Engagement and Achievement

Is Academic Engagement the Panacea for Achievement in Mathematics across Racial/Ethnic Groups? Assessing the Role of Teacher Culture

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Student engagement with school symbolizes efforts toward learning and is one of the strongest predictors of academic success. However, returns to engagement vary across racial and ethnic groups. Scholars have established that human agency is constrained by organizational environments, but they have not adequately assessed whether the advantages associated with engagement and the disadvantages associated with disengagement accrue evenly to groups of students depending on the educational environment. Using ECLS-K data, we examine how one aspect of schools' organizational culture–Collective Pedagogical Teacher Culture–moderates the relationship between engagement and mathematics achievement for students of different racial/ethnic groups in elementary school. Our study suggests that exhibiting the attributes that are valued in American society, i.e., academic engagement or, more abstractly, a strong ethic toward working academically, is not sufficient for the mathematics achievement of many students—especially minority youth. Students must study in environments that nourish and capitalize upon those attributes so that diverse students can enhance their academic trajectories. Teachers are critical for student learning, and when teachers perceive the presence of Collective Pedagogical Teacher Cultures, returns to student engagement are higher.

It is common lore that hard work complements or even trumps basic intellect. This is evident in the widely held belief that a strong work ethic is the key to financial success and in the symbolism of the ubiquitous phrase "pick yourself up by your bootstraps." Social scientists have found that this cultural norm differentiates the United States from other countries, and it guides multiple

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realms of American society, ranging from policy development to perceptions of individual's character (Alger and Hoeller 2008; Bellah et al. 1996). In the realm of education and among the youth of society, this work ethic is signified through students' engagement with school, or the extent to which our young students are attentive, eager to learn, task-persistent, independent, flexible, and organized in elementary school. These characteristics symbolize students' efforts and agency in the work of learning (Marks 2000).

As sociologists have clearly illustrated, human agency is constrained by organizational environments. In this case, students are agents in the work of learning and their engagement with school represents a set of behaviors that are rewarded in the education system (Singh et al. 2002; Bodovski and Farkas 2007). Of course, researchers do not naively think schools are unadulterated meritocracies, yet the widespread finding that the most engaged students achieve the greatest academic success appears meritocratic. The extent of rewards, however, is conditioned by schools because some schools help students translate their engagement into higher achievement (Finn and Cox 1992; Lee and Smith 1993; Marks 2000). Yet, it is unclear whether the advantages associated with academic engagement and the disadvantages associated with disengagement accrue evenly to different groups of students depending on the environments in which they study.

We fill this important gap in the literature by illustrating how school organizational culture moderates the relationship between engagement and achievement for White, Black and Latino/a students. Specifically, we assess components of Collective Pedagogical Teacher Culture, which are found when teachers perceive that professional community and teacher collaboration are valued in the school (Moller et al. 2013). We then assess the role that Collective Pedagogical Teacher Culture plays in moderating the relationship between students' academic engagement when they enter kindergarten and mathematics achievement between kindergarten and the fifth grade, using a nationally representative sample from the Early Childhood Longitudinal Study (ECLS-K) of 1998. We study mathematics achievement through cross-classified growth curve models, a methodologically sophisticated and informative technique.

It is necessary to better understand how organizational culture interacts with student engagement to predict mathematics achievement trajectories for different racial and ethnic groups because students' engagement with school has emerged as one of the leading indicators of academic success (Singh et al. 2002; Bodovski and Farkas 2007), and returns to engagement are uneven for different racial and ethnic groups (Downey and Pribesh 2004; Johnson et al. 2001; Mickelson 1990; Smerdon 1999; Ogbu 2003). Furthermore, racial and ethnic gaps in achievement are smaller amongst students who study with teachers who perceive that their schools have Collective Pedagogical Teacher Cultures (Moller et al. 2013). Nonetheless, it remains unclear why some groups of students achieve at higher levels when they study with these teachers while others are unaffected or slightly disadvantaged. Finally, it is necessary to better understand how organizational culture interacts with student engagement to predict mathematics achievement because teachers interact differently with students depending on the perceived organizational culture of schools (Gamoran et al. 2000), but it is unclear how

this interaction shapes student outcomes and how this varies by race/ethnicity and student engagement.

Our research contributes to the literature because we focus on academic engagement in elementary school using a longitudinal, nationally representative sample of kindergarten students. Most prior studies of school culture or engagement have focused on the secondary school years, and no study has examined the effects of teachers' perceived organizational culture of schools on mathematics' achievement by students' engagement and race/ethnicity. It is important to study mathematics achievement because technological advances have enhanced the importance of mathematics knowledge to students' long-term success because adults are more likely than in earlier periods to employ mathematical concepts in their everyday lives (Burrill 2001). We study achievement in the elementary years because students who struggle at early ages continue to underachieve in the upper grades. And, as years pass, the achievement gaps that existed in the early grades widen, and the need for intervention grows. Our research is also innovative because we employ a decay curve to measure the effects of Collective Pedagogical Teacher Culture on student achievement. This measure is ideal for the analysis because prior studies on effective schools and teachers are mired in causal uncertainty (Gamoran et al. 2000). By creating a lag of the key variables, we can better establish a causal link. Finally, this research contributes to the literature by exploring some of the mechanisms that explain the relationship between teachers' perceptions of school organizational culture and student achievement.

Academic Engagement in Elementary School and Race/Ethnicity

Our research is guided by a structural vulnerability perspective, where individual outcomes, whether they are labor market outcomes or educational outcomes, are shaped by individuals' characteristics, including behavior, interacting with structural features of society. For students, achievement in school and later outcomes are shaped by students' characteristics in the context of the organizational environment of the schools in which they study (Bodovski, Nahum-Shani, and Walsh 2013; Gamoran et al. 2000; Hallinan 1991; Kerckhoff 1993). Scholars have clearly established that schools generate learning opportunities and condition the extent that students' agency can generate success.

An important component of students' agency is their academic engagement in school. The most engaged students display work habits that are learning-related. These include task participation, persistence, and completion (Bodovski and Farkas 2007; Newmann 1992). Academically engaged students are cognitively committed to learning, a commitment that is evident in their attentiveness, efforts at problem-solving, enthusiasm, and interest in school (Bodovski and Farkas 2007).

Academic engagement is considered essential to academic success (West, Hauskin and Collins 1995). Indeed, Duncan et al. (2007) examined six large-scale longitudinal studies and found that academic engagement, along with math and reading skills at school-entry, are consistently the strongest predictors

of achievement. Additionally, studies focused on the elementary years, utilizing the same data source as the present study, have consistently found that academic engagement is associated with greater achievement (Bodovski and Farkas 2007; Claessens, Duncan, and Engel 2009; Condron 2009; Duncan et al. 2007; DiPerna, Lei and Reid 2007).[1]

Studies have illustrated racial/ethnic differences in academic engagement in the elementary school years, but scholars have not settled on the extent that academic engagement differentially translates into achievement across racial/ethnic groups. Indeed, some studies have found that Latino/a and Black students begin school less academically engaged than White students (Howse et al. 2003; Yair 2000; Ream and Rumberger 2008). This result is partially corroborated through analysis of ECLS-K data as Black students sampled in the ECLS-K receