner, Kober, Frizzell, & Ferguson, 2016). These same surveys suggest slightly higher percentages for teacher role models – especially among women.

Roles of Black teachers and faculties

The conceptual frame above substantially abstracts from, and, *if valid*, is logically upstream from investigation of socially-elaborated, structural phenomena of race and gender. *Leong and Brown (1995) (cited in Leong and Serafica (2001)) observe that classical career decision frameworks assume: a) that career development is an uninterrupted, continuous process; b) that career decision makers have social and economic capital*

sufficient to enable career choice; c) all work is held to be dignified; d) labor markets operate freely; and e) career choices primarily flow from persons' internal ("personality") factors. As the authors point out each of these assumptions can be critiqued from a cross-cultural perspective. We know, for example, that women – especially those at the highest end of academic ability scales – have been broadly responsive to secular advancement of opportunity outside of the traditional lane of K12 teaching (Bacolod, 2007; Corcoran et al., 2004; Dolton, 2006; Flyer & Rosen, 1997). The Black teaching force was reduced by tens of thousands during post-*Brown* desegregation (Ethridge, 1979; Fairclough, 2004; Fultz, 2004). Late-stage desegregation era court orders (with no attending affirmative action mandate) generally yielded incremental reductions in Black faculty (Oakley, Stowell, & Logan, 2009). Applicant hiring rates of Black teachers (after conditioning on observables) have been shown to be materially lower than those of their White counterparts (D'amico, Pawlewicz, Earley, & McGeehan, 2017).

If occupational affect and self-concept are social constructions then it logically follows that career decision making is culturally differentiated and that cultural attitudes toward institutions are important mediators (Cheatham, 1990; Leong & Brown, 1995; Leong & Serafica, 2001; Meir & Tziner, 2001). This paper's central hypothesis that experienced K12 context is formative of teaching affect can be situated within existing understandings of a racialized student and teacher experience. When I suggest a material impact of K12 context on students' subsequent teaching decisions, I simply make explicit the notion that high-school age potential teachers discern (perhaps as stereotypes and emotions) the burdens and affordances of being a teacher of Color in their own schools. The expectancy-value decision framework from above appears viable in this racialized context. Perceived task cost/difficulty can be extended to conceive psychic costs associated with persisting in White-centric spaces (e.g., Carter Andrews, 2012; Carter Andrews, Brown, et al., 2019; Kohli, 2018), subjective/socialized task value can be evaluated in relation to differentiated conditions of institutional and curricular cultural sustenance (e.g., Paris & Alim, 2014), and own ability can be

evaluated in the context of contingent occupational goals, demands and socially inculcated self-concept. Where and how can prospective Black teachers anticipate being more and less effective while sustaining the related burdens of teaching?

Here, I follow a growing literature (Bristol, 2018; Bristol & Shirrell, 2019; Kelly, 2007; Kohli, 2019; J. L. Nelson, 2019; Nicholson-Crotty et al., 2016; Pizarro & Kohli, 2019) that engages whether Black teachers act both as individuals and as Black faculties – that is, as cadres with institution-level impact. Researchers are now firmly aware of the advantages of Black teachers in within-classroom, Black teacher-Black student working relationships in effecting enhanced achievement, attainment, and school affect (as evidenced by absenteeism, suspension rates, etc.) (Gershenson et al., 2021; Redding, 2019). Further, *students* of all races rate Black and Latinx teachers higher than White teachers in their own evaluations of instructional quality (Cherng & Halpin, 2016). It may be, and is a residual empirical question, that Black students can detect or investigate (see Goings & Bianco, 2016) the comparative within-school efficacy of Black educators in such a way as to influence their own prospective advantage as educators. If so, the observed social justice orientation among Black and other pre-service teachers of Color (Ronfeldt et al., 2014; Su, 1997) – where prospective educators discern advantage – may itself be related to own-exposure to Black educators.

I argue here that Black faculties, as a construct (Drake & Cowen, 2022), will operate at the organizational/school level – and that Black-faculty effectiveness is elaborated by Black-teacher proportion. Underlying racial structures in the organizational behavior of schools are commonly framed within an extension of Kanter's (1977) *boundary heightening* hypothesis that the experience of minority groups in organization settings can be affected by their numbers by influencing both their degree of social isolation and organizational tendencies to essentialize their roles (Bristol, 2018; Mabokela & Madsen, 2003a, 2003b; Madsen & Mabokela, 2000). Per Kanter's own environmental taxonomy, this suggests the possibility of distinct socialized experiences for teachers of Color in

progressively White-faculty contexts where one's experience as a Black teacher may be substantially different in "balanced" (~50/50), "tilted" (~65/35), "skewed" (~85/15), and "uniform" (with very few minorities) environments. Progressively tokenized minorities are likely to face escalating performance pressures, boundary heightening (where real differences are counter-constructively pronounced), and role entrapment (where, in the present context, Black teachers are construed narrowly as instrumentalized solutions to problematized Black students (Brockenbrough, 2015; Mabokela & Madsen, 2003b)).

In concert with decreasing tokenization costs as Black-faculty proportion increases, Grissom et al. (2015) emphasize a bureaucracy literature that predicts organization change through minority representation.[29] Mechanisms of representation, advocacy, shared beliefs, and empathetic understanding are strengthened by minority teacher-bureaucrats. Perhaps more powerfully, minority bureaucrats induce change in others. The majority is restrained in its own biases by the "check" of minority presence and minority student (and family)-clients increase their demands on the institution as a function of higher expectations – with an idealized longer-term effect of bureaucratic resocialization. In concise terms, Black teachers and students coproduce bureaucratic change (Lim, 2006) in ways that plausibly acknowledge and disrupt disaffective school experience and culture (e.g., Carter Andrews, 2012; Carter Andrews, Brown, et al., 2019; Carter, 2007; Goings & Bianco, 2016; Warren et al., 2022), shape teachers' own pedagogical and emotional networks (Bristol, 2018; Bristol & Shirrell, 2019; J. L. Nelson, 2019), or effect curricular change (e.g., Halvorsen & Mirel, 2013) in ways that might – *if perceived* – influence prospective teachers. In this respect, Black-faculty proportion may be related to the broader set of considerations – teacher selection criteria, teaching assignments, teacher and student support systems, professional learning, and pedagogical goals –

[29] Nicholson-Crotty et al. (2016) work within this framework and find that *school-level* (i.e., faculty-level) effects are null while identifying a *classroom-level* Black teacher-Black student match effect when modeling gifted and talented referrals. *Aggregated* school-level data in another context do predict gifted program referrals (Grissom et al., 2017).

that would allow current and prospective teachers (and students) to thrive (Bristol & Shirrell, 2019; Gist & Bristol, 2022) in an affirmative, humanizing environment (Warren et al., 2022). It is upon this reformist conception of teachers, teacher faculties, and organizational change, in fact, that recruitment strategies are increasingly centered. High school students of Color are actively invited to analyze school features (their own and systemic) as they imagine their own possibilities to contribute to progress and change (Lac, 2022; Lightfoot & White, 2022; Tandon, Bianco, & Zion, 2015).

Data

I rely on state-wide administrative data provided by the Michigan Education Research Institute-Michigan Education Data Center (see Michigan Education Data Center, 2023) that supports an analysis of K12 students graduating high school from Spring 2009 to Spring 2019. These data contain several components. Longitudinal K12 student data (grades 3 to 12) captures school, grade, English language learner (ELL) status, economic disadvantage (ED) status, special education (SpED) status, achievement test scores,[30] and race and gender. ELL, ED, and SpED indicators are only available for Spring 2013 forward. Postsecondary data records for these same students supports a link between K12 experience and subsequent study in institutions of higher education (IHEs). These records classify programs of study and related coursework by US Department of Education CIP code. The postsecondary data are a synthesis by data administrators of National Student Clearinghouse data and a complementary, Michigan-specific collection comprehensive of all Michigan postsecondary institutions.[31] Finally staffing data allows the

[30] I rely on the state's grade 3 to 8 MEAP/MSTEP scores and (primarily) the system-wide 11th grade administration of the SAT/ACT.

[31] As such, it is my assumption that the data are substantially more comprehensive of students attending postsecondary programs within the state of Michigan (and prefer these within-state data in my analyses).

identification of all school personnel with assignments to schools attended by K12 students within the panel; I am particularly interested in teacher, principal and counselor roles and race.[32]

The data are limited in several important ways. Michigan administrative data available to this project do not identify students' assignments to individual teachers. As such, I rely exclusively on school-level measures of teacher race. Gershenson et al. (2022), for example, use marginal changes in school-level race as an instrument for teacher-student match in their investigation of Black student attainment (itself a "one-time event" like postsecondary teaching choice here). Their approach plausibly addresses any processes of non-random, within-school sorting of teachers and students. Also, teacher-student racial match is substantially contingent on, and increasing in, Black-faculty proportion. The absence of teacher-student links leaves these two correlated but theoretically distinct constructs (Drake, 2023; Nicholson-Crotty et al., 2016) confounded. For chronologically older students graduating in the early years of the panel, I have no information about their early K12 paths since student data commences with 2008-2009. This substantially limits power when investigating longer-term middle-school and elementary-school effects where long-term student K12 pathways are not defined. Finally, though mitigated by my research emphasis on students' early postsecondary activity, it is important to note that the postsecondary careers of the K12 students in this panel are not complete. A subset of these students will return to study for years to come. Those (possibly now latent) preferences are not discernable.

The ultimate assembled dataset contains one observation per student, with a series of student- and school-level predictors (elaborated below), a measure of whether a student studies teaching in a postsecondary program (following a classification regime similar to Kraft et al. (2020)), and descriptions of postsecondary institution status as either a 4-year Michigan institution and/or a

[32] Principals and counselors are not always assigned at the school-level. When no school-level personnel are assigned, district personnel with those same roles are inferred to serve at the school level. This naturally occurs, for example, in small districts where personnel serve roles across schools.

designated Michigan Education Preparation Institution (EPI) as cataloged by the US Department of Education in their Title II collection (Office of Postsecondary Education, 2023). The final dataset includes approximately 880,000 students attending any in-state or out-of-state postsecondary IHE, 566,000 attending a 4-year Michigan IHE, and 500,000 a Michigan EPI. Rates of pre-teaching activity are, respectively, 5.8%, 7.1%, and 7.5%. Within those data, Black students number, respectively, 102,000, 60,000, and 49,000 with teaching rates of 3.7%, 4.8%, and 4.9%. Within these pools only about 82% of school-year combinations have Black students present and only 40% have Black teachers present.

Method

The preceding theoretical framework makes no claim that K12 experience is comprehensive of K12 students' career decision processes – only, rather, that it plays an important role. Inherent in this argument is that K12 experience is non-transferable. In an economists' perfect-information environment, all prospective teachers would be aware of all school conditions and related affordances. Here, I anticipate that individuals' own school experiences matter, especially those encounters that shape the intersection of self-concept and related efficacy of teaching. I also anticipate that they matter most in the short-run and that prospective teachers will synthesize new information acquired after high school as they encounter new socializing environments. For example, the career switching teacher almost by definition has encountered new circumstances and understandings of the affordances of teaching. I am especially aware of the experiences and higher attrition rates of students of Color in traditional teacher preparation programs *(Bristol & B. Goings, 2018; Ladson-Billings, 2014; Lindsay et al., 2017), and specifically seek to exclude these postsecondary confounds from my inquiry here.*

Idealized data would include an exit interview for all high school graduates where reliable postsecondary intentions – including plans to study teaching – are cataloged. This is to say that I

assume that graduation marks the substantial end of the temporal influence of students' K12 experiences. I expect K12 effects to be attenuated by both time and competing experience. To approximate this condition, I confine my inference of teaching choice to the appearance of a student in a teaching (education)-related postsecondary CIP code program of study (consistent with Kraft et al. (2020)) within 4 years of high school graduation. The four-year cut-off is a compromise between insisting on total proximity between the decision to teach and acknowledging that evidence of teaching intent in the postsecondary record may be delayed as students take background courses, pursue content area courses, perhaps initiate work in a community college and then transfer to an EPI, and (in some cases) apply to education preprofessional programs within their IHEs in later years of study. Analysis of the first graduating cohort within the data over which I have 11 years of postsecondary history suggests this decision rule retains ~80% of eventual teaching activity. I emphasize evidence of admission in a *program of study*, rather than appearance in an education-related course, as a minimum threshold of teaching intent. We know that *completion* of postsecondary programs is itself racialized, including in teacher education (Bristol & B. Goings, 2018; Ladson-Billings, 2014; Lindsay et al., 2017) and I seek to limit this confound by selecting the more expansive (and proximate to K12 experience) measure of *program* matriculation.

This study does not make a causal claim. Rather, within described constraints I seek to uncover suggestive evidence in support of my research questions. A central constraint is my focus on a single per-student event outcome (postsecondary teaching choice), precluding identification of within-student effects as a function of variation in school context. As noted, Gershenson et al.'s interest in Black-student K12 attainment is similar. They are also interested in longitudinal K12 co-experience of Black students and Black teachers as a predictor of a singular event (attainment). That project's focus, however, is extending the within-classroom, teacher-student match literature and makes a claim that changes in school-level Black-faculty levels are a valid instrument for within-

school teacher-student match. Here, however, I centrally posit a school-level phenomenon that presumes between-school differences in teachers' bureaucratic operations. This hypothesis does not structurally preclude, however, the possibility of within classroom effects. Within-classroom match will be increasing in Black-faculty proportion and any effect must be interpreted in this confounded context. This is especially true in the secondary school context – on which most estimates below are calculated – where a given high school student may be exposed to dozens of teachers in their four-year tenure. This study has a conditioned interest on college-bound students. So while within-school, potentially racialized selection processes may occur (e.g., in overt and covert student tracking), I focus on students (Black and non-Black) who enter postsecondary study. To this extent, the college-preparation teacher corps (and related school experience) is more likely to be shared in common by all students retained for analysis.[33]

My model specification, estimated as a linear probability model, is as follows:

$$P(teach_{ijkt}|post_{i,k,t}) = \propto + \beta(fR_{jt} * sR_i) + sR_i\delta + S_{it}\gamma + \lambda_{jt} + \mu_{kt} + \varepsilon_i \quad (3.1)$$

Indexes are for student, *i*, K12 school, *j*, IHE, *k*, and year/cohort, *t*. Here, I model a binary teaching/not-teaching outcome, ***teach***, exclusively among students attending a postsecondary institution, ***post***. This approach yields an analysis of relative rates of preprofessional teaching activity versus other programs of study – and, by construction, controls for exogenous, race-specific influences on absolute college-going rates. This approach to defining the regression pool conditions analysis on students both able of (e.g., economically) and committed to postsecondary education and acknowledges a degree of analytical "leakage" among prospective teachers to non-IHE pathways –

[33] It is a further feature of (and, depending on perspective, limitation of) this analysis that Black faculties may themselves influence the within-school teaching assignments alignment with college-preparatory track courses.

for example, those who qualify to teach but choose instead to work in a family retail business without further formal education. A sensitivity to this restriction to postsecondary students is reported below.

The parameter of interest is $\boldsymbol{\beta}$. It is the estimated effect of a continuous linear measure of the *school-level* measure faculty proportion that is Black, fR_{jt} as interacted with the Black-student indicator that is a component of a vector of student race controls, sR_i. The main effect for faculty proportion Black is subsumed by a vector of students' graduating *high school*-by-year fixed effects, λ_{jt}. These same fixed effects absorb all other school-level features including confounding racial characteristics of non-teaching staff and peers – though not, notably, the interactions of other staff and peers with Black students *in particular*. That confound is addressed in sensitivity analyses – especially, where λ_{jt} is replaced by ν_{ij}, a vector of Black-student indicator-by-school fixed effects. This scenario fully interacts Black students' race with their school contexts and identifies a residual Black faculty-Black student effect based upon longitudinal changes in Black-faculty proportion. This approach also substantially mitigates concerns about between-school variation in race-specific processes. For example, consider a wealth gap (not subsumed by ED status) between Black and non-Black prospective teachers in the context of a teaching profession that has offered inferior wages while still attracting workers through the compensations of (for example) time flexibility, altruism, and identity (Dolton, 2006; Flyer & Rosen, 1997). This may peculiarly deter Black prospective teachers who seek to change their generational class status (Goings & Bianco, 2016). The alternative fixed-effect specification controls for between-school variation in these type of phenomena.

In initial models, I employ a vector of postsecondary institution-by-year fixed effects, μ_{kt}, that capture any institution-specific changes. These are invoked by the profound and differential declines in teaching preparation enrollments (especially among Black students) in this period at

Michigan institutions of higher education (IHEs) (Drake & Cowen, 2022; Office of Postsecondary Education, 2023) that might lead to evolving levels of comparative vitality of teaching programs within those IHEs over time. This is of concern given administrative delays in capturing intent to teach (by registration in an IHE teaching program) that might allow unobserved re-evaluation of the teaching decision and survey work showing (in one study) that ~20% of women and ~50% of men make their ultimate decision to study teaching while in college (Montecinos & Nielsen, 1997). (More recent work confirms active, but skeptical, consideration of teaching careers among students at a large state university (Bowsher et al., 2023; Will, 2023).) This specification is most tractable when we assume that prospective teachers of interest go to college – especially an EPI (all 4-year institutions) that allows them to evaluate teaching vs. other options. IHE fixed effects become deleterious when we seek to identify marginal effects over a broad range of postsecondary and (more globally) non-postsecondary career choices. They are problematic here because they, by construction, allow only within-IHE identification and exclude from estimates all students attending an IHE (by year) that is either fully populated with non-teaching students or teaching students. This has a practical effect of significantly reducing the estimation pool (on the one hand) – but effectively expanding an "EPI-only" analysis to include all IHEs (especially preparatory 2-year programs) that support study of teaching.

There are several threats to validity of the framework in equation (1) – some of which can be investigated and some of which are not resolvable. Both student and teacher selection biases will be residually present. I include observable controls for students, S_{it}, which routinely include students' gender and 11th grade ACT/SAT scores – as well as test for effect sensitivity to inclusion of economic disadvantage, English language learner, and special education status indicators available only selectively. As is the case throughout this literature commencing with (Dee, 2005), Black students and Black educators come together in specific contexts – and we should suppose that

mutual selection occurs in these Michigan data (Drake and Cowen, 2022). As such, the external validity of any result is ambiguous, even while I argue the core analysis of within-school differences in apparent teaching intent between White and Black students as a function of between-school differences in Black-faculty proportion is plausible within this fixed-effects framework. This is especially true if any discerned moderation effect is robust to other likely confounds of the Black faculty-Black student interaction and underlying postsecondary teaching rates of K12 students appear to be broadly distributed – and thereby mitigate concerns about systematic biases in teaching affect across school contexts.

Findings

Table 3.1 presents the distributions of students and teachers within Kanter's (1977) qualitative levels of minority representation. Even in the context of substantial migrations of Black-K12 populations to non-urban school systems with predominantly-White teaching corps over this period (Drake & Cowen, 2022), college-bound Black students are broadly distributed across these comparative school contexts – where their non-Black IHE peers are predominantly educated in schools with fewer than 5% Black teachers. This shows that substantial Black-student college going is located in the traditional urban centers of Black teacher employment and a sensitivity of aggregate rates of Black teacher matriculation to these students' career choices.

Figures 3.1, 3.2, and 3.3 show the longitudinal rates of postsecondary pre-teaching among Black, White and students of all other races. These tabulations are important in two key ways. First, the consistent downward trend in postsecondary teaching rates is as expected and consistent with U.S Department of Education Title II survey data for Michigan (Drake & Cowen, 2022; Office of Postsecondary Education, 2023).[34] We also see Black teaching rates are consistently lower than

[34] These data differ from Title II data employed in other analyses (e.g., Kraft et al., 2020). Title II enrollments are not reported by age/high-school cohort as is evident within these data and instead blend enrollments across all stages of postsecondary study. This study's data discerns whether a pre-teaching student has *ever* been enrolled in a preteaching

Table 3.1. Distribution of students and teachers across qualitatively different Black-faculty conditions

	Students			
Black teacher percentage category	**Black**	**White**	**All other**	**Mean percent of teachers who are Black**
0%	10,946	262,010	68,886	0.0%
>0% & <= 5%	13,546	105,869	34,693	1.9%
>5% & <= 15%	9,663	14,980	9,895	8.2%
>15% & <= 35%	9,150	893	3,852	26.3%
>35% & < 50%	6,320	243	1,737	42.0%
>50%	9,968	294	2,614	61.8%
Total	59,593	384,289	121,677	3.7%

Notes: Tabulations are within the preferred regression pool of students attending a 4-year Michigan university. Distribution of students in other regression pool scenarios is similar. Black teacher percentage categories follow those qualitatively distinct levels established by Kanter (1977).

White throughout the panel period as is the broader national norm (Lindsay et al., 2017). Second, these data would suggest there is minimal prima facie between-school variation in pre-teaching rates among Black, White, and students identifying of other race/ethnicity. This is to say that Black or White teachers are not predominantly emerging from specific high school contexts. Any relationship between Black-faculty proportion and comparative rates of teaching will be within the conditioned framework of Equation 3.1.

program, where Title II data only acknowledge current enrollments and have an embedded persistence confound. Finally, Title II only applies to ultimately sanctioned Education Preparation Institutions (EPIs) credentialed to grant professional licenses. Pre-professional teaching study in other IHEs is excluded.

Figure 3.1. Black-student postsecondary pre-teaching rates across qualitatively different own-high school Black-faculty percentages

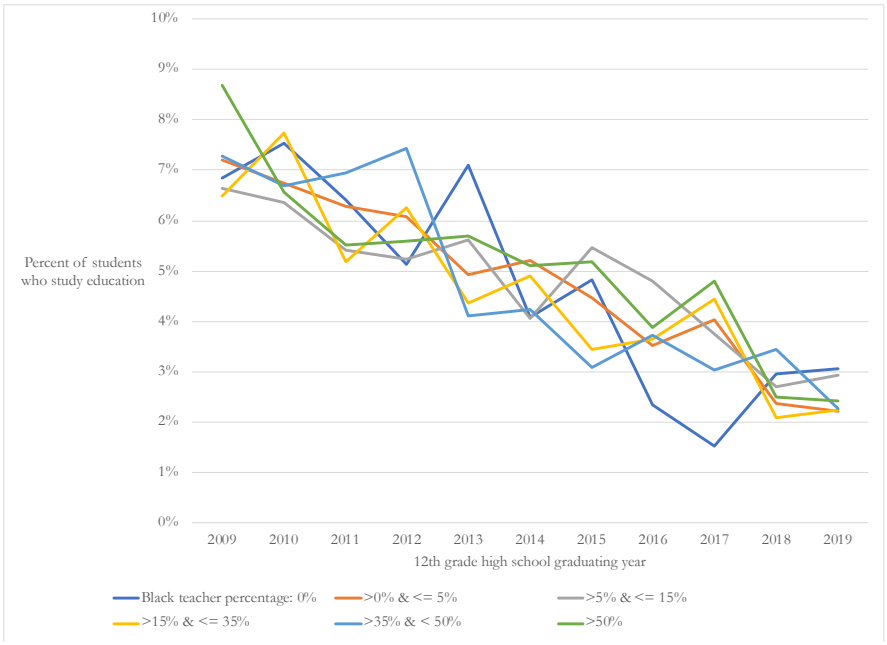


Figure 3.2. White-student postsecondary pre-teaching rates across qualitatively different own-high school Black-faculty percentages

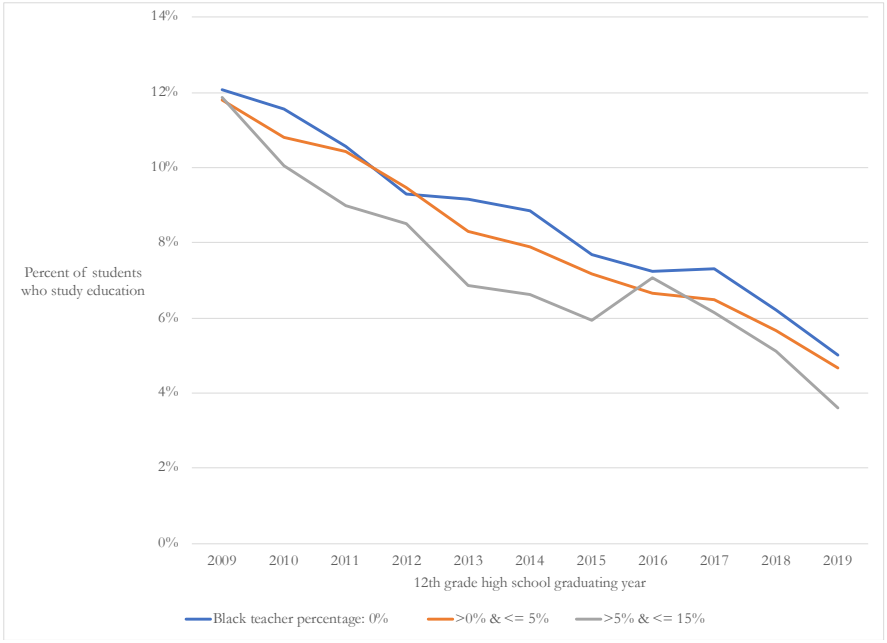
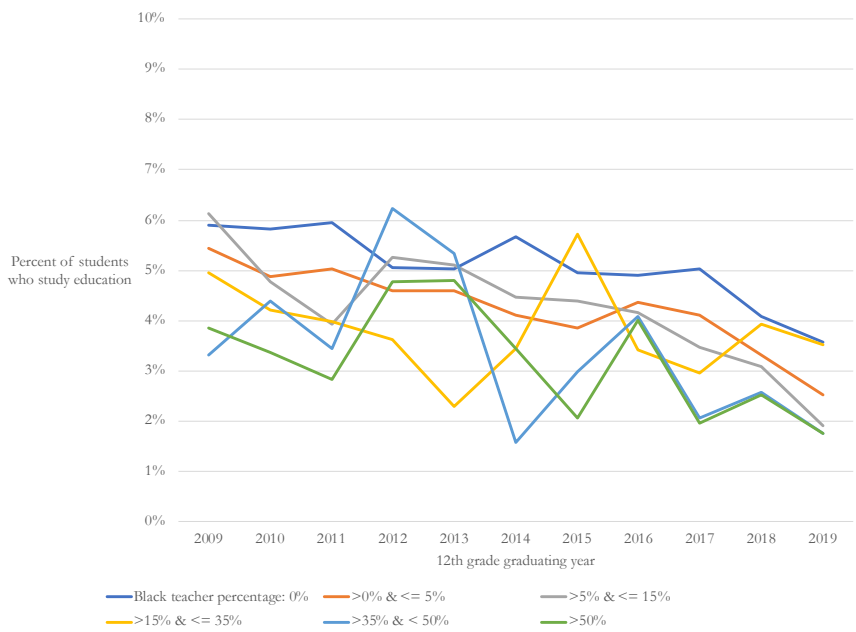


Figure 3.3. Non-Black, non-White student postsecondary pre-teaching rates across qualitatively different own-high school Black-faculty percentages



Notes: Tabulations are within the preferred regression pool of students attending a 4-year Michigan university. Distribution of students in other regression pool scenarios (see Table 3.2) is similar. Black teacher percentage categories follow those qualitative distinct levels established by Kanter (1977). Trendlines for high-Black faculty percentage categories is excluded for White students because of very small (and sometimes 0) cell sizes within the time series (as per Table 3.1). Rates for 2015 to 2018 have fewer than 4 years after graduation to calculate rates; though rates will only be biased if delays in non-teaching postsecondary activity differ from those in pre-teaching.

Competing between school phenomena

A series of competing factors plausibly affecting teacher labor markets (i.e., postsecondary pre-teaching rates) that operate differentially across schools are observable within these data and may point to contextual sensitivities and confounds to results emerging from equation (1). While no list can be comprehensive of possible confounds, I investigate several prominent in the literature. Drake and Cowen (2022) observe that new Black teachers in Michigan looking for a job might select contexts in which enrollments are growing. This is especially true in contexts like Michigan where many districts have substantially contracted; Detroit, Flint, and other key centers of Black teacher employment have experienced substantial declines in enrollment and attending teacher employment contraction over the period of study. By extension, prospective teachers may make their own

inferences about the economic viability of teaching based upon their own K12 school experiences. Figures B.1 and B.2 (Appendix B) shows rather that pre-teaching rates are, in fact, similar across school growth contexts. Alternatively, observed teacher turnover – reflecting job dissatisfaction, working conditions, district economic distress, or evaluation pressure (Brunner et al., 2019) – might similarly influence pre-teaching decisions. Figures B.3 B.4 (Appendix B) finds no related bivariate relationship among Black-student teaching activity and Black-faculty proportion but does reveal apparent lower rates of teaching among non-Black students in the highest turnover schools. This apparent confound is invested later. Pre-teaching rates are strikingly similar across traditional public schools and chartered public school academies for White and Black students, but a degree of separation for student of other races/ethnicities is apparent (Figure B.5, Appendix B).

Postsecondary teaching study may be sensitive to own-school contexts with comparatively different student-body achievement score profiles (Figure B.6 and Table B.1). Figure B.6 shows a degree of separation in the early years of the panel among Black-student pre-teaching rates by schools' achievement score quartiles, with those attending the lowest achieving schools exhibiting discernably lower rates of teaching study. While an imperfect measure, achievement may be interpreted as a high-profile proxy for teaching effectiveness (in fact or reputationally) – possibly providing feedback into prospective teachers' evaluation of altruistic potential. A set of competing regressions in Table B.1 show that raw achievement score levels – as opposed to measures of racial difference in student achievement – appear to capture this phenomenon. There is a clear confluence of Michigan Black teacher service and schools with low absolute levels of achievement (Drake et al., 2019).

Kraft et al. (2020) exploit state-level policy differences and timing to tie Race to the Top-era teacher evaluation reforms to state-level declines in pre-teaching activity as measured by Title II data completions. They find substantial change in *absolute levels* of pre-teaching activity as a function of

policy reforms like those that occurred in the summer of 2011 in Michigan (Brunner et al., 2019). Drake and colleagues (2019) show that policy implementation was racially skewed within and between schools in post-reform Michigan, raising the prospect of differential rates of pre-teaching attrition. Table B.2 reports the results of difference-in-difference analysis related to these concerns. As shown – and in distinction from the between-state findings of Kraft et al. (2020) showing meaningful contraction in pre-teaching study in response to state law – this within-state, between-school analysis finds little evidence of reform-related change to pre-teaching *rates* among postsecondary students in relation to *implemented* differential rates of own-high school issuance of low teacher evaluation ratings.

Table B.3 reports results from integration of the multiple, preceding measures of between-school difference into a regression framework. These models (through partitions) are also fully interacted with student race. This work establishes two important contexts for the primary analysis in this paper. First, it shows that – in the presence of school fixed effects – Black-faculty proportion interacted with student race is insensitive to inclusion of the other identified between-school measures in cross-sectional models. This offers suggestive evidence that the effect of interest in equation (3.1) (Black student * proportion of faculty that is Black) is not confounded by competing, but omitted, interactions of school-level phenomena and student race. (Compare models 4-6 to 10-12.) (Principal, counselor, and peer race sensitivities are addressed later.) Other analysis in Table B.3 explores the possible structure of any interaction of Black students and proportion of faculty that is Black. Race-specific Black-faculty proportion effects estimated without a school fixed effect suggest that any interaction may represent suppressed levels of White rather than enhanced levels of Black pre-teaching choice vs. other postsecondary majors. Inclusion of a school fixed effect to absorb related confounds substantially reverses this phenomenon – *and suggests, rather, that any (positive) Black-*

faculty effect may reflect enhanced Black student postsecondary pre-teaching. Further, this estimated linear effect size (0.044, p< .1) is similar to that reported for the main analytical framework following.

Moderation of comparative rates of within-school pre-teaching difference

Tables 3.2 and 3.4 report the primary findings for the paper. Table 3.2 is implemented per equation (1) and shows results within multiple scenarios: all observed 12th grade students, all postsecondary students, those who attend a 4-year university, those within Michigan EPIs, and (following Corcoran et al., 2004) a donor pool that includes only nurses and social workers. I prefer the lens of 4-year Michigan universities because it represents the narrow perspective most closely aligned with my policy interest – serious indication of interest in (and ability to enter) a postsecondary degree program equivalent to that necessary to become a licensed teacher within four years of high school graduation. The EPI-only lens is similar and incorporates the predominant share of 4-year observations – including all large state universities – but excludes students comfortable attending universities and colleges where teaching study is not an option. Nurses and social workers are evaluated as a donor pool exclusive to other fields with roughly equivalent credentials and a disproportionately female workforce. In a complementary results panel, I incrementally limit the estimation pools to only those with ACT/SAT scores above the teacher median for those with a policy interest in "high quality" teachers – or, alternatively, prospective teachers with the most elastic teach/not-teach decision given their comparatively expansive set of career options.

Referring to column (7) estimated over a panel of 4-year Michigan-university students (my preferred specification), the identified effects can be interpreted as follows: Black K12 students choose pre-teaching pathways vs. same-school non-Black peers more often as own-high school

Table 3.2. Black faculty proportion moderation of Black student postsecondary study of teaching.

	All students		All postsecondary			4-year Michigan IHE			Michigan EPIs			Teachers, nurses, and social workers†		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
11th Grade ACT/SAT score	X		X	X		X	X		X	X		X	X	
IHE-by-year fixed effect			X			X			X			X		
All students														
Black Student * Proportion [0,1] of graduating high school teachers who are Black	-0.006*	0.000	0.021***	0.007*	0.007**	0.038***	0.031***	0.019***	0.042***	0.037***	0.025***	0.196***	0.098***	0.062***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.027)	(0.025)	(0.022)
Observations (000)	1,123	1,436	749	811	877	536	536	564	478	478	498	135	145	154
R-squared	0.030	0.029	0.089	0.033	0.034	0.072	0.039	0.039	0.070	0.040	0.041	0.213	0.095	0.094
Proportion non-Black teaching	0.045	0.037	0.062	0.062	0.059	0.075	0.075	0.073	0.078	0.078	0.077	0.349	0.350	0.346
Proportion Black teaching	0.022	0.015	0.037	0.038	0.036	0.048	0.048	0.048	0.049	0.049	0.048	0.216	0.222	0.220
High ACT/SAT students														
Black Student * Proportion [0,1] of graduating high school teachers who are black	-0.008	-0.005	0.030***	-0.007	-0.004	0.050***	0.052***	0.015	0.049***	0.052***	0.031***	0.111**	-0.014	0.010
	(0.008)	(0.004)	(0.008)	(0.007)	(0.007)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)	(0.009)	(0.053)	(0.042)	(0.035)
Observations	413	726	332	365	431	288	288	315	272	272	293	62	68	76
R-squared	0.038	0.037	0.096	0.043	0.043	0.083	0.050	0.049	0.082	0.051	0.051	0.210	0.113	0.114
Proportion non-Black students teaching	0.058	.038	.066	.066	.061	.072	.072	.070	.075	.075	.072	.355	.355	.348
Proportion Black students teaching	0.038	.008	.043	.044	.034	.045	.045	.043	.046	.046	.044	.239	.240	.224

Notes: *** p<0.01, ** p<0.05, * p<0.1. Errors reflect clustering at the district level. All columns are linear probability models of the decision to study teaching. Column labels indicate the scope of the regression pool. ELL, ED, and SpED measures are excluded. All models include high school-by-year fixed effects. Sensitivities to these covariates are shown in Table B.4. Also included are a vector of student race indicators, with White students as the reference category, and a gender indicator. Students' 11th grade ACT/SAT composite z-Score are included as described above. Missing data for 11th grade ACT/SAT scores is very common among students not attending any postsecondary program. 48% of all students (and 68% of Black students) not attending a postsecondary program are missing their 11th grade score vs. 11% of those found in postsecondary data. IHE-by-year fixed effects included in (3), (6), and (9) have the effect of identifying estimates within IHEs where teaching *and* non-teaching options exist. These effects are not defined for students not attending a postsecondary program. High ACT/SAT students are those whose z-Scores are greater than the mean z-Score for teachers of 0.33. The density of sample pre-teaching activity (i.e., proportion of pre-teachers vs. non-teachers) increases from left to right. Increasing effect sizes should be interpreted in this context.

† Nurses and social workers are well-defined categories with the CIP-code classification system.

Black-faculty proportion increases. The effect size is substantial within the context of underlying Black teaching rates of 4.8% – suggesting a 1.5 percentage point marginal gain in a school faculty that has a faculty that is 50% Black. These effects persist (and are larger) when analysis is partitioned to include only students with ACT/SAT scores above the teacher sample median. The phenomenon persists in the narrower pool of Michigan colleges and universities which are EPIs and within the narrow pool of teachers, nurses, and social workers. These are descriptive findings where the underlying causality may be tied to other school features where Black teachers work at higher rates – though the estimate is sufficiently robust that 62% of the estimate would have to be due to bias to invalidate the inference (Frank, Maroulis, Duong, & Kelcey, 2013; Rosenberg, Xu, Lin, & Frank, 2022). Estimates in Table B.4 shows that these results are broadly insensitive to inclusion of student covariates beyond gender and ACT/SAT z-Score, and importantly, that results are similar for the spring 2009 to 2015 period where four years of postsecondary data are uniformly available for all K12 students. The insensitivity of results to inclusion of student-level measures of economic disadvantage mitigates concern that identified effects are instead tied to economic profiles of Black students correlated to increasing levels of Black-faculty proportion that might prevent entry into a perceived low-wage profession.

As indicated above, my preference is to evaluate comparative rates of preprofessional teaching among 4-year college-going students. This has the effect of conditioning on broader college-going phenomena that are (substantially) exogenous to Black faculty proportion. Table 3.2 results also report when I relax this preference by including estimates over all students appearing in postsecondary data – including fields like cosmetology, HVAC technicians, etc. – and then to the entire pool of observed 12th grade students. The Black-faculty proportion moderation effect reported above is not present in this most extensive estimation sample. This may be due, in part, due to the

statistical difficulty of identifying teaching activity in this diluted pool. Declining Black and non-Black teaching rates across increasingly extensive estimation pools are reported in the table. Overall, 59% of Black and 38% of non-Black 12th grade observations are exclusive of postsecondary activity. (These same non-college-going students have very high rates of missing ACT/SAT scores; sensitivities to inclusion of this measure and related shifts in estimation sample are shown.) Still, the data presented in Table 3.2 implicates a narrative where, on one hand, Black K12-faculty proportion positively moderates Black-student entry into a university teaching program among college-goers, but then, on the other, may simultaneously associated with lower Black-student university attendance rates – such that the net moderation effect on absolute rates of Black postsecondary teaching is flat to negative (as evidenced in columns (1) and (2) in Table 3.2; see also sensitivities in Table B.5). Table 3.3 presents evidence that mitigates this concern. Black-faculty moderation of university attendance rates appears to be positive – not negative – such that increasing Black-faculty proportion is associated with marginal increases in both Black-student 4-year college attendance *and* increases in the study of teaching within students' colleges and universities. In this vein, I re-emphasize that Black-faculty moderation effects (Table 3.2) are robust (and larger) among high-scoring ACT/SAT students – a group that is arguably more invariantly college-bound. Further, these students are likely exposed to college-preparatory trajectories within schools, incrementally centering analysis on (within-school tracks of) teachers and teaching practice intended to induce credential-seeking consistent with teacher licensure. These facts notwithstanding, I draw readers' attention to the residual external validity concerns embedded in the partitioned 4-year Michigan university sample. Teaching rates among college-goers are not the same as teaching rates at large, and Black-faculty moderation of global university attendance may be biased toward non-teaching majors (in spite of the evidence presented here).

Table 3.3. Black faculty proportion moderation of Black-student postsecondary attendance by IHE type and field of study

	4-year Michigan IHE		Michigan EPI	
	(1)	(2)	(3)	(4)
ACT/SAT z-score	X		X	
Black Student * Proportion [0,1] of graduating high school teachers who are Black	0.024	0.116***	0.034**	0.147***
	(0.017)	(0.016)	(0.016)	(0.014)
Observations (000)	1,123	1,436	1,123	1,436
R-squared	0.235	0.168	0.225	0.150
Black mean enrollment rate	23.5%		19.0%	
Non-Black mean enrollment rate	40.4%		36.1%	

Notes: *** p<0.01, ** p<0.05, * p<0.1. Errors reflect clustering at the district level. All columns are linear probability models of observed enrollment in program type (as per column label) among all 12th grade students in panel. Covariates are as in Table 3.2. School-by-year fixed effect are included. Results are similar for students with high ACT/SAT zScores (as defined in Table 3.2). Mean enrollment rates are across all fields of study (inclusive of teaching).

Returning to discussion of Table 3.2, I present sensitivities to IHE fixed effects. As discussed, these effects propitiously manage the broad instability in postsecondary teacher preparation rates during the period of analysis – while deleteriously confining effect estimates to postsecondary institutions with both teachers and non-teachers. In this respect, these results are highly endogenous by construction. (Notice that point estimates are higher when these effects are imposed in columns (3) and (6).) Still, it is encouraging that effects within the partitioned EPI-only sample (which is weighted to large universities offering a broad array of fields of study) are statistically insensitive to inclusion of these effects within the all-students and high-ACT/SAT subsamples. Given this result, I proceed without these controls.

Analyses reported in Table 3.4 are differentiated from Table 3.2 by the fixed-effect specification. Per equation (1), models underlying Table 3.2 incrementally specify a school-by-year fixed effect such that evolving school-level influences on postsecondary teaching choice are absorbed equivalently for all students. Table 3.4 specifies instead a *Black student*-by-school fixed

effect. This has two important effects. The first is that only marginal, longitudinal within-school changes in the Black-faculty proportion parameter (as interacted with Black students) are left unabsorbed. This shifts the interpretation of the effect from one that emphasizes structural differences in school-level phenomena associated with absolute levels of Black-faculty proportion (as in Table 3.2), to one that evaluates the impact of within-school marginal change in that measure.

Table 3.4. Moderation effect of *within-school changes* in high-school Black-faculty proportion on comparative rates of postsecondary pre-teaching activity among same-school Black and non-Black students

	(1)	(2)	(3)	(4)
	All post-secondary	**4-year Michigan IHE**	**Michigan EPIs**	**Teachers, nurses and social workers only**
All students				
Black Student * Proportion [0,1] of graduating high school teachers who are black	0.015	0.020*	0.028**	0.028
	(0.012)	(0.011)	(0.012)	(0.049)
Observations	811,390	536,605	478,364	145,883
R-squared	0.024	0.027	0.027	0.051
High ACT/SAT students				
Black Student * Proportion [0,1] of graduating high school teachers who are black	-0.011	0.015	0.015	-0.182**
	(0.020)	(0.018)	(0.019)	(0.092)
Observations	365,198	288,275	272,866	68,448
R-squared	0.026	0.029	0.029	0.040

Notes: *** p<0.01, ** p<0.05, * p<0.1. Errors reflect clustering at the district level. All columns are linear probability models of the decision to study teaching. ELL, ED, and SpED measures are excluded. All models include Black student-by-school and (separate) year fixed effects. Also included are a vector of student race indicators, with White students as the reference category, students' 11th grade ACT/SAT composite z-Score, and gender indicator. High ACT/SAT students are those whose z-Scores are greater than the mean z-Score for teachers of 0.33.

These changes are more likely to modify frequency of classroom-level exposure of individual students to Black teachers than to change the qualitative character of schools' faculties or invoke mechanisms that might transform broad school experience. Further, we know that Michigan district-level faculty racial proportion was strikingly stable throughout this period (Drake and Cowen, 2022).

Analysis underlying Table 3.4, if one assumes that school contexts are stable through time, also has a second benefit of fully interacting student race with all school-level features such that any racially interacted policy effects, residential patterns, economic differentials precluding teaching, and school-within-a-school social phenomena are controlled. As can be seen, marginal changes in within-school Black-faculty proportion are generally associated with comparatively high levels of Black postsecondary pre-teaching – though statistical significance is not present among a partitioned analysis of high-scoring students after school-level fixed effects substantially absorb variation in Black-faculty proportion.

Table 3.5 scenarios relax the assumption of the continuous linear effect in equation (3.1) in two ways. First, I evaluate differences in comparative Black-student pre-teaching study as a function of categorical, qualitative Black-faculty levels (see Table 3.1). Second, given these results, I also explore a quadratic specification that might identify an underlying non-linear effect. Column (1) demonstrates that identified effects in Table 3.2 are in fact phenomena of schools with Black-faculty proportion of greater than .15 (or 15%). Columns (2) and (3) confirm that the linear effect specification disappears when the regression pool excludes these high Black-faculty contexts. The categorical *effect sizes* in Table 3.5 are also most easily interpretable. Black teaching rates are (comparatively) ~2.0 percentage points higher than non-Black in these high-Black faculty schools. This statistic can be is contextualized by the raw underlying 4.8% mean pre-teaching rate for Black

Table 3.5. Re-estimation of Table 3.2 results using non-linear specifications of Black-faculty proportion

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Black-faculty percentage of schools included in estimation pool:	**All schools**	**Category 3 and lower**	**Category 2 and lower**	**Category 2 and lower – alternate fixed effect†**	**All schools**	**Category 3 and lower**	**Category 2 and lower**
Black student * categorical level of faculty Black							
Cat. 1: >0% & <= 5%	0.001						
	(0.004)						
Cat. 2: >5% & <= 15%	0.001						
	(0.004)						
Cat. 3: >15% & <= 35%	0.019***						
	(0.006)						
Cat. 4: >35% & < 50%	0.024***						
	(0.005)						
Cat. 5: >50%	0.012***						
	(0.003)						
Black student * proportion [0,1] of graduating high school teachers who are Black		0.064***	0.012	0.095*	0.086***	0.012	0.063
		(0.022)	(0.045)	(0.050)	(0.021)	(0.055)	(0.116)
Black student * square of proportion [0,1] of graduating high school teachers who are Black					-0.094***	0.193	-0.508
					(0.032)	(0.208)	(1.129)
Observations	536,312	517,358	504,971	504,675	536,312	517,358	504,971
R-squared	0.039	0.039	0.039	0.027	0.039	0.039	0.039

Notes: *** p<0.01, ** p<0.05, * p<0.1. Errors reflect clustering at the district level. All columns are linear probability models of the decision to study teaching estimated among students attending 4-year Michigan IHEs. The model in column (1) is categorical adaptation of the interaction effect of interest in equation (1) as reported in Table 3.2. Black-faculty percentage levels used approximate the qualitatively different levels in Kanter (1977). Category 0 is the reference category and represents schools with 0% Black faculty. Columns (2) and (3) re-estimate a continuous measure of Black-faculty proportion as in Table 3.2, but with the estimation pool limited to, respectively, categories 0 to 3 and 0 to 2. (2) confirms that the more parsimonious linear specification of Black-faculty proportion is robust to this narrower regression pool. (3), by excluding all categories where effects are located in column (1), confirms that effects do indeed appear to be confined to higher levels of Black-faculty proportion – even when a more parsimonious measure of Black-faculty proportion is employed. (5) and (6) test quadratic specifications within these estimation pools. Categorical models over the pool of students with high scores on the ACT/SAT yield similar results though category 3 is not significant (even if point estimate is similar) in the lower powered regression. †Alternate fixed effect is the Black student-by-school fixed effect described in Table 3.4. This effect size should be interpreted with caution. It is estimated in the context of marginal percentage changes within schools.

students (again, similar across all Black-faculty contexts (Figure 3.1)) in four-year Michigan universities.

Interestingly, the interaction of Black-faculty proportion and Black students persists in low-Black faculty contexts (Table 3.5, column 4) in the presence of Black student -by- school fixed effects. Recall that this effect is identified using typically small longitudinal changes in Black-faculty proportion. As such, the practical effect size is lesser. Where the ~2 percentage point conditional increase in Black student postsecondary teaching levels described in column 1 is large vs. typical pre-teaching rates, a (for example) 5 percentage point increase in school Black faculty would yield only a ~0.5 percentage point increase in Black teaching rates (if we stipulate to point estimates).

Other elements of racial complexity

The preceding work assumes that students' graduating high school context is sufficient to identify and interrogate any Black-faculty effect. I successively relax two strong assumptions here. First, I acknowledge that students' individual high school pathways may be complex (involving, for example, varying degrees of school transfer) and construct student-specific measures of Black-faculty exposure. To complement these measures, I construct a revised set of fixed effects. I interact students' grade-specific school codes with students' cohorts in a longitudinal fixed-effect specification. This is to say that there are separate fixed effects for students' schools in 9^{th}, 10^{th}, 11^{th}, and 12^{th} grades. I also incrementally acknowledge the complex racial character of non-Black students. Within the schools where Black-faculty percent exceeds 15% and Table 3.5 results are located, Black students represent 73%, White students 4%, and students identified of other race or ethnicity 23% (see Table 3.1) of observations. (Students identifying of other race/ethnicity are roughly equally designated as Latinx, Asian, and of two or more races.)

Results in Table 3.6 show that estimated effects where students' graduating high school parameters are employed (Table 3.2) are similar to those where student-specific measures of Black-

Table 3.6. Sensitivity of Black-faculty proportion effects to a longitudinal fixed-effects specification and a White-student only reference category

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Parameterization of Proportion Black faculty and Fixed Effects:	**Graduating high school**		**Student-specific**		**Graduating high school**		**Student-specific**	
Black Student * Proportion [0,1] of high school teachers who are Black	0.029***	0.055***	0.031***	0.055***				
	(0.005)	(0.005)	(0.006)	(0.018)				
All other races student * Proportion [0,1] of high school teachers who are Black		0.029*		0.027				
		(0.016)		(0.018)				
Black student * Categorical proportion of faculty Black								
Cat. 1: >0% & <= 5%					0.001	-0.000	0.002	0.001
					(0.004)	(0.004)	(0.005)	(0.005)
Cat. 2: >5% & <= 15%					0.004	0.005	0.006	0.006
					(0.005)	(0.006)	(0.006)	(0.007)
Cat. 3: >15% & <= 35%					0.017**	0.018	0.021***	0.039***
					(0.007)	(0.015)	(0.006)	(0.008)
Cat. 4: >35% & < 50%					0.021**	0.034**	0.017***	0.048**
					(0.009)	(0.014)	(0.006)	(0.023)
Cat. 5: >50%					0.014***	0.034***	0.016***	0.020*
					(0.005)	(0.007)	(0.006)	(0.010)
All other races student * Categorical proportion of faculty Black								
Cat. 1: >0% & <= 5%						-0.005		-0.002
						(0.003)		(0.003)
Cat. 2: >5% & <= 15%						0.001		-0.000
						(0.005)		(0.005)
Cat. 3: >15% & <= 35%						0.000		0.021***
						(0.013)		(0.008)
Cat. 4: >35% & < 50%						0.014		0.034
						(0.012)		(0.027)
Cat. 5: >50%						0.021***		0.003
						(0.007)		(0.008)
Observations	373,322	373,322	364,789	364,789	373,320	373,322	364,789	364,789
R-squared	0.037	0.037	0.066	0.066	0.067	0.037	0.066	0.066

Notes: *** p<0.01, ** p<0.05, * p<0.1. Errors reflect clustering at the district level. All columns are linear probability models of the decision to study teaching estimated among students attending 4-year Michigan IHEs. Black-faculty proportion is alternately parameterized as "Graduating School" where the school-wide faculty proportion for the graduating year is specified, and "Student specific" where student-specific school-wide faculty percentages are calculated over students' high school careers as a function of their attendance across schools. In the graduating school scenario fixed effects are specified as in equation (1) (School-by-year and IHE-by-year). In the student-specific scenario, a grade-level vector of school fixed effects is substituted and interacted with graduating cohort year to control for student-specific school-level phenomenon across various schools attended in their high school career. Students are assigned each year to the school where they had the greatest attendance. "All other races students" are students who are indicated within the data as neither White nor Black. Category 0 is the reference category and represents schools with 0% Black faculty. Covariates are student ACT/SAT z-Scores, gender, race, and main effects for student-specific Black-faculty proportion measures. Results are insensitive to inclusion of these main effects as they are substantially absorbed by fixed effect specification. Non-Black and non-White students in Categories 3 to 5 are approximately equally distributed between Asian, Latinx, and students of multiple race/ethnicities.

faculty proportion are employed, mitigating concern about complex student-transfer processes. Additionally, enhanced pre-teaching effects for Black students vs. White students in high Black-faculty contexts (greater than 15%) appear to be roughly twice as high as when compared to a consolidated non-Black reference group. These same Black faculty-by-Black student effects are also larger and more consistently identified than analogous effects between Black-faculty proportion and an indicator for students of other race/ethnicity.

As reported in Table B.6, I also acknowledge that students' K12 careers include both middle and elementary school experience. (Recall that teaching intent has been reported by teacher candidates to be sometimes developed in the early grades.) I extend the longitudinal fixed-effects regime described above to successively include confounding student-specific middle and elementary school effects. I then specify interactions between student race and the race of middle and elementary school teachers. These enhancements are extremely costly to available observations. They both demand continuous presence by students in the included grade bands and successively exclude students whose K12 careers precede the spring 2009 initiation of my dataset. Further, this reduction in power occurs in parallel to the inclusion of the multiple parameters outlined above. Within these constraints, high school-only effects are shown to be robust to longitudinal school fixed effects comprehensive of students' extended middle and high school experience. (Point estimates are similar, but not significant, when elementary fixed effects are included.) More complex specifications of additive high school, middle school, and elementary effects in the presence of these same longitudinal fixed effects are not significant. Correlations between high school, middle school, and elementary Black-faculty proportions among Black students are moderate (pairwise correlations range between 0.5 and 0.7), discounting collinearity concerns. Instead, these results – in particular, the attenuation of the otherwise robust high school-level effect – is likely a function of substantially reduced power in tandem with a material shift in available student observations to contexts with

highly stable student residential patterns. That is, the analysis is structurally shifted away from the context of effects identified in Table 3.5.

The specification in equation (3.1) perhaps most obviously ignores other racial features of school experience. Principal race, counselor race, and peer race are all observable and correlated with faculty race. Table 3.7 reports results of investigating these confounds and shows that the Black teacher proportion effect is, in fact, robust to and the dominant predictor of comparative Black-student pre-teaching rates.

Table 3.7. Sensitivity of Black teacher proportion effect to other observable school-level racial elements

	(1)	(2)	(3)	(4)	(5)
Black Student * Proportion (0,1] of high school **teachers** who are Black	0.031***				0.041***
	(0.006)				(0.015)
Black Student * Proportion (0,1] of high school **principals** who are Black		0.012***			0.008
		(0.003)			(0.006)
Black Student * Proportion (0,1] of high school **counselors** who are Black			0.013**		-0.006
			(0.005)		(0.007)
Black Student * Proportion (0,1] of high school **student peers** who are Black				0.014***	-0.003
				(0.004)	(0.010)
Observations	536,312	485,015	470,599	550,794	428,968
R-squared	0.039	0.038	0.037	0.040	0.037

Notes: *** p<0.01, ** p<0.05, * p<0.1. Errors reflect clustering at the district level. All columns are linear probability models of the decision to study teaching estimated among students attending 4-year Michigan IHEs. The reference group is all non-Black students. Measures of school race are those of students' graduation high schools (as in Table 3.2 and per Equation (1)). Principal and counselor race is determined by school unless not such role is present in which case similar personnel assigned to the district are substituted (if available). School-by-year and IHE-by-year fixed effects are specified. Covariates are student ACT/SAT z-Scores, gender, race. Main effects for student-specific Black-faculty proportion measures.

Finally, a series of partitioned regressions reported in Table 3.8 revisit concerns of competing between-school effects that might confound – or, alternatively, locate and contextualize –

Black faculty-related effects. Inspection of Table 3.8 shows that Black-faculty effects are primarily located in urban schools but that effects are substantially similar across other exhibited school

Table 3.8. Sensitivity of Black teacher proportion effects to partitions in between school dimensions

	(1)	(2)	(3)	(4)	(5)	(6)
	Growing enrollment schools	**Declining enrollment schools**	**Teacher turnover less than median**	**Teacher turnover greater than median**	**Teacher low-effectiveness rate < 1.1%**	**Teacher low-effectiveness rate > 1.1%**
Black Student * Proportion (0,1] of high school teachers who are Black	0.038***	0.027***	0.028	0.029***	0.033***	0.031***
	(0.009)	(0.006)	(0.040)	(0.007)	(0.010)	(0.010)
Observations	315,617	220,607	265,245	269,504	402,779	133,533
R-squared	0.040	0.035	0.037	0.041	0.040	0.035

	(7)	(8)	(9)	(10)	(11)	(12)
	Below median ACT/SAT scores	**Above median ACT/SAT scores**	**All suburbs**	**Cities**	**Traditional Public School**	**Public school academy**
Black Student * Proportion (0,1] of high school teachers who are Black	0.028***	0.037***	0.012	0.026***	0.028***	0.021
	(0.009)	(0.012)	(0.019)	(0.009)	(0.005)	(0.032)
Observations	205,468	330,721	152,681	63,977	317,108	13,181
R-squared	0.042	0.037	0.032	0.032	0.035	0.065

Notes: *** p<0.01, ** p<0.05, * p<0.1. Errors reflect clustering at the district level. All columns are linear probability models of the decision to study teaching estimated among students attending 4-year Michigan IHEs. The reference group is all non-Black students. Measures of school race are those of students' graduation high schools (as in Table 3.2 and per Equation (1)). School-by-year are specified. Covariates are student ACT/SAT z-Scores, gender, race. Main effects for student-specific Black-faculty proportion measures. Growing enrollment is determined by a lagged three-year enrollment change. Teacher turnover is the lag of the proportion of teachers not returning to students' schools. The median here is across all-race students. Within the Black-enrollment rated quartile in Figures B.3 and B.4 (centered on higher rates of teacher turnover) the interaction effect is .044 (p<.01) for Q1-Q3 and .038 (p<.01) for the visual outlier Q4. The low effectiveness rate of 1.1% is the median rate of low effectiveness ratings for the high school teachers of all Black students in the dataset and the regression is for the post spring 2012 reform period. The analog partition of schools with high and low rates of Black-teacher low effectiveness ratings yield a similar result. Median ACT/SAT scores are the enrollment weighted school median across the dataset. Locales of all sizes labeled "suburb" or "city" are assigned here. Towns and rural settings are excluded. Chartered Public School Academy observations are incrementally lowered by low rates of racial diversity such that fixed-effect cells absorb substantial variation within the comparatively small observation set.

contexts. These interacted results elaborate the previous finding locating effects in schools with Black-faculty proportion greater than 15% as these are the precise school contexts in which these school faculties predominantly exist. The point estimate is marginally higher in schools with high ACT/SAT scores suggesting a possible interaction with the suggested relation between school achievement ("effectiveness") and teaching choice presented in Table B.1. Point estimates are also marginally higher in schools with growing student enrollment.

Discussion

Tabulations in Figures 3.1 to 3.3 broadly mitigate concern that the residential deurbanization patterns of Black K12 students in Michigan (and nationally) (Drake & Cowen, 2022) have led to attending declines in Black teacher preparation enrollments. Black faculty rates approximate urbanicity and absolute rates of Black postsecondary study of teaching are similar across these contexts. In this sense, the Black-faculty moderation effects identified in in this work can be viewed as a compensating effect for other contextual phenomena leading to lower comparative baseline levels of teacher preparation activity. Looking forward, I note this study offers no evidence that marginal changes in Black teacher employment in predominantly White schools will – in isolation – be sufficient to reshape teaching career affect among K12 Black students. The small positive effects associated with marginal increases in Black faculty levels in predominantly White-faculty schools (Table 3.5, column 4) are not sufficient to materially change Black teacher representation levels.

Cumulatively, the preceding analyses locate a substantial Black-faculty moderation effect in schools with greater than 15% Black faculty that seems broadly robust, indeed largely insensitive, to observable potential between-school confounds (and, given precision of estimates and power, perhaps other unobserved omitted constructs (Frank et al., 2013)). This result of enhanced comparative levels of Black-student teaching choice is consistent with *both* hypotheses of classroom-level teacher-student match and with bureaucratic theories where Black-faculty proportion reaches a

threshold where the school-level experience for all students is transformed through enacted policy and culture. Classroom effects will be less frequent and, if cumulative in nature, harder to discern in schools with fewer Black teacher-Black student encounters as is likely the case in low-Black faculty contexts. In the absence of a teacher-student link, these effects remain confounded. I emphasize, however, that the interaction of Black faculty and Black students in low frequency categories are precisely estimated near zero in this work. On balance, this phenomenon supports the conjecture that a threshold effect may exist (where, perhaps, tokenization costs may weigh more heavily in predominately White contexts but are displaced by affirming representational effects as Black-faculty proportion increases) and that school-level mechanisms may predominate.

I re-emphasize the frequencies in Table 3.1 that show that this study's located effects are a function of the postsecondary pre-teaching choices of very few White (and other non-Black) students who attended high schools with substantial rates of Black-faculty employment. Student (i.e., family) selection biases here are of significant concern and limit the generalizability of these findings. This said, I also re-emphasize that the results here are contingent on key mitigating assumptions: by construction, the analysis evaluates only students who attended a four-year university and incrementally condition on students' ACT/SAT scores and gender. (Results are broadly insensitive to other student-level measures.) In this respect, these non-Black students are similar to their Black K12 within-school peers – likely sharing a broadly similar college-preparation experience. Further, given a consolidating emphasis on university admission and success, this curricular track experience may be more consistent across schools than other school features.

The result that any underlying school principal-driven effect is dominated by the interaction of *teaching* faculty and students (Table 3.7) incrementally focuses our contemplation of underlying mechanisms. Hiring and retention of Black teachers (Bartanen & Grissom, 2019), for example, is only indirectly related to teaching practice and experience. In particular, teaching effectiveness (and

sustainability of that teaching) may, in fact, be more explicitly tied to the motivation channels (i.e., altruism (Bartanen, Kwok, Avitabile, & Kim, 2023) as weighed against attending costs) that may drive teaching career decisions. This result supports the hypothesis that teaching effectiveness – teaching's broad capacities and affordances – may be more important than those aspects of school culture and policy that fall within the aegis of formal school leadership.

Correspondingly, I emphasize that it is more likely the choices and operations of teachers themselves that should shape our interpretation of this study and focus future inquiry. Any related organizational process or mechanism will be co-constructed by individual teachers and future research should attend to between-school differences not only in quantitative measures of Black faculty (and other school-level constructs) but also in qualitative difference. We should not expect teachers to be the same across contexts. Bristol (2018) finds, for example, in a small-scale study of Black teachers in Boston schools that those working alone are more likely to be from alternative pathways and less likely to have emerged from the school system itself. Black teachers working in larger cadres typically follow a traditional path through EPIs. These separate preparation experiences alone may inculcate differing pedagogical orientations and institutional stance. Further, Bristol effectively characterizes an organization-level, generational effect – one where reproduction of teachers and teaching is valued and predominant in high-Black faculty contexts. Kelly (2007) documents how Black teachers working in White contexts do so having weighed real costs of tokenization against their own capacities – as *individuals* – to effect progress in these contexts. Jackson (2009) discerns value-added differences between Black teachers self-sorting into comparatively Black and White school contexts post desegregation in Charlotte-Mecklenburg. Similarly, within similar state-level Michigan data, Black teachers exhibit very strong *but not universal* preference for working with Black students in school systems (often in secular decline) that employ large numbers of other Black teachers (Drake & Cowen, 2022).

My work here is theoretically located in the mechanisms of career decision theory and the differential experience and capacities of individuals in racialized organizations. Ultimately, the racialized patterns in our school landscape that shape these phenomena are produced by the organization of society, assumptions of civil rights reforms, and the ultimately narrow ambitions of *Brown* and *Milliken* and related decisions. These decisions include explicit programs of closure of schools with Black teachers and deemphasis of faculty representation rates in consolidated schools that has persisted past the profound dislocation tied to the implementation of *Brown* into the No Child Left Behind and Race to the Top era reforms (Bell, 2004; Bell Jr, 1977; Bristol, 2018; Fairclough, 2004; Fultz, 2004; Kang, 2020). These are the system parameters within which prospective educators operate *as individuals* and one lens through which research about the educator pipeline must be understood. For those sharing a policy interest in vibrant Black teacher corps, the work here reinforces the conclusion that schools that include significant communities of Black families, students, and educators carry essential features that warrant our ongoing commitment and investment (Bell, 2004). Supported by the reinforcing effects of Black-faculty traditions, these communities may offer the flywheel for the ongoing project of representational gains, including providing support networks that extend beyond faculty peers in individual schools (e.g., Black Male Educators Alliance, 2023) and model the broader capacities of teaching likely essential to expanded recruitment (Lac, 2022).

A central focus of work going forward, however, must be centered on the growing racial complexity of residential and school-going patterns and the essential need to understand and acknowledge the challenges of diversity in suburban teacher pipelines. Future work should investigate several factors. First, what are perceived teacher and teaching differences across contexts? In particular, I continue to encourage interest in exploring dimensions of teacher efficacy given anticipated efficacy's centrality to career decision. The contextualizing work done in this paper, for

example, reveals a sensitivity of postsecondary teaching activity to own-school student achievement levels while school administrator use of (ultimately job-threatening) low teacher evaluation ratings has no effect. What, then, are prospective teachers' career goals? How do they evaluate their own-schools' effectuation of these goals? How do these processes inform their projections for own efficacy and risk? Do they associate school effectiveness with teachers and teaching? If so, do they invoke individual teacher models, sub-groups of teachers, or teaching as a broad institution? Do they, in fact, identify with any of these individuals, groups, or the school? This is to say, is there predictive alignment between prospective teachers' own goals and evaluated school effectiveness predictive of teaching career choice?

Within emergent career choice models, then, alignment of occupational- and self-concept would establish a coherency consistent with teaching choice. We should imagine multiple coherencies. Is there, for example, an academic-centric teaching efficacy model that is broadly applicable across racial context, urbanicity, and other school features? (Relatedly, is the national phenomenon of protracted declines in teaching interest a crisis of confidence in the technology of teaching itself?) Alternatively, is there an alternative coherency of school community? Of cultural reproduction and/or sustenance? Of social justice?

These prospective teacher career stories (career coherencies and incoherencies) may reveal the mechanisms which implicate the results here. Perhaps the Black-faculty proportion phenomenon reported here is operationally as simple as a condition where sufficient (quantitative) exposure to Black faculties (rather than idiosyncratic relationships with Black teachers) subverts a binding vocational stereotype that teachers and teaching are typically White. If this is the case, dislocation of Black teaching traditions provides profound risk to the pipeline of future Black educators. My emphasis on the centrality of altruism in career decisions, however, offers an alternative mechanism where prospective teachers evaluate their capacity to effectuate desirable school outcomes. Here

policy prescriptions (including Grow Your Own initiatives (e.g., Michigan Department of Education, 2023)) may best center on engaging structural phenomena and facilitating prospective teachers' evaluation of their own capacities vis a vis academic achievement, equity, and social justice (Lac, 2022; Lightfoot & White, 2022). In particular, pipeline initiatives that seek to reduce barriers to teaching should be sensitive to not just to internal goals to meet staffing levels, but should also likely be integrated with visions of operative faculties and teaching that align with and sustain the motivation of prospective teachers.

Within this work we need to allow that Black faculties (*and the individuals that choose to join them*) effect broad organizational change sufficient to heighten teaching interest. We need to allow that prospective and new educators are already sophisticated actors choosing to join the contexts that they see effective. If so, can those faculties' priorities and capacities be understood and transferred to other contexts where prospective Black educators experience and evaluate their own talents and the affordances of K12 teaching? Moreover, I emphasize again the results from Table 3.1 that implicate symmetric questions about the desirability of teaching in high-Black faculty proportion schools. Unadjusted Black postsecondary pre-teaching rates are strikingly similar across qualitative Black-faculty proportion conditions which, in turn, span broad differences in urbanicity and other school contexts. The context-dependent high-Black-faculty proportion effect identified here therefore compensates for a broader, complex story associated with depressed interest in teaching. What are those stories and how can policy and practices mitigate them?

Finally, I encourage an extension of two key approaches. First, the postsecondary data used here are powerful in that they reveal real career choice. This (costly) action of investment in postsecondary study by students is inherently different than a (costless) survey response and offers an opportunity to link K12 environmental factors broadly to other career decisions (e.g., comparative rates of study in engineering). These same data, however, can also guide the processes

of theory building I outline above – especially in locating inquiry. Which career models of teaching coherence are modally descriptive and which models apply to school contexts exceptional to underlying trends? That is, which schools with lower rates of Black-faculty proportion also have strong traditions of new Black teacher emergence? Which schools with high Black-faculty proportion have few teachers emerging from their college-bound cohorts? Second, we should locate more of our teacher pipeline work in K12 schools. Despite the advancement in alternative preparation programs and pathways, educators still predominantly begin teaching study immediately or shortly after high school. Beyond the theory and evidence presented here that these contexts may strongly inform teaching choice, these K12 environments are ideally situated to allow interrogation of the information, decisions, and related mechanisms driving not just the motivations of those who decide to teach, but, perhaps more importantly those who don't (Kyriacou & Coulthard, 2000). Evaluation studies of increasingly popular grow your own programs (e.g., Leech et al., 2019) will pull inquiry in this direction, but the broader project of understanding and enhancing the teacher pipeline should always seek proximity to prospective teachers' complex and socialized decisions to teach or not teach.

REFERENCES

ACT Inc. (2016). *The Condition of Future Educators 2015*. Retrieved from http://www.act.org/content/dam/act/unsecured/documents/Future-Educators-2015.pdf

Altman, M. (2005). The ethical economy and competitive markets: Reconciling altruistic, moralistic, and ethical behavior with the rational economic agent and competitive markets. *Journal of Economic Psychology, 26*(5), 732-757. doi:https://doi.org/10.1016/j.joep.2005.06.004

Angrist, J. D., & Lang, K. (2004). Does School Integration Generate Peer Effects? Evidence from Boston's Metco Program. *The American Economic Review, 94*(5), 1613-1634.

Angrist, J. D., & Pischke, J.-S. (2008). *Mostly harmless econometrics: An empiricist's companion*: Princeton university press.

Arsen, D., & DeLuca, T. (2016). Which Districts Get Into Financial Trouble and Why: Michigan's Story. *Journal of Education Finance, 42*(2), 100-126.

Arsen, D., & Mason, M. L. (2013). Seeking accountability through state-appointed emergency district management. *Educational Policy, 27*(2), 248-278.

Bacolod, M. P. (2007). Do alternative opportunities matter? The role of female labor markets in the decline of teacher quality. *The Review of Economics and Statistics, 89*(4), 737-751. doi:10.1162/rest.89.4.737

Barak, A. (2001). A Cognitive View of the Nature of Vocational Interests: Implications for Career Assessment, Counseling, and Research. In F. T. L. Leong & A. Barak (Eds.), *Contemporary Models in Vocational Psychology*. Mahwah, NJ: Lawrence Erlbaum Associates.

Bartanen, B., & Grissom, J. A. (2019). *School Principal Race and the Hiring and Retention of Racially Diverse Teachers (EdWorkingPaper No. 19-59).* Retrieved from Annenberg Institute at Brown University: https://edworkingpapers.com/sites/default/files/ai19-59.pdf

Bartanen, B., Kwok, A., Avitabile, A., & Kim, B. H. (2023). Why Do You Want to Be a Teacher? A Natural Language Processing Approach.

Bassett-Jones, N., & Lloyd, G. C. (2005). Does Herzberg's motivation theory have staying power? *Journal of management development, 24*(10), 929-943.

Bell, D. (2004). *Silent covenants: Brown v. Board of Education and the unfulfilled hopes for racial reform*: Oxford University Press.

Bell Jr, D. A. (1977). The Legacy of WEB DuBois: A Rational Model for Achieving Public School Equity for America's Black Children. *Creighton L. Rev., 11*, 409.

Black Male Educators Alliance. (2023). What we do. Retrieved from https://blackmaleeducatorsalliance.org/our-team/

Bowen, D. H., Buck, S., Deck, C., Mills, J. N., & Shuls, J. V. (2015). Risky business: an analysis of teacher risk preferences. *Education Economics, 23*(4), 470-480. doi:10.1080/09645292.2014.966062

Bowsher, A., Bill, K., Malen, B., Saltmarsh, J., Brown, T. M., & Rice, J. K. (2023). *Mixed messages: The role of social messages in undergraduate prospective teachers' intent to teach*. Paper presented at the American Educational Research Association, Chicago.

Boyd, D., Lankford, H., Loeb, S., & Wyckoff, J. (2005). The Draw of Home: How Teachers' Preferences for Proximity Disadvantage Urban Schools. *Journal of Policy Analysis and Management, 24*(1), 113-132.

Boyd-Swan, C., & Herbst, C. M. (2019). Racial and ethnic discrimination in the labor market for child care teachers. *Educational Researcher, 48*(7), 394-406. doi:10.3102%2F0013189X19867941

Bristol, T. J. (2015). Teaching boys: towards a theory of gender-relevant pedagogy. *Gender & Education, 27*, 53-68. doi:10.1080/09540253.2014.986067

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. doi:10.1177/0042085917697200

Bristol, T. J., & B. Goings, R. (2018). Exploring the Boundary-Heightening Experiences of Black Male Teachers: Lessons for Teacher Education Programs. *Journal of Teacher Education, 0*(0), 0022487118789367. doi:10.1177/0022487118789367

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. doi:10.3102%2F0002831218804806

Brockenbrough, E. (2015). "The Discipline Stop" Black Male Teachers and the Politics of Urban School Discipline. *Education and Urban Society, 47*(5), 499-522.

Brown, D. (2002). Introduction to Theories of Career Development. Origins, Evolution and Current Efforts. In D. Brown (Ed.), *Career Choice and Development*. San Francisco: Jossey-Bass.

Brummet, Q. (2014). The effect of school closings on student achievement. *Journal of Public Economics, 119*, 108-124. doi:https://doi.org/10.1016/j.jpubeco.2014.06.010

Brunner, E., Cowen, J. M., Strunk, K. O., & Drake, S. (2019). Teacher Labor Market Responses to Statewide Reform: Evidence From Michigan. *Educational Evaluation and Policy Analysis, 41*(4), 403-425. doi:10.3102/0162373719858997

Carlson, D., & Cowen, J. M. (2014). Student Neighborhoods, Schools, and Test Score Growth Evidence from Milwaukee, Wisconsin. *Sociology of Education*, 0038040714561801.

Carruthers, C. K. (2009). *Faculty Composition and Student Achievement in Charter Schools.* (PhD), University of Florida.

Carter Andrews, D. J. (2012). Black achievers' experiences with racial spotlighting and ignoring in a predominantly White high school. *Teachers College Record, 114*(10), 1-46.

Carter Andrews, D. J., Brown, T., Castro, E., & Id-Deen, E. (2019). The Impossibility of Being "Perfect and White": Black Girls' Racialized and Gendered Schooling Experiences. *American Educational Research Journal, 56*(6), 2531-2572. doi:10.3102/0002831219849392

Carter Andrews, D. J., Castro, E., Cho, C. L., Petchauer, E., Richmond, G., & Floden, R. (2019). Changing the Narrative on Diversifying the Teaching Workforce: A Look at Historical and Contemporary Factors That Inform Recruitment and Retention of Teachers of Color. *Journal of Teacher Education, 70*, 6+. doi:10.1177%2F0022487118812418

Carter, D. J. (2007). Why the Black kids sit together at the stairs: The role of identity-affirming counter-spaces in a predominantly White high school. *The Journal of Negro Education*, 542-554.

Cheatham, H. E. (1990). Africentricity and career development of African Americans. *Career Development Quarterly, 38*(4), 334. doi:10.1002/j.2161-0045.1990.tb00223.x

Cheng, D. A. (2019). Teacher Racial Composition and Exclusion Rates Among Black or African American Students. *Education and Urban Society, 51*(6), 822-847. doi:10.1177/0013124517748724

Cherng, H.-Y. S., & Halpin, P. F. (2016). The importance of minority teachers: Student perceptions of minority versus White teachers. *Educational Researcher, 45*(7), 407-420.

Chronical Guidance Inc. (2019). Chronical Career Library Arranged by Holland Code. Retrieved from http://www.chroniclecareerlibrary.com/CGP/CGP/2ndpghoc.html

Clewell, B. C., & Villegas, A. M. (1998). Diversifying the Teaching Force To Improve Urban Schools: Meeting the Challenge. Introduction. *Education and Urban Society, 31*(1), 3-17.

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2006). Teacher-Student Matching and the Assessment of Teacher Effectiveness. *The Journal of Human Resources, 41*(4), 778-820.

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2007a). *How and why do teacher credentials matter for student achievement?* Retrieved from https://www.nber.org/papers/w12828.pdf

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2007b). Teacher credentials and student achievement: Longitudinal analysis with student fixed effects. *Economics of Education Review, 26*(6), 673-682. doi:https://doi.org/10.1016/j.econedurev.2007.10.002

Cohen, D. K., Raudenbush, S. W., & Ball, D. L. (2003). Resources, instruction, and research. *Educational Evaluation and Policy Analysis, 25*(2), 119-142.

Corcoran, S. P., Evans, W. N., & Schwab, R. S. (2004). Changing labor market opportunities for women and the quality of teachers 1957-1992. *American Economic Review, 94*, 230-235. doi:10.1257/0002828041301920

Cowan, J., Goldhaber, D., Hayes, K., & Theobald, R. (2016). Missing elements in the discussion of teacher shortages. *Educational Researcher*, 0013189X16679145.

Croft, M., Guffy, G., & Vitale, D. (2018). *Encouraging more high school students to consider teaching.* Retrieved from https://www.act.org/content/dam/act/unsecured/documents/pdfs/Encouraging-More-HS-Students-to-Consider-Teaching.pdf

D'amico, D., Pawlewicz, R. J., Earley, P. M., & McGeehan, A. P. (2017). Where Are All the Black Teachers? Discrimination in the Teacher Labor Market. *Harvard Educational Review, 87*(1), 26-49. doi:10.17763/1943-5045-87.1.26

Deci, E. L., & Ryan, R. M. (2000). The "What" and "Why" of Goal Pursuits: Human Needs and the Self-Determination of Behavior. *Psychological Inquiry, 11*(4), 227-268.

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

Dee, T. S. (2005). A teacher like me: Does race, ethnicity, or gender matter? *American Economic Review, 95*(2), 158-165.

Diem, S., Welton, A. D., Frankenberg, E., & Jellison Holme, J. (2016). Racial diversity in the suburbs: how race-neutral responses to demographic change perpetuate inequity in suburban school districts. *Race Ethnicity and Education, 19*(4), 731-762. doi:10.1080/13613324.2014.946485

Disatnik, D., & Sivan, L. (2016). The multicollinearity illusion in moderated regression analysis. *Marketing Letters, 27*(2), 403-408. doi:10.1007/s11002-014-9339-5

Dolton, P. J. (2006). Teacher supply. *Handbook of the Economics of Education 2*, 1079-1161.

Drake, S. (2023). Paper 2 of Dissertation: Title TBD. In S. Drake (Ed.), *Dissertation Title: TBD.*

Drake, S., Auletto, A., & Cowen, J. M. (2019). Grading Teachers: Race and Gender Differences in Low Evaluation Ratings and Teacher Employment Outcomes. *American Educational Research Journal, 56*(5), 1800-1833. doi:10.3102/0002831219835776

Drake, S., & Cowen, J. (2022). Deurbanization and the Struggle to Sustain a Black Teaching Corps: Evidence From Michigan. *Educational Researcher, 51*(1), 27-39. doi:10.3102/0013189x211051312

Duke Sanford Center for Child and Family Policy. (2019). North Carolina Education Research Data Center. Retrieved from https://childandfamilypolicy.duke.edu/research/nc-education-data-center/

Eccles, J. (2009). Who Am I and What Am I Going to Do With My Life? Personal and Collective Identities as Motivators of Action. *Educational Psychologist, 44*(2), 78-89. doi:10.1080/00461520902832368

Edwards, D. S. (2019). *Who chooses? Charter and non-resident school enrollment in Michigan*. Retrieved from https://epicedpolicy.org/wp-content/uploads/2019/06/EPIC_Choice_Policy_Brief_June2019.pdf

Edwards, D. S. (2020). *Just out of reach? Unrestrained supply, constrained demand, and access to effective schools in and around Detroit*.

Egalite, A. J. (2018). where race match literature is going or some such.

Egalite, A. J., Kisida, B., & Winters, M. A. (2015). Representation in the classroom: The effect of own-race teachers on student achievement. *Economics of Education Review, 45*, 44-52. doi:https://doi.org/10.1016/j.econedurev.2015.01.007

Ehrenberg, R. G., Goldhaber, D. D., & Brewer, D. J. (1995). Do teachers' race, gender, and ethnicity matter? Evidence from the National Educational Longitudinal Study of 1988. *ILR Review, 48*(3), 547-561.

El-Mekki, S. (2021). Teaching while Black: An open letter to school leaders. *Educational Leadership, 78*(December 2020/January 2021), 40-44.

Elfers, A. M., Plecki, M. L., St John, E., & Wedel, R. (2008). Undergraduates' views of K-12 teaching as a career choice. *Retrieved from Seattle, WA*.

Ethridge, S. B. (1979). Impact of the 1954 Brown vs. Topeka Board of Education decision on Black educators. *The Negro Educational Review, 30*(4), 217.

Fairclough, A. (2004). The costs of Brown: Black teachers and school integration. *The Journal of American History, 91*(1), 43-55.

Fairlie, R. W., Hoffmann, F., & Oreopoulos, P. (2014). A community college instructor like me: Race and ethnicity interactions in the classroom. *American Economic Review, 104*(8), 2567-2591.

Flyer, F., & Rosen, S. (1997). The New Economics of Teachers and Education. *Journal of Labor Economics, 15*(1, Part 2), S104-S139. doi:10.1086/209858

Frank, K. A., Maroulis, S. J., Duong, M. Q., & Kelcey, B. M. (2013). What would it take to change an inference? Using Rubin's causal model to interpret the robustness of causal inferences. *Educational Evaluation and Policy Analysis, 35*(4), 437-460.

Fryer Jr, R. G., & Levitt, S. D. (2004). Understanding the black-white test score gap in the first two years of school. *Review of Economics and Statistics, 86*(2), 447-464.

Fuller, B., Kim, Y., Galindo, C., Bathia, S., Bridges, M., Duncan, G. J., & García Valdivia, I. (2019). Worsening School Segregation for Latino Children? *Educational Researcher, 48*(7), 407-420. doi:10.3102/0013189x19860814

Fultz, M. (2004). The Displacement of Black Educators Post-Brown: An Overview and Analysis. *History of Education Quarterly, 44*(1), 11-45.

Gershenson, S. (2019). *Student-Teacher Race Match in Charter and Traditional Public Schools*. Retrieved from Washington DC: https://fordhaminstitute.org/national/research/student-teacher-race-match-charter-and-traditional-public-schools

Gershenson, S., Hansen, M., & 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., Lindsay, C. A., & Papageorge, N. W. (2017). *The long-run impacts of same-race teachers*. Retrieved from Bonn: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2940620

Gershenson, S., Hart, C. M. D., 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. doi:10.1257/pol.20190573

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.

Giesselmann, M., & Schmidt-Catran, A. W. (2020). Interactions in Fixed Effects Regression Models. *Sociological Methods & Research, 0*(0), 0049124120914934. doi:10.1177/0049124120914934

Gist, C. D., & Bristol, T. J. (2022). *Handbook of research on Teachers of Color and Indigenous Teachers*: American Educational Research Association.

Goings, R. B., & Bianco, M. (2016). It's Hard To Be Who You Don't See: An Exploration of Black Male High School Students' Perspectives on Becoming Teachers. *The Urban Review: Issues and Ideas in Public Education, 48*(4), 628-646. doi:10.1007/s11256-016-0371-z

Goldhaber, D., Theobald, R., & Tien, C. (2017). *The theoretical and empirical arguments for diversifying the teacher workforce: A review of the evidence*. Retrieved from

Gordon, J. A. (1994). Why students of color are not entering teaching: Reflections from minority teachers. *Journal of Teacher Education, 45*(5), 346-353.

Gordon, J. A. (2002a). *The color of teaching*: Routledge.

Gordon, J. A. (2002b). The Color of Teaching Revisited. *Multicultural Perspectives, 4*(2), 3-7. doi:10.1207/S15327892MCP0402_2

Gottfredson, G. D., & Holland, J. L. (1996). *Dictionary of the Holland Occupational Codes* (3rd ed.). Odessa FL: Pychological Assessment Resources.

Gottfredson, L. S. (2002). Gottfredson's Theory of Circumscription, Compromise, and Self-Creation. In D. Brown (Ed.), *Career Choice and Development*. San Francisco: Jossey Bass.

Grissom, J. A., & Keiser, L. R. (2011). A supervisor like me: Race, representation, and the satisfaction and turnover decisions of public sector employees. *Journal of Policy Analysis and Management, 30*(3), 557-580.

Grissom, J. A., Kern, E. C., & Rodriguez, L. A. (2015). The "Representative Bureaucracy" in Education: Educator Workforce Diversity, Policy Outputs, and Outcomes for Disadvantaged Students. *Educational Researcher, 44*(3), 185-192.

Grissom, J. A., & Redding, C. (2015). Discretion and disproportionality: Explaining the underrepresentation of high-achieving students of color in gifted programs. *AERA Open, 2*(1), 2332858415622175.

Grissom, J. A., Rodriguez, L. A., & Kern, E. C. (2017). Teacher and Principal Diversity and the Representation of Students of Color in Gifted Programs: Evidence from National Data. *The Elementary School Journal, 117*(3), 396-422. doi:10.1086/690274

Guarino, C. M., Santibañez, L., & Daley, G. A. (2006). Teacher Recruitment and Retention: A Review of the Recent Empirical Literature. *Review of educational research, 76*(2), 173-208.

Hall, M., Tach, L., & Lee, B. A. (2016). Trajectories of ethnoracial diversity in American communities, 1980–2010. *Population and Development Review, 42*(2), 271. doi:10.1111/j.1728-4457.2016.00125.x

Halvorsen, A.-L., & Mirel, J. E. (2013). Intercultural education in Detroit, 1943–1954. *Paedagogica Historica, 49*(3), 361-381. doi:10.1080/00309230.2012.739180

Hanushek, E. A., Kain, J. F., O'Brien, D. M., & Rivkin, S. G. (2005). *The market for teacher quality* (0898-2937). Retrieved from https://www.nber.org/papers/w11154.pdf

Hanushek, E. A., Kain, J. F., & Rivkin, S. G. (2004). Why Public Schools Lose Teachers. *The Journal of Human Resources, 39*(2), 326-354. doi:10.2307/3559017

Harris, D. N., & Adams, S. J. (2007). Understanding the level and causes of teacher turnover: A comparison with other professions. *Economics of Education Review, 26*(3), 325-337. doi:http://dx.doi.org/10.1016/j.econedurev.2005.09.007

Herzberg, F. (1987). One more time: how do you motivate employees? [with retrospective commentary]. *Harvard Business Review, 65*(5), 109-120.

Herzberg, F., Masuner, B., & Snyderman, B. (1959). *The Motivation to Work*. New York: Wiley.

Holt, S. B., & Gershenson, S. (2015). The impact of teacher demographic representation on student attendance and suspensions. *IZA Discussion Paper Series*. Retrieved from http://ftp.iza.org/dp9554.pdf

Hopkins, B., Kilbride, T., & Strunk, K. O. (2021). Trends in Michigan's K-12 Public School Teaching Workforce. Retrieved from https://epicedpolicy.org/wp-content/uploads/2021/05/Teacher_Workforce_Pol_Brief_May2021.pdf

Hoxby, C. (2000). *Peer effects in the classroom: Learning from gender and race variation*. Retrieved from https://www.nber.org/papers/w7867

Hui, T. K. (2019, January 31, 2019). NC charter schools have nearly doubled since 2011. Some say it's time for a new cap. *The News & Observer*. Retrieved from https://www.newsobserver.com/news/politics-government/article225299125.html

Ingersoll, R. M. (2001). Teacher turnover and teacher shortages: An organizational analysis. *American Educational Research Journal, 38*(3), 499-534.

Jacinto, A., & Gershenson, S. (2019). The intergenerational Transmission of Teaching, No. 12201. *Institute of Labor Economics Discussion Papers*.

Jackson, C. K. (2009). Student Demographics, Teacher Sorting, and Teacher Quality: Evidence from the End of School Desegregation. *27*(2), 213-256. doi:10.1086/599334

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.

Johnson, M. K., & Mortimer, J. t. (2002). Career Choice and Development from a Sociological Perspective. In D. Brown (Ed.), *Career Choice and Development*. San Francisco: Jossey-Bass.

Jones, D. R. (1964, 05/12/
1964 May 12). Detroit teachers back Federation: Reject N.E.A. affilliation in vote on representation. *New York Times* p. 34. Retrieved from http://ezproxy.msu.edu/login?url=https://www.proquest.com/historical-newspapers/detroit-teachers-back-federation/docview/115788110/se-2?accountid=12598
http://za2uf4ps7f.search.serialssolution.com/?ctx_ver=Z39.88-2004&ctx_enc=info:ofi/enc:UTF-8&rfr_id=info:sid/ProQ%3Ahnpnewyorktimes:115788110&rft_val_fmt=info:ofi/fmt:kev:mtx:journal&rft.genre=article&rft.jtitle=New+York+Times+%281923-Current+file%29&rft.atitle=DETROIT+TEACHERS+BACK+FEDERATION%3A+REJECT+N.E.A.+AFFILIATION+IN+VOTE+ON+REPRESENTATION&rft.au=By+DAVID+R.+JONESSpecial+to+The+New+York+Times&rft.aulast=By+DAVID+R.+JONESSpecial+to+The+New+York+Times&rft.aufirst=&rft.date=1964-05-12&rft.volume=&rft.issue=&rft.spage=34&rft.isbn=&rft.btitle=&rft.title=New+York+Times+%281923-Current+file%29&rft.issn=03624331&rft_id=info:doi/&ProQDocID=115788110

Joshi, E., Doan, S., & Springer, M. G. (2018). Student-Teacher Race Congruence: New Evidence and Insight From Tennessee. *AERA Open, 4*(4), 2332858418817528.

Kane, T. (2018, October 15, 2018). Develop and Validate — Then Scale. Lessons from the Gates Foundation's Effective Teaching Strategy. *Education Next*. Retrieved from https://www.educationnext.org/develop-validate-scale-lessons-gates-foundation-effective-teaching-strategy/

Kang, L. (2020). *Dismantled: The Breakup of an Urban School System: Detroit, 1980-2016*: Teachers College Press.

Kanter, R. M. (1977). Some Effects of Proportions on Group Life: Skewed Sex Ratios and Responses to Token Women. *American Journal of Sociology, 82*(5), 965-990.

Kelly, H. (2007). Racial Tokenism in the School Workplace: An Exploratory Study of Black Teachers in Overwhelmingly White Schools. *Educational Studies, 41*(3), 230-254. doi:10.1080/00131940701325712

King, S. H. (1993). Why Did We Choose Teaching Careers and What Will Enable Us to Stay?: Insights from One Cohort of the African American Teaching Pool. *The Journal of Negro Education, 62*(4), 475-492. doi:10.2307/2295518

Kohli, R. (2018). Behind School Doors: The Impact of Hostile Racial Climates on Urban Teachers of Color. *Urban Education, 53*(3), 307-333. doi:10.1177/0042085916636653

Kohli, R. (2019). Lessons for Teacher Education: The Role of Critical Professional Development in Teacher of Color Retention. *Journal of Teacher Education, 70*(1), 39-50. doi:10.1177/0022487118767645

Kraft, M. A., Brunner, E. J., Dougherty, S. M., & Schwegman, D. J. (2020). Teacher accountability reforms and the supply and quality of new teachers. *Journal of Public Economics, 188*, 104212. doi:https://doi.org/10.1016/j.jpubeco.2020.104212

Kyriacou, C., & Coulthard, M. (2000). Undergraduates' views of teaching as a career choice. *Journal of education for Teaching, 26*(2), 117-126.

Lac, V. T. (2022). A teacher action research study on Critical Hope in a teacher pipeline program for minoritized youth. In C. D. Gist & T. J. Bristol (Eds.), *Handbook of research on Teachers of Color and Indigenous Teachers* (pp. 67-78): American Educational Research Association.

Ladson-Billings, G. (2009). *The dreamkeepers: Successful teachers of African American children*: John Wiley & Sons.

Ladson-Billings, G. (2014). Culturally relevant pedagogy 2.0: aka the remix. *Harvard Educational Review, 84*(1), 74-84. doi:10.17763/haer.84.1.p2rj131485484751

Leath, S., Mathews, C., Harrison, A., & Chavous, T. (2019). Racial Identity, Racial Discrimination, and Classroom Engagement Outcomes Among Black Girls and Boys in Predominantly Black and Predominantly White School Districts. *American Educational Research Journal, 56*(4), 1318-1352. doi:10.3102/0002831218816955

Lee, V. E., & Bryk, A. S. (1988). Curriculum tracking as mediating the social distribution of high school achievement. *Sociology of Education*, 78-94.

Leech, N. L., Haug, C. A., & Bianco, M. (2019). Understanding Urban High School Students of Color Motivation to Teach: Validating the FIT-Choice Scale. *Urban Education, 54*(7), 957-983. doi:10.1177/0042085915623338

Lent, R. W., Brown, S. D., & Hackett, G. (2002). Social Cognitive Career Theory. In D. Brown (Ed.), *Career Choice and Development*. San Francisco: Jossey Bass.

Leong, F. T. L., & Brown, M. T. (1995). Theoretical Issues in Cross-Cultural Career Development: Cultural Validity and Cultural Specificity. In W. B. Walsh & S. H. Osipow (Eds.), *Handbook of Vocational Psychology*. Mahwah, NJ: Lawrence Erlbaum.

Leong, F. T. L., & Serafica, F. C. (2001). Cross-Cultural Perspective on Super's Career Development Theory: Career Maturity and Cultural Accomodation. In F. T. L. Leong & A. Barak (Eds.), *Contemporary Models in Vocational Psychology* (pp. 167-206). Mahweh, NJ: Lawrence Erlbaum.

Lieberson, S. (1980). *A piece of the pie: Blacks and white immigrants since 1880*: Univ of California Press.

Lightfoot, B. A., & White, T. C. (2022). Critical pedagogy in a GYO program: Idenity, sociopolitical development, and transformational resistestance In Latinx students' aspirations to teach. In C. D. Gist & T. J. Bristol (Eds.), *Handbook of research on Teachers of Color and Indigenous Teachers* (pp. 79-96): American Educational Research Association.

Lim, H. H. (2006). Representative bureaucracy: Rethinking substantive effects and active representation. *J Public administration review, 66*(2), 193-204.

Lindsay, C. A., Blom, E., & Tilsley, A. (2017). *Diversitfying the Classroom: Examining the Teacher Pipeline*. Retrieved from https://www.urban.org/features/diversifying-classroom-examining-teacher-pipeline

Lindsay, C. A., & Hart, C. M. D. (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. doi:10.3102/0162373717693109

Long, M. C., Goldhaber, D., & Huntington-Klein, N. (2015). Do completed college majors respond to changes in wages? *Economics of Education Review, 49*, 1-14. doi:https://doi.org/10.1016/j.econedurev.2015.07.007

Lortie, D. C. (1977). Schoolteacher: A sociological study.

Mabokela, R. O., & Madsen, J. (2003a). Crossing Boundaries: African American Teachers in Suburban Schools. *Comparative Education Review, 47*(1), 90-111. doi:10.1086/345838

Mabokela, R. O., & Madsen, J. (2003b). Intergroup Differences and their Impact on African American Teachers. *Urban Education, 38*(6), 725-749. doi:10.1177/0042085903257091

Madsen, J., & Mabokela, R. O. (2000). Organizational Culture and Its Impact on African American Teachers. *American Educational Research Journal, 37*(4), 849-876. doi:10.2307/1163495

Markowitz, A. J., Bassok, D., & Grissom, J. A. (2020). Teacher-child racial/ethnic match and parental engagement with Head Start. *American Educational Research Journal, 57*(5), 2132-2174.

Markus, H. (1977). Self-schemata and processing information about the self. *Journal of personality and social psychology, 35*(2), 63-78.

Martin, M. J. R., Matthews, S. A., & Lee, B. A. (2017). The Spatial Diffusion of Racial and Ethnic Diversity Across U.S. Counties. *Spatial demography, 5*(3), 145-169. doi:10.1007/s40980-016-0030-8

McKinney de Royston, M., Madkins, T. C., Givens, J. R., & Nasir, N. i. S. (2020). "I'm a Teacher, I'm Gonna Always Protect You": Understanding Black Educators' Protection of Black Children. *American Educational Research Journal, 0*(0), 0002831220921119. doi:10.3102/0002831220921119

Meir, E. I., & Tziner, A. (2001). Cross-Cultural Assessment of Interests. In F. T. L. Leong & A. Barak (Eds.), *Contemporary Models in Vocational Psychology* (pp. 133-166). Mahweh, NJ: Lawrence Erlbaum.

Michigan Department of Education. (2023). Future Proud Michigan Educator Staff Grant. Retrieved from https://www.michigan.gov/mde/services/ed-serv/educator-recruitment/future-proudmieducator/individuals-working-in-pk12-schools/staff-grant

Michigan Education Data Center. (2020). *K12 Student and Staff Data*. Retrieved from: https://medc.miedresearch.org

Michigan Education Data Center. (2023). *State of Michigan K12 administrative data*. Retrieved from: https://medc.miedresearch.org

Mirel, J. (1999). *The rise and fall of an urban school system: Detroit, 1907-81* (Second ed.). Ann Arbor: University of Michigan Press.

Montecinos, C., & Nielsen, L. E. (1997). Gender and cohort differences in university students' decisions to become elementary teacher education majors. *Journal of Teacher Education, 48*, 47+.

National Academies of Sciences, E., & Medicine. (2020). *Changing Expectations for the K-12 Teacher Workforce: Policies, Preservice Education, Professional Development, and the Workplace* (978-0-309-49900-2). Retrieved from Washington, DC: https://www.nap.edu/catalog/25603/changing-expectations-for-the-k-12-teacher-workforce-policies-preservice

National Center for Education Statistics. (2020). Elementary/Secondary Information System. Retrieved from https://nces.ed.gov/ccd/elsi/

National Center for Educational Statistics. (2019). *Spotlight A: Characteristics of Public School Teachers by Race and Ethnicity*. Retrieved from https://nces.ed.gov/programs/raceindicators/spotlight_a.asp

National Center for Educational Statistics. (2020). Schools and Staffing Survey. https://nces.ed.gov/surveys/sass/tables.asp

Nelson, J. D. (2016). Relational Teaching with Black Boys: Strategies for Learning at a SingleSex Middle School for Boys of Color. *Teachers College Record, 118*(6), 1-27. doi:10.1177/016146811611800608

Nelson, J. L. (2019). How Organizational Minorities Form and Use Social Ties: Evidence from Teachers in Majority-White and Majority-Black Schools. *American Journal of Sociology, 125*(2), 382-430. doi:10.1086/705158

Neugebauer, M. (2015). Who chooses teaching under different labor market conditions? Evidence from West Germany, 1980–2009. *Teaching and Teacher Education, 45*, 137-148. doi:https://doi.org/10.1016/j.tate.2014.10.004

Nicholson-Crotty, S., Grissom, J. A., Nicholson-Crotty, J., & Redding, C. (2016). Disentangling the causal mechanisms of representative bureaucracy: Evidence from assignment of students to gifted programs. *Journal of Public Administration Research and Theory, 26*(4), 745-757.

Oakley, D., Stowell, J., & Logan, J. R. (2009). The impact of desegregation on black teachers in the metropolis, 1970–2000. *Ethnic and Racial Studies, 32*(9), 1576-1598. doi:10.1080/01419870902780997

Ocasio, K. M. (2014). Nuestro camino: a review of literature surrounding Latino teacher pipeline. *Journal of Latinos and Education, 13*(4), 244-261.

Office of Postsecondary Education. (2020). Title II Reports. https://title2.ed.gov/Public/Home.aspx

Office of Postsecondary Education. (2023). Title II Reports. from U.S. Department of Education https://title2.ed.gov/Public/Home.aspx

Ouazad, A. (2014). Assessed by a Teacher Like Me: Race and Teacher Assessments. *Education Finance and Policy, 9*(3), 334-372. doi:10.1162/EDFP_a_00136

Parham, T. A., & Helms, J. E. (1981). The influence of Black students' racial identity attitudes on preferences for counselor's race. *Journal of Counseling Psychology, 28*(3), 250.

Paris, D., & Alim, H. S. (2014). What are we seeking to sustain through culturally sustaining pedagogy? A loving critique forward. *Harvard Educational Review, 84*(1), 85-100.

Perry, T. (1975). *History of the American Teachers Association*. Washington, DC: National Education Association.

Peterson, G. W., Jr., J. P. S., Lenz, J. G., & Reardon, R. C. (2002). A Cognitive Information Processing Approach to Career Problem Solving and Decision Making. In D. Brown (Ed.), *Career Choice and Development*. San Francisco: Jossey Bass.

Phi Delta Kappan. (2019). *The 51st Annual PDK Poll of the Public's Attitudes Toward Public Schools*. Retrieved from https://pdkpoll.org/perspectives

Pizarro, M., & Kohli, R. (2019). "I Stopped Sleeping": Teachers of Color and the Impact of Racial Battle Fatigue. *Urban Education, 0*(0), 0042085918805788. doi:10.1177/0042085918805788

Podgursky, M., Monroe, R., & Watson, D. (2004). The academic quality of public school teachers: An analysis of entry and exit behavior. *Economics of Education Review, 23*(5), 507-518.

Reardon, S. F., & Owens, A. (2014). 60 Years After Brown: Trends and Consequences of School Segregation. *Annual Review of Sociology, 40*(1), 199-218. doi:10.1146/annurev-soc-071913-043152

Redding, C. (2019). A Teacher Like Me: A Review of the Effect of Student–Teacher Racial/Ethnic Matching on Teacher Perceptions of Students and Student Academic and Behavioral Outcomes. *Review of educational research, 89*(4), 499-535. doi:10.3102/0034654319853545

Rentner, D. S., Kober, N., Frizzell, M., & Ferguson, M. (2016). Listen to Us: Teacher Views and Voices. *Center on Education Policy*.

Richardson, P. W., & Watt, H. M. G. (2006). Who Chooses Teaching and Why? Profiling Characteristics and Motivations Across Three Australian Universities. *Asia-Pacific Journal of Teacher Education, 34*(1), 27-56. doi:10.1080/13598660500480290

Ronfeldt, M., Kwok, A., & Reininger, M. (2014). Teachers' Preferences to Teach Underserved Students. *Urban Education, 51*(9), 995-1030. doi:10.1177/0042085914553676

Rosen, S. (1986). Chapter 12 The theory of equalizing differences *Handbook of Labor Economics* (Vol. 1, pp. 641-692): Elsevier.

Rosenberg, J. M., Xu, R., Lin, Q., & Frank, K. A. (2022). Konfound-It!: Quantify the Robustness of Causal Inferences. Retrieved from http://konfound-it.com.

Schmidt, W. H., Burroughs, N. A., Zoido, P., & Houang, R. T. (2015). The Role of Schooling in Perpetuating Educational Inequality:An International Perspective. *Educational Researcher, 44*(7), 371-386. doi:10.3102/0013189x15603982

Shieh, G. (2010). On the Misconception of Multicollinearity in Detection of Moderating Effects: Multicollinearity Is Not Always Detrimental. *Multivariate Behavioral Research, 45*(3), 483-507. doi:10.1080/00273171.2010.483393

Simmel, G. (1950). *The sociology of georg simmel* (Vol. 92892): Simon and Schuster.

Sleeter, C. E., La Vonne, I. N., & Kumashiro, K. K. (2015). *Diversifying the teacher workforce: Preparing and retaining highly effective teachers*: Routledge.

Spillane, J. P., Reiser, B. J., & Reimer, T. (2002). Policy implementation and cognition: Reframing and refocusing implementation research. *Review of educational research, 72*(3), 387-431.

Spokane, A. R., Luchetta, E. J., & Richwine, M. H. (2002). Holland's Theory of Personalities in Work Environments. In D. Brown (Ed.), *Career Choice and Development*. San Francisco: Jossey Bass.

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of personality and social psychology, 69*(5), 797.

Steinberg, M. P., & Sartain, L. (2020). What Explains the Race Gap in Teacher Performance Ratings? Evidence From Chicago Public Schools. *Educational Evaluation and Policy Analysis*, 0162373720970204. doi:10.3102/0162373720970204

Su, Z. (1997). Teaching as a profession and as a career: Minority candidates' perspectives. *Teaching and Teacher Education, 13*(3), 325-340.

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.

Sun, M., Penuel, W. R., Frank, K. A., Gallagher, H. A., & Youngs, P. (2013). Shaping professional development to promote the diffusion of instructional expertise among teachers. *Educational Evaluation and Policy Analysis, 35*(3), 344-369.

Sutcher, L., Darling-Hammond, L., & Carver-Thomas, D. (2016a). *A coming crisis in teaching? Teacher supply, demand, and shortages in the U.S.* Retrieved from https://learningpolicyinstitute.org/sites/default/files/product-files/A_Coming_Crisis_in_Teaching_REPORT.pdf

Sutcher, L., Darling-Hammond, L., & Carver-Thomas, D. (2016b). Teacher Supply and Demand: Getting the Numbers -- and the solutions -- right. Retrieved from https://learningpolicyinstitute.org/blog/teacher-supply-and-demand-getting-numbers-solutions-right

Tandon, M., Bianco, M., & Zion, S. (2015). Pathways2teaching: Being and becoming a "Rida". In C. Sleeter, L. V. I. Neal, & K. K. Kumashiro (Eds.), *Diversifying the teacher workforce: Preparing and retaining highly effective teachers of color*. New York: Routledge.

Taylor, S. E., & Fiske, S. T. (1976). The token in the small group: Research findings and theoretical implications. *Psychology and Politics: Collected Papers*, 110-117.

Todd-Breland, E. (2018). *A political education: Black politics and education reform in Chicago since the 1960s*: UNC Press Books.

Townes, D. L., Chavez-Korell, S., & Cunningham, N. J. (2009). Reexamining the relationships between racial identity, cultural mistrust, help-seeking attitudes, and preference for a Black counselor. *Journal of Counseling Psychology, 56*(2), 330.

Turner, E. O. (2020). Suddenly diverse *Suddenly Diverse*: University of Chicago Press.

Valadez, J. R. (2008). Shaping the Educational Decisions of Mexican Immigrant High School Students. *American Educational Research Journal, 45*(4), 834-860.

Walker, V. S. (2018). *The lost education of Horace Tate: Uncovering the hidden heroes who fought for justice in schools*: The New Press.

Warren, C. A., Carter Andrews, D. J., & Flennaugh, T. K. (2022). Connection, Antiblackness, and Positive Relationships That (Re)Humanize Black Boys' Experience of School. *Teachers College Record, 124*(1), 111-142.

Watt, H. M. G., Karabenick, S. A., & Richardson, P. W. (2014). *Teacher Motivation : Theory and Practice*. New York: Routledge.

Watt, H. M. G., & Richardson, P. W. (2007). Motivational Factors Influencing Teaching as a Career Choice: Development and Validation of the FIT-Choice Scale. *The Journal of Experimental Education, 75*(3), 167-202. doi:10.3200/JEXE.75.3.167-202

Watt, H. M. G., & Richardson, P. W. (2014). Why people choose teaching as a career: An expectancy-value approach to understanding teacher motivation *Teacher Motivation* (pp. 25-41): Routledge.

Watt, H. M. G., Richardson, P. W., & Wilkins, K. (2014). Profiles of professional engagement and career development aspirations among USA preservice teachers. *International Journal of Educational Research, 65*, 23-40. doi:https://doi.org/10.1016/j.ijer.2013.09.008

Wigfield, A., & Eccles, J. S. (2000). Expectancy–Value Theory of Achievement Motivation. *Contemporary Educational Psychology, 25*(1), 68-81. doi:https://doi.org/10.1006/ceps.1999.1015

Will, M. (2023, April 14, 2023). 'Poor for the rest of your life': Negative messages can deter prospective teachers. *Education Week*. Retrieved from https://www.edweek.org/teaching-learning/poor-for-the-rest-of-your-life-negative-messages-can-deter-prospective-teachers/2023/04

Wisely, J. (2019, June 17, 2019). Michigan schools face huge racial disparity — and it's hard to fix. *Detroit Free Press*. Retrieved from https://www.freep.com/story/news/education/2019/06/17/racial-disparities-in-schools/1333607001/

Yarnell, L. M., & Bohrnstedt, G. W. (2018). Student-Teacher Racial Match and Its Association With Black Student Achievement: An Exploration Using Multilevel Structural Equation Modeling. *American Educational Research Journal, 55*(2), 287-324. doi:10.3102/0002831217734804

Youngs, P., Elreda, L. M., Anagnostopoulos, D., Cohen, J., Drake, C., & Konstantopoulos, S. (2022). The development of ambitious instruction: How beginning elementary teachers' preparation experiences are associated with their mathematics and English language arts instructional practices. *Teaching and Teacher Education, 110*, 103576. doi:https://doi.org/10.1016/j.tate.2021.103576

Zarkin, G. A. (1985). Occupational choice: An application to the market for public school teachers. *The Quarterly Journal of Economics, 100*(2), 409-446.

APPENDIX A: SUPPLEMENT TO PAPER 1

Data and sample

The K12 administrative data used in this paper are sourced through the Michigan Department of Education, the state's Center for Educational Performance and Information, and their research partner the Michigan Education Data Center (Michigan Education Data Center, 2020). Researcher data extracts available since 2005 to 2006 were changed after the 2015-2016 school year. These new data are retroactive to the fall of 2011 and minor discrepancies exist with prior extracts. We are aware of none, however, material to the arguments of this paper. The contiguous fall 2005-2015 data are used in the retrospective analyses of Black teaching job loss and the newer data are used for describing and modeling recent trends in Black teacher employment. These data include comprehensive school staffing panels and student panels that allow school-level identification of teacher race, administrator race (see more below), within-school assignments, and profiles of the race and gender of students attending schools. We emphasize that in Michigan, charter schools (even when nominally managed by larger charter management organizations) are usually administratively recorded in school districts with one or two schools. We adhere to these administrative structures in our analysis.

Our approach in this paper is to focus exclusively on the experience of K12 teachers. We begin with comprehensive statewide administrative panels. While many credentialed teachers serve in other roles within schools (e.g., as curriculum and subject area leaders) we exclude them from our analysis. We similarly exclude all classroom teachers whose assignment codes suggest they are not "lead" classroom teachers – primarily teaching aides. Our sample is further refined by the exclusion of educators working in adult education and certain offsite programs without standard student enrollment data tied to school building attendance. These definitions of a "teacher" may differ from those in other analyses of Michigan's administrative data. As indicated in the main body of the text,

several Michigan school districts – especially those schools serving predominantly Black communities – experienced financial distress during the period of analysis. In some cases, traditional public school districts were dissolved and/or consolidated – or (in the case of the Education Achievement Authority in Detroit) split apart. As observed in the endnotes to the main body, our approach is to create consolidated school districts for the entire period of analysis of this study.

The administrative data indicate multiple assignments for many staff. These assignments are paired with an indicator of their full-time equivalent demands. We associate teachers and administrators with the school building in which their largest FTE assignment occurs. In the unusual case of ties, we assign personnel to buildings at random. Administrator race – used as an independent variable in logistic models of new hire – is determined by inspection of the assignment codes of all school personnel. In larger school organizations where administrative duties are specialized, we exclude individuals whose titles (assignment codes) indicate they are not directly involved in management of schools' teaching staffs. It our objective to narrow our definition of administrator to the best inference of those who supervise, evaluate and (in most cases) select teaching staffs. Michigan has many small school districts where administrative functions are consolidated, and data suggest that principals are sometimes shared across buildings. To handle these situations, we progressively search inside district administrative data first for appropriately titled school-level administrators, and then to those with district-level assignment codes to infer administrators handling supervision and evaluation of teaching staffs.

As we have indicated, Black teacher supply, as in many states, is highly constrained in Michigan. Black enrollment (though not Black completion rates) are available for certified educator preparation institutions (EPIs) from the US Department of Education's Office of Postsecondary Education (2020). There is no distinction within the enrollment data among students of different levels of progress within their programs. We geographically link EPIs with prospective employers by

calculating the full matrix of drive times between EPIs and school districts (Google, 2018). Teacher supply is parameterized as the fourth lag of the number of Black enrollees (normalized by the number of district new teacher hires) that are (1) less than 20 minutes away; (2) between 20 and 50 minutes away; 50 and 75 minutes; 75 and 100 minutes; and, finally, 100 and 200 minutes. We acknowledge that EPI distance to potential places of employment is different than the distance from one's high school (as proxy for "home") identified in other studies (e.g, Boyd, Lankford, Loeb, & Wyckoff, 2005).

Table 1.1 Analysis

Following is a reproduction of equation (1) from the main body.

$$TotalBlackTeachers_{jt} = TotalStudents_{jt} * \sum_s \left(\%Students_{jst} * \left(\frac{Teachers}{Students} \right)_{jst} * \%FacultyBlack_{jst} \right) \quad (1.1)$$

The simple simulation underlying Table 1.1 is conducted under a series of strong assumptions. Equation (1) is not a model, but rather an algebraic statement that decomposes the number of Black teaching jobs in a catchment as a function of staffing levels (teacher-student ratio), faculty racial composition (percent of teachers who are Black), and TPS vs. charter shares of student enrollment in the respective TPS catchments. This relationship is, as stated in (1), inherently multiplicative such that partitioning marginal effects in the presence of multiple term changes is complex. In our approach we impose two key assumptions. First, we assume that staffing levels logically follow (or result from) enrollment levels. This is justified by the state's predominant reliance on fully transferable per pupil allowances that follow students to their geographically assigned school or to charter or inter-district choice schools. (See section on school closures below for further discussion.)

We implement this assumption by first evaluating catchment-wide enrollment losses (gains) and then evaluating market share shifts between TPS and charter schools. We acknowledge that, on

the margin, schools can compete for students by suppressing administrative or other non-teacher costs. Empirically, however, we find that charter school student/teacher ratios were stable in the period and TPS ratios (weighted by the districts in which Black teachers work) expanded. This logically follows reduced enrollments and the inability to amortize un-addressable fixed district costs over larger student bases. Our second assumption is that *changes in* faculty racial composition decisions do not precede school-level enrollment losses (gains). The central phenomenon over this period of analysis is of students migrating away from schools with larger Black faculties to schools with smaller or entirely non-Black faculties. We have no basis for ascribing or proscribing any causal relationship here or relating it to other (e.g., economic or school quality) factors. Empirically, however, with very few exceptions, TPS and charter district faculties' racial profiles are remarkable static, such that their (demand inducing) qualitative differences are likely small. For these reasons, we believe the approximations in Table 1.1 are reasonable vis a vis the conclusions we reach.

Specifically, we implement our simulation with this simple algorithm. First, we reproduce 2005 catchment-level Black teaching jobs as given by (1.1):

$$TotalBlackTeachers_{j,05} = TotalStudents_{j,05} * \sum_s \left(\%Students_{js,05} * \left(\frac{Teachers}{Students} \right)_{js,05} * \%FacultyBlack_{js,05} \right) \quad \text{(A.1a)}$$

We then substitute in 2015 catchment-level enrollment levels while holding all other terms remain at 2005 levels, simulating the implied level of Black teaching jobs under this *ceteris paribus* hypothesis.

$$TotalBlackTeachers_{j,H1} = TotalStudents_{j,15} * \sum_s \left(\%Students_{js,05} * \left(\frac{Teachers}{Students} \right)_{js,05} * \%FacultyBlack_{js,05} \right) \quad \text{(A.1b)}$$

Differencing the total number of jobs in (1b) and (1a) yields the simulated catchment-level job loss due to enrollment declines where Black teachers worked in 2005. We then iterate this *ceteris paribus* approach by progressively substituting into (1b) 2015 catchment market share, 2015 charter and then TPS student-teacher ratios, and finally 2015 charter and TPS Black faculty percentage. As a gauge to the sensitivity of these results to the ordering assumptions above, consider the scenario in which within-catchment charter school and TPS school student teacher ratios precede (and hypothetically effect) charter market share. In this scenario, simulated job loss in Table 1.1 in relation to charter market share gains declines from 240 to 83, job loss from TPS student-teacher ratio expansion increases from 463 to 608, and charter student-teacher ratio expansion from 35 to 47. These marginal differences are non-trivial but are an order of magnitude smaller than likely catchment-level K12 population decline effects to which they are compared.

Detroit catchment example

As we have emphasized, (1.1) is an algebraic expression that is defined at the TPS catchment level. The consolidated Detroit TPS catchment values for 2005 and 2015 are as follows.

	Black teachers employed	**Enrollment**	**Charter market share**	**TPS market share**	**Charter teacher-student ratio**	**TPS teacher-student ratio**	**Charter sector percent faculty Black**	**TPS sector percent faculty Black**
2005	4222	167,219	0.164	0.836	0.043	0.043	0.414	0.626
2015	2038	99,580	0.367	0.633	0.044	0.037	0.339	0.635

Per (A1a) above (with a small rounding error and index *05* denoting 2005 values from the table above), actual 2005 Black teacher employment can be restated:

$$4222_{05} = 167{,}219_{05} * [\ (0.164_{05} * 0.043_{05} * 0.414_{05})_{charter} + (0.836_{05} * 0.043_{05} * 0.626_{05})_{TPS}\ ] \text{ (A.2a)}$$

Per (A1b) above, substituting 2015 enrollment into (A.2a) in **bold type**, yields the following:

$$\widehat{2514} = \mathbf{99,580_{15}} * [\ (0.164_{05} * 0.043_{05} * 0.414_{05})_{charter} + (0.836_{05} * 0.043_{05} * 0.626_{05})_{TPS}\ ]$$ (A.2b)

The value for the "Detroit only" scenario in column 2 of Table 1.1 (1708 jobs lost) can then be found by taking the difference of 4222 and 2514, the estimate from (A.2b). We continue substituting 2015 values successively below and reporting differences from the last estimate. These values populate the rest of the Detroit Only scenario in Table 1.1. Other scenario values are simply the sum of the component factors over all catchments included in a given scenario.

Substituting 2015 Charter/TPS shares of catchment enrollment…

$$\widehat{2335} = \mathbf{99,580_{15}} * [\ (\mathbf{0.367_{15}} * 0.043_{05} * 0.414_{05})_{charter} + (\mathbf{0.633_{15}} * 0.043_{05} * 0.626_{05})_{TPS}\ ]$$ (A.2c)

2514 – 2335 = 179 (jobs lost due to comparatively White 2005 charter faculties vs. same-catchment peers)

Substituting 2015 charter school teacher-student ratio (simply the inverse of student-teacher ratio)…

$$\widehat{2340} = \mathbf{99,580_{15}} * [\ (\mathbf{0.367_{15}} * \mathbf{0.04t_{15}} * 0.414_{05})_{charter} + (\mathbf{0.633_{15}} * 0.043_{05} * 0.626_{05})_{TPS}\ ]$$ (A.2d)

2335 – 2340 = (5)

…2015 TPS teacher-student ratio …

$$\widehat{2135} = \mathbf{99,580_{15}} * [\ (\mathbf{0.367_{15}} * \mathbf{0.04t_{15}} * 0.414_{05})_{charter} + (\mathbf{0.633_{15}} * \mathbf{0.037_{15}} * 0.626_{05})_{TPS}\ ]$$ (A.2e)

2340 – 2135 = 205

…2015 charter Black faculty percentage…

$$\widehat{2016} = \mathbf{99,580_{15}} * [\ (\mathbf{0.367_{15}} * \mathbf{0.04t_{15}} * \mathbf{0.339_{15}})_{charter} + (\mathbf{0.633_{15}} * \mathbf{0.037_{15}} * 0.626_{05})_{TPS}\ ]$$ (A.2f)

2135 – 2016 = 119

…and, lastly, 2015 TPS Black faculty percentage…

$$\widehat{2038} = \mathbf{99,580_{15}} * [\ (\mathbf{0.367_{15}} * \mathbf{0.04t_{15}} * \mathbf{0.339_{15}})_{charter} + (\mathbf{0.633_{15}} * \mathbf{0.037_{15}} * \mathbf{0.635_{15}})_{TPS}\ ]$$ (A.2g)

2016 – 2038 = (22)

School closures and policy feedback

Though the most rigorous analysis is outside the scope of our work here, school closings offer an opportunity to size policy feedback mechanisms that may ultimately cause the loss of Black teachers. The simple simulation above acquiesces to a logic that reduced enrollment *ceteris paribus* reduces the need for teachers, inherently leading to net job losses. Operationally, especially in a large district such as Detroit, this may involve the closing of campuses. One can hypothesize that school closures – because of their dislocating effects on neighborhood dynamics – are among the most acute policy decisions driving changed affect toward a school district. In this respect, school closure may be a galvanizing event *driving* both teacher exit and enrollment migrations outside of catchment – rather than simply a result of antecedent enrollment declines (as we implicitly assume). Student transfer outside a catchment in Michigan does not require residential relocation (Edwards, 2021), increasing the likelihood of exit. These factors may create a reinforcing dynamic between exogeneous socio-economic pressures on a school district, general affect toward a district (e.g., driven by perceptions of school quality), and district operational policy. In the present case, however, it appears that feedback associated with school closure is likely small relative to the broader forces shaping student enrollment and attending teacher employment in Top 10 catchments. Still, we find suggestive evidence that both teacher and student exit rates from Top 10 catchments are higher after school closings.

Teacher exit after closings

Simple (unconditioned) tabulations of teacher exit show that they are higher after a school closure (as determined by expiry of an administrative school code). In the Top 10 public school (inclusive of TPS and charter schools) catchments employing Black teachers (in year 2005), mean Black-teacher 2005 to 2014 exit rates rise from 10.2% to 15.6% for teachers working in a school that closes. Inclusion of a district-by-teacher age group (> 35 years, >45 years, >55 years) fixed effect when regressing exit on school closure, suggests that true excess exit rates in schools that close may

be ~2.8% points ($p < .001$) among Black teachers. The estimated excess rate is similar when models are further conditioned on school fixed effects (2.5 points) or lagged school-level teacher exit rates (2.9 points).

Given actual frequency of school closure and attending numbers of teachers affected, this rate would translate into excess system exit of only 78 Black teachers associated with school closure over 10 years in Top 10 districts. These statistics do not reflect possible additional teacher exit after school reorganizations (e.g., for performance reasons or a shift in grade band) or follow-on effects in future years. Through 2012, teacher retention systems when downsizing would have been predominantly seniority based such that teachers from a closed school would have right to transfer. Labor market reforms passed in July 2011 would allow district deviation from these patterns, first visible in academic year 2013/2014, though there is little evidence that this new administrative discretion was widely exploited.

Student exit after closings

One may also wonder if school closure policy led *students* to leave. Here, among students not already scheduled to age out of their current school, we regressed an indicator of inter-catchment transfer on whether a student's school was closed within an estimation pool of all students from Top 10 catchments for the period 2005 to 2014. We specified fixed effects so that students were compared to their same-district, same-race, same-economic disadvantage status, same-grade, same-year peers. This simple model suggests an excess likelihood of transfer from a catchment of 6.5 ($p < .001$) percentage points after one's school closes and yields estimates similar to models further conditioned on student fixed effects (FE) (5.5 points), student and school FE (5.1 points), and student FE and lagged school level transfer rates (4.8%). This rate and attending levels of students affected by school closure implies 1.5 percent of student catchment transfers were associated with school closure. These results do not include sibling effects or lagged effects, though they are similar

to *district-level* analysis of similar Michigan data (Edwards, 2021) that presumably captures spillover effects outside of specific school closings as well as TPS-charter within-catchment transfers.

Table 1.3 Analysis

The logistic analysis in Table 1.3 includes the covariates summarized in Table A.1, following. As discussed, lagged measures remove from the sample new schools formed since 2010. These are predominantly charter schools, and inspection reveals that these new schools are routinely successful in hiring Black teachers when serving Black student populations. In addition to listed independent variables, the regression also includes indicators for teacher subject area. All subjects are mapped to a categorical variable with 15 levels consistent with typical conceptions of subject area: ELA, ESL, math, science, vocational instruction, etc. These indicators play an important role in controlling for biases in Black and non-Black teacher preparation and teacher hiring – e.g., disproportionate rates of Latinx hiring into positions requiring language skills.

We also hypothesize effects related to racialized school phenomena. Observable measures – beyond descriptive indicators of student and personnel race – include Black-specific measures of teacher evaluation ratings and student test scores. We evaluate both absolute measures and Black/non-Black gaps of these measures. Inclusion of these measures is extremely costly to sample size – since many schools have no Black teachers and/or Black students and not all schools have achievement test scores (especially, K-2 schools). Nevertheless, results are substantially similar to those presented in Table 1.3 and nearly all differences are a function of reduced sample rather than introduced covariates.

Transfer hires

Estimates in Table 1.3 are over a pool of new teacher hires because we prefer its comparatively forward-looking perspective on building and expanding faculties with new teachers. By restricting the estimation sample to hiring events for new public school teachers, the analysis is

conditioned on hiring events in which schools are willing to hire a novice teacher and the workplace preferences and networks of novice teachers which may be different than those of in-service teachers. Results in Table A.2 are estimated over the complementary set of hiring events, where in-service teachers are hired into a new district. Results are substantially similar (as are results that pool both types of hires). Black administrators are more unambiguously associated with the hire of in-service teacher, however. We find this suggestive evidence interesting. It may reflect different professional networks, a preference of Black administrators and/or teachers to work within one another, or a preference for hiring Black administrators for Black teachers with experience.

Table A.1. Summary statistics for variables in Table 1.3 logistic regression

	Mean	Std. Dev.	Min	Max
New Hire is Black (outcome)	0.07	0.25	0.00	1.00
1st lag of school-level Black student proportion in (2011)	0.26	0.34	0.00	1.00
1st lag of three-year change in Black student proportion (points)	0.01	0.04	-0.79	0.37
1st lag of indicator for whether district became Black in prior 3 years.	0.01	0.12	0.00	1.00
1st lag of proportion of school's teachers black	0.08	0.16	0.00	1.00
1st lag of proportion of school's administrators Black	0.18	0.33	0.00	1.00
4th lag of Number of Black EPI enrollees within stated drivetimes (DT) to district office. Normalized by number of district new hires.				
DT < 25 minutes	30.35	87.17	0.00	1905.00
25 < DT < = 50	27.78	76.96	0.00	2151.00
50 < DT <= 75	23.39	86.66	0.00	2153.00
75 < DT <= 100	23.73	86.43	0.00	2166.00
100 < DT <= 200	73.54	166.97	0.00	2284.00
Indicator for if school was a NCLB priority school in 2012	0.06	0.23	0.00	1.00
Indicator for if school was a NCLB focus school in 2012	0.12	0.32	0.00	1.00
District is in large or mid-size city	0.18	0.39	0.00	1.00
District is in suburb	0.34	0.47	0.00	1.00
District is a charter district	0.32	0.47	0.00	1.00
School district is contiguous to Detroit catchment	0.07	0.26	0.00	1.00
1st lag of ELL student proportion in school	0.08	0.16	0.00	0.97
1st lag of economic disadvantage proportion in school	0.61	0.27	0.00	1.00
1st lag of proportion of school students in special education	0.14	0.09	0.00	1.00
1st lag of proportion of school's teachers receiving a "minimally effective" or "ineffective rating"	0.05	0.11	0.00	1.00
1st lag of proportion of school's teachers receiving a "highly effective" rating	0.33	0.30	0.00	1.00
New hire is male	0.23	0.42	0.00	1.00
Middle school indicator	0.24	0.43	0.00	1.00
High school indicator	0.23	0.42	0.00	1.00
Charter school	0.32	0.47	0.00	1.00

Table A.1 (cont'd). Summary statistics for variables in Table 1.3 logistic regression

	Mean
Categorical indicators of personnel race	
School faculty is (0/1) …	
> 0% Black <= 5%	0.121
> 5% Black <= 10%	0.083
> 10% Black <= 25%	0.090
> 25% Black <= 40%	0.054
> 40% Black <= 60%	0.033
> 60% Black <= 75%	0.016
> 75% Black <= 90%	0.007
> 90% Black	0.028
School administration is (0/1) …	
> 5% Black <= 10%	0.006
> 10% Black <= 25%	0.049
> 25% Black <= 40%	0.025
> 40% Black <= 60%	0.062
> 60% Black <= 75%	0.029
> 75% Black <= 90%	0.006
> 90% Black	0.120

Table A.2. Logistic model of Black teacher hiring from 2013 to 2018. (Odds ratios.) *Transfer hires of in-service teachers only.*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	All transfer hires		**All transfer hires**		**Exclude top 10 Black employing districts (2011)**		**Black student body growth only**		**Black and total student body growth only**	
Measures of student body race										
Proportion of students Black in 2011	16.68***	9.36***	21.25***	12.11***	17.55***	9.88***	11.19***	6.76***	12.72***	7.79***
3-year change in proportion students Black			13.25***	10.44***	22.36***	16.43***	14.31**	8.05*	4.71	3.67
School ever became >50% student Black			1.61***	1.40*	1.57**	1.38	1.49*	1.33	1.71*	1.52
Linear measures of personnel race										
Proportion of teachers Black	7.90***		8.61***		11.85***		19.56***		12.78***	
Proportion of administrators Black	1.75***		1.73***		1.87***		2.13***		2.26***	
Categorical indicators of personnel race										
School faculty is (0/1)…										
> 0% Black <= 5%		2.38***		2.27***		2.19***		2.27***		1.89***
> 5% Black <= 10%		2.82***		2.75***		2.58***		2.72***		2.44***
> 10% Black <= 25%		3.79***		3.68***		3.85***		4.27***		4.16***
> 25% Black <= 40%		4.43***		4.45***		4.74***		5.31***		4.57***
> 40% Black <= 60%		6.41***		6.27***		6.34***		10.33***		8.50***
> 60% Black <= 75%		9.54***		9.60***		12.87***		14.32***		11.10***
> 75% Black <= 90%		10.28***		10.23***		14.09***		17.58***		16.33***
> 90% Black		8.99***		7.82***				11.28**		8.20
School administration is (0/1)…										
> 0% Black <= 5%		0.38		0.38		0.48		†		†
> 5% Black <= 10%		0.99		1.03		1.21		0.94		1.23
> 10% Black <= 25%		1.11		1.08		1.19		1.24		1.09
> 25% Black <= 40%		1.36**		1.37**		1.38**		1.69***		1.58*
> 40% Black <= 60%		1.44***		1.40***		1.38***		1.34*		1.28
> 60% Black <= 75%		1.62***		1.56***		1.66***		1.64**		1.58**
> 75% Black <= 90%		1.85***		1.84***		1.69***		2.56***		2.28***
> 90% Black		1.71***		1.68***		1.88***		2.08***		2.08***
Observations	21,954	21,995	21,704	21,744	18,927	18,960	10,110	10,067	6,305	6,276

Notes: Parameters predict whether a new hire is Black. Odds ratios are presented here. This table is presented as a complement to Table 1.3 in the main body. Where Table 1.3 is estimated over a pool of first-year teacher hires (i.e., first-year Michigan public school teachers), the results here are estimated over a pool of inter-district transfers (i.e., transfers from one district employer to another. More formally, we predict the joint outcome of (1) whether a Black teacher inter-district transfer candidate qualified for a position exists, (2) applies for the position, and (3) is hired. Results are similar when modeling *any* district hire, rather than exclusively transfer teachers. Partitioned analyses of TPS and charter sectors are also qualitatively similar. Covariates for all models include: TPS/charter sector indicator; an indicator for districts located next to the Detroit catchment; measures of proximate Black teacher preparation enrollees (as proxy for teacher supply); priority and focus school status in 2012; city and suburb locale indicators; ELL, economic disadvantage, and special education percentages; frequencies for high and low teacher evaluation ratings; indicators for teacher gender, grade band, and subject taught; and year fixed effects. Time varying school measures are lagged one year. Teacher and administrator race are constructed to approximate the qualitatively distinct levels of minoritization described by Kanter (1977). †Low frequency condition omitted due to collinearity. Reference category for administration for school administration race is 0 to 5% Black administration in these scenarios, while the reference category for teacher race is 0% Black faculty. School-level cluster-robust standard errors specified. *** p<0.01, ** p<0.05, * p<0.1

APPENDIX B: TABLES AND FIGURES SUPPLEMENTARY TO PAPER 3

Figure B.1. Black postsecondary pre-teaching rates by own-high school enrollment growth quartile

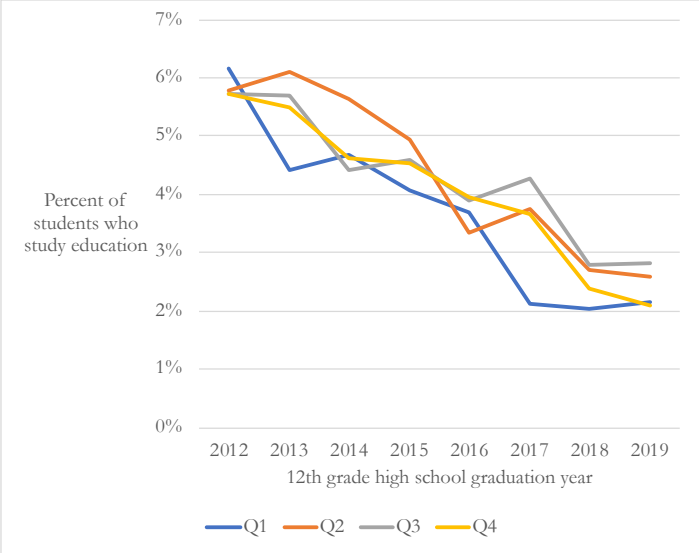
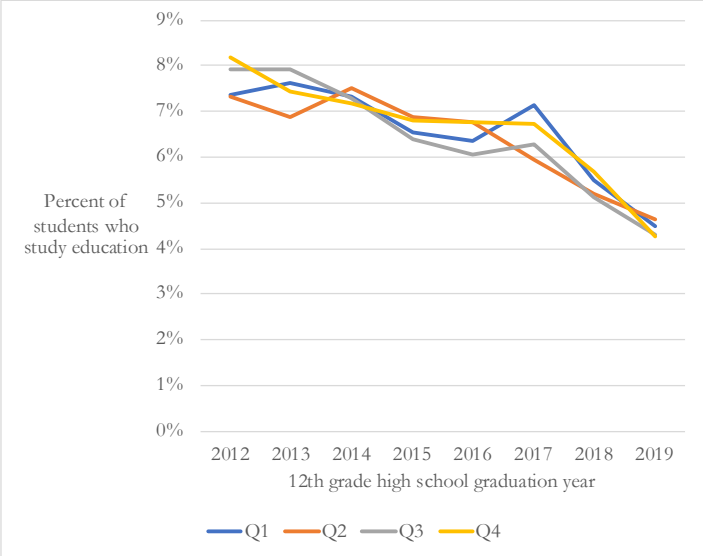


Figure B.2. Non-Black postsecondary pre-teaching rates by own-high school enrollment growth quartile



Notes: Tabulations are within the preferred regression pool of students attending a 4-year Michigan university. Distribution of students in other regression pool scenarios (see Table 3.2) is similar. Quartiles are those given by weighted by Black student 12th-grade attendance. Mean three-year student growth rates are -25.2% (Q1), -8.7% (Q2), 0% (Q3), and 29.8% (Q4). Tabulations within Black (rather than all-student) student body growth quartiles are similar. Percent of students who study education is given by those appearing in an education-related program of study as designated by CIP code.

Figure B.3. Black postsecondary pre-teaching rates by own-high school teacher turnover quartile

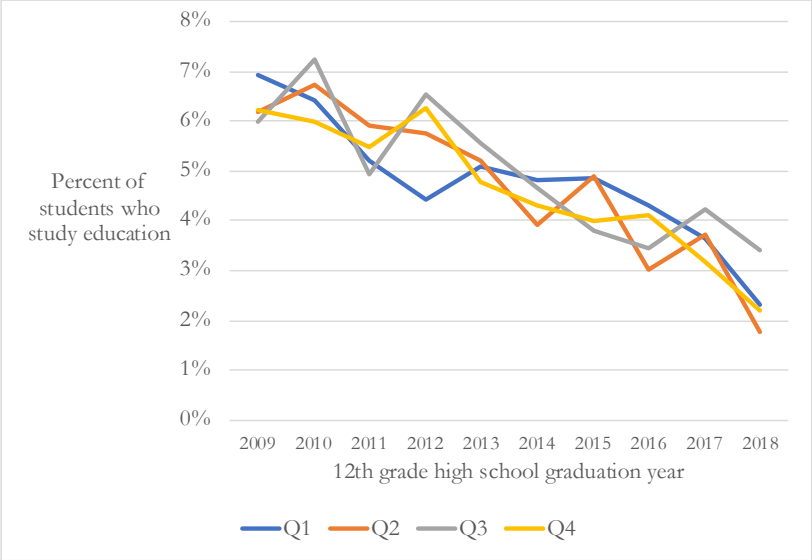
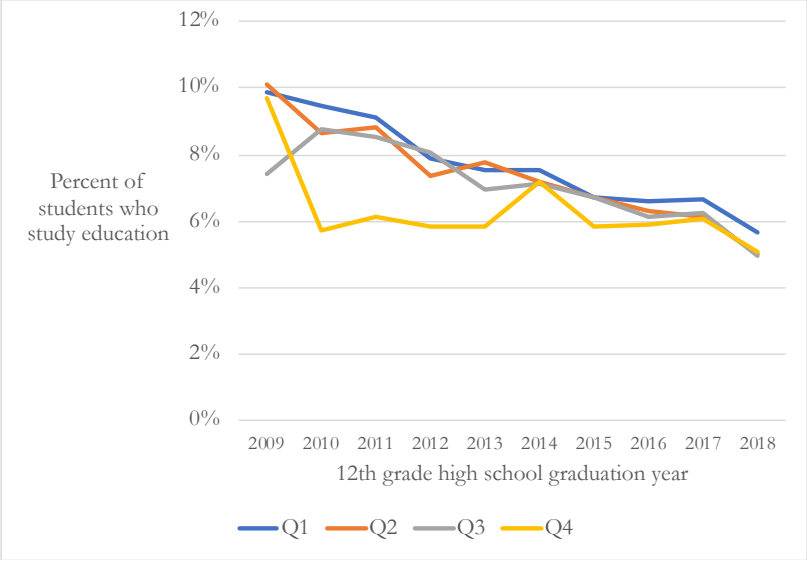
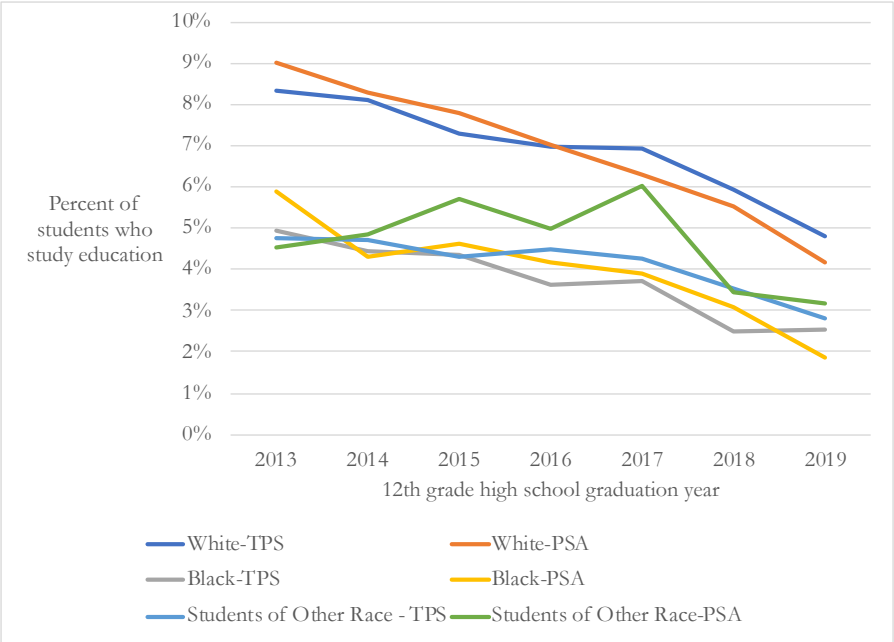


Figure B.4. Non-Black postsecondary pre-teaching rates by own-high school teacher turnover quartile



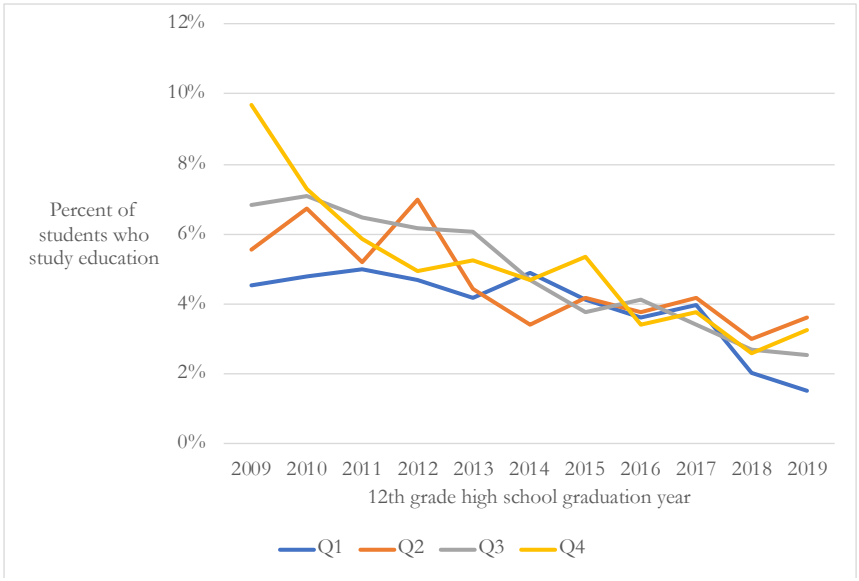
Notes: Tabulations are within the preferred regression pool of students attending a 4-year Michigan university. Quartiles are those given by weighted by Black student 12th-grade attendance. Turnover statistics are the first lag to the 12th grade year and are a simple measure of the percent of teachers not returning to teaching service year-over-year in the same district. Turnover mean rates by quartile are 6.3% (Q1), 12.7% (Q2), 20.2% (Q3), and 36.8% (Q4).

Figure B.5. Postsecondary pre-teaching rates by high school sector and race/ethnicity



Notes: Tabulations are within the preferred regression pool of students attending a 4-year Michigan university. TPS = traditional public school and PSA = a chartered Public Service Academy.

Figure B.6. Black postsecondary pre-teaching rates by own-high school achievement score quartile



Notes: Tabulations are within the preferred regression pool of students attending a 4-year Michigan university. Achievement quartiles are student-weighted and are given by the first lag of 11th standardized SAT or ACT math scores for students of all races. Tabulations of reading score frequencies and black-student only achievement quartile frequencies are similar.

Table B.1. Conditional rates of pre-teaching activity by own-*school* achievement score profile

	All students				Black students only					
	Mean z Score	**Mean student growth in z Score**	**Black - White z Score Difference**	**Black z Score to White z Score ratio**	**Mean Math z Score**	**Mean student growth in z Score**	**Black - White z Score Difference**	**Black z Score to White z Score ratio**	**Mean Black student z Scores**	**Mean growth in Black student z Scores**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Math scores										
Q2	0.020***	0.014***	0.004**	-0.002	0.004*	-0.004	-0.003	-0.003	0.003	0.004
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.006)
Q3	0.022***	0.015***	-0.001	-0.014***	0.009***	0.002	-0.002	-0.006*	0.003	0.003
	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Q4	0.018***	0.011***	-0.004	-0.009***	0.009***	-0.003	-0.001	-0.005*	0.008***	0.003
	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)
Observations	514,151	362,530	449,973	449,973	52,912	36,854	49,811	49,811	52,753	36,681
R-squared	0.018	0.015	0.017	0.018	0.007	0.006	0.006	0.007	0.007	0.006
Reading scores										
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Q2	0.024***	0.018***	0.003	-0.003	0.007**	0.002	-0.001	-0.002	0.007**	0.011**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.005)	(0.003)	(0.003)	(0.003)	(0.005)
Q3	0.024***	0.019***	-0.003	-0.013***	0.008***	0.005	0.000	-0.006	0.007**	-0.003
	(0.003)	(0.003)	(0.002)	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)
Q4	0.020***	0.015***	-0.003	-0.010***	0.012***	0.005	0.001	-0.004	0.011***	0.006
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)
Observations	416,521	264,420	362,666	362,666	43,267	27,257	40,639	40,639	43,120	26,999
R-squared	0.017	0.015	0.017	0.017	0.005	0.005	0.005	0.005	0.005	0.005

Notes: Table shows linear probability model regression estimates of comparative pre-teaching rates between schools as a function of schools' quartiles by the achievement test measure in each column. The reference category is the first quartile (Q1) where z-Scores increase by indicated quartile. *** p<0.01, ** p<0.05, * p<0.1. Errors reflect clustering at the district level. Models are estimated within the preferred regression pool of students attending a 4-year Michigan university. z-Scores are standardized 11th grade SAT/ACT scores. All modeled achievement measures are lagged one year. Growth is determined based upon students' z-Score growth over their 8th grade math or reading performance. The regression model includes year fixed effects and students' individual composite 11th grade z-Score and gender. Models estimated over the smaller pool where ELL, ED, and SpED measures are available are similar – and are primarily differentiated by the shift in estimation pool rather than the presence of additional covariates.

Table B.2. Differences in postsecondary pre-teaching rates after 2011 teacher evaluation reforms as a function of own-high school rates of teacher low-effectiveness ratings.

	Black students	**White students**	**Students of other races/ ethnicities**
	(1)	(2)	(3)
Post reform * Schools with high rates of low effectiveness scores	0.007	0.006	0.001
	(0.005)	-0.003	(0.004)
Observations	54,396	369,487	112,487
R-squared	0.020	0.026	0.022

Notes: *** p<0.01, ** p<0.05, * p<0.1. Errors reflect clustering at the district level. The median post-reform low effectiveness rating (minimally effective plus ineffective) in high schools weighted by Black student enrollments of 1.1% is used as the cut-off for the treated/untreated condition. Enrollment-weighted mean school-level low teacher effectiveness ratings are effectively 0 in the "untreated" donor pool and 4.6% in the "treated" schools. (Models that use a continuous measure of low-effectiveness rating percentage as the treatment yield similar results). The post-reform period commences for the Spring 2012 academic year (Brunner et al., 2019). School and year fixed effects absorb all main effects. Student race and ACT/SAT composite z-Score are covariates. (ELA, ED, and SpED are not available throughout the panel period). Analyses that confine treatment condition to high rates of low effectiveness scores for Black teachers only are null. A triple difference analysis that interacts Black-faculty proportion with the treatment condition here is null.

Table B.3. Sensitivity of estimates of Black faculty proportion effect on rates of preprofessional teaching to school fixed effects in presence of school-level covariates

	No School Fixed Effect			School Fixed Effect		
	Black only	**White only**	**Other race/ ethnicities**	**Black only**	**White only**	**Other race/ ethnicities**
Time-varying, school-level covariates included						
	(1)	(2)	(3)	(4)	(5)	(6)
Percentage of school-level teachers who are Black	0.004	-0.034	-0.029***	0.043*	0.007	0.024
	(0.006)	(0.023)	(0.009)	(0.022)	(0.080)	(0.079)
Observations	23,304	79,799	30,886	23,269	79,777	30,857
R-squared	0.006	0.021	0.011	0.021	0.026	0.025
No school covariates						
	(7)	(8)	(9)	(10)	(11)	(12)
Percentage of school-level teachers who are Black	0.008*	-0.103***	-0.044***	0.044*	-0.003	0.029
	(0.005)	(0.020)	(0.011)	(0.024)	(0.072)	(0.076)
Observations	27,607	200,887	59,276	27,473	200,833	59,225
R-squared	0.006	0.018	0.009	0.024	0.025	0.027

Notes: *** p<0.01, ** p<0.05, * p<0.1. Errors reflect clustering at the district level. All cells are unique linear probability models of the decision to study teaching and show the parameter estimates for proportion of school faculty that is Black [0,1]. As indicated, students are partitioned by race/ethnicity. Estimation pool is among students in 4-year Michigan IHEs. In addition to the school fixed effects specified in models 1, 2, 3, 7, 8, and 9, all models include year fixed effects. Models include school-by-year level measures of: Black faculty proportion (effects shown) and, selectively, lagged standardized math scores, rates of low teacher effectiveness scores, enrollment growth rates, teacher turnover rates and sector. Students' own ACT/SAT composite z-Score, and gender are included. Results are insensitive to inclusion of ED, ELL, and SpED status. Analysis is confined by predictor availability to spring 2013 and later for models with between-school covariates. The described turnover parameter estimate (not shown) but of interest in later discussion is -0.023 ($p < .1$) in column 1 and -0.012 (not significant) in column 4.

Table B.4. Sensitivity of Table 3.2 4-year Michigan IHE results to inclusion of student covariates and 2009 to 2015 estimation pool

Estimation Pool:	**All observations**	**ED, ELL, and SpED available**	**ED, ELL, and SpED available**	**Spring 2009 to 2015 only**
ED, ELL, SpED specified:	**No**	**No**	**Yes**	**No**
All students				
	(1)	(2)	(3)	(4)
Black Student * Proportion [0,1] of graduating high school teachers who are black	0.031***	0.027***	0.023***	0.033***
	(0.006)	(0.005)	(0.006)	(0.006)
Observations	536,312	330,289	330,289	408,236
R-squared	0.039	0.037	0.037	0.037
High ACT/SAT students				
	(5)	(6)	(7)	(8)
Black Student * Proportion [0,1] of graduating high school teachers who are black	0.052***	0.023**	0.018**	0.059***
	(0.010)	(0.009)	(0.009)	(0.012)
Observations	287,892	177,487	177,487	214,010
R-squared	0.050	0.047	0.047	0.048

Notes: *** p<0.01, ** p<0.05, * p<0.1. Errors reflect clustering at the district level. All columns are linear probability models of the decision to study teaching. Model (2) represents marginal effect of shift in estimation pool only from all available observations (1) to one where student covariates are available. Model (3) represents the incremental change due to inclusion of those predictors. Model (4) tests robustness of results to pool where 4 years of postsecondary data are available for all students. All models include school-by-year fixed effects and are estimated over students in a 4-year Michigan IHE. Other covariates are as in Table 2. They include a vector of student race indicators, with White students as the reference category, students' 11th grade ACT/SAT composite z-Score, and gender indicator. High ACT/SAT students are those whose z-Scores are greater than the mean z-Score for teachers of 0.33.

Table B.5: Sensitivity of Table 3.2 extensive sample (all postsecondary and non-postsecondary students) to covariates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Black-student x school FE		X		X		X		X		X
Student z-score available			X	X	X	X	X	X	X	X
z-score specified					X	X	X	X	X	X
ED, ELL, SpED available							X	X	X	X
ED, ELL, SpED specified									X	X
All students										
Black Student * Proportion [0,1] of graduating high school teachers who are black	0.000	-0.006	0.003	-0.008	-0.006*	-0.008	-0.006*	-0.008	-0.009***	-0.009
	(0.003)	(0.007)	(0.003)	(0.010)	(0.003)	(0.010)	(0.003)	(0.013)	(0.003)	(0.013)
Observations (000)	1,436	1,436	1,123	1,123	1,123	1,123	710	710	710	710
R-squared	0.029	0.030	0.029	0.029	0.030	0.031	0.028	0.029	0.029	0.030
High ACT/SAT students										
Black Student * Proportion [0,1] of graduating high school teachers who are black	-0.005	-0.009	-0.012	-0.085	-0.008	-0.084	-0.032***	-0.115	-0.038***	-0.116
	(0.004)	(0.010)	(0.008)	(0.064)	(0.008)	(0.064)	(0.008)	(0.151)	(0.008)	(0.150)
Observations (000)	726	725	413	412	413	412	255	255	255	255
R-squared	0.037	0.038	0.037	0.038	0.038	0.039	0.038	0.039	0.038	0.039

Notes: *** p<0.01, ** p<0.05, * p<0.1. Errors reflect clustering at the district level. All columns are linear probability models of the decision to study teaching. Models are specified as in Table 2 with modifications and sample restrictions as described above. No IHE fixed effects are employed. Black-student x school fixed effects have the effect of identifying effects on marginal within-school changes in Black faculty proportion while controlling for race-specific school phenomena. Non-postsecondary students have very high rates of missing test scores. ED, ELL, and SpED indicators are present only after 2012.

Table B.6. Middle and elementary school effects in presence of longitudinal fixed-effect strategy

Regression pool and fixed effects strategy:	**Grades 9 to 12**	**Grades 6 to 12**	**Grades 3 to 12**	**Grades 6 to 12**	**Grades 3 to 12**	**Grades 4 to 12**
	(1)	(2)	(3)	(4)	(5)	(6)
Black Student * Proportion [0,1] of students' Grade 9 to 12 teachers who are Black	0.031***	0.024**	0.021	0.023	0.013	0.030
	(0.006)	(0.010)	(0.025)	(0.015)	(0.027)	(0.026)
Black Student * Proportion [0,1] of students' Grade 6 to 8 teachers who are Black				-0.002	-0.031	-0.031
				(0.016)	(0.064)	(0.041)
Black Student * Proportion [0,1] of students' Grade 3 to 5 teachers who are Black					0.054	0.039
					(0.062)	(0.035)
Observations	364,789	199,456	66,732	198,736	66,221	104,651
R-squared	0.066	0.116	0.222	0.116	0.222	0.188

Notes: *** p<0.01, ** p<0.05, * p<0.1. Errors reflect clustering at the district level. All columns are linear probability models of the decision to study teaching estimated among students attending 4-year Michigan IHEs. The reference group is all non-Black students. The interaction effect reported is notably different than that specified in Table 2. Here student-specific means for own-school Black faculty proportion are used – rather than graduating high school. This captures the student-specific, school-specific longitudinal experience of students across schools. The primary driver of within-school differences in these measures will be student mobility/transfer activity. Regression pools are defined by the pool of students with continuous enrollment within the indicated grade band. This is the result of specification of a vector of school-by-grade-by-graduating cohort fixed effects to control for school-level phenomena throughout students' K12 careers. The regression pools are therefore increasingly biased toward students in stable residential contexts as grade bands are enlarged. The regression pool also shrinks rapidly as progressively more students attended early grades before the spring 2009 beginning of the dataset. Covariates are student ACT/SAT z-Scores, gender, race, and main effects for student-specific Black faculty proportion measures. Results are insensitive to inclusion of these main effects as they are substantially absorbed by fixed effect specification. Models (2) and (3), while retaining a high-school only effect of interest test enhanced longitudinal school fixed-effect controls that a specific to each students full K12 experience in middle and elementary schools.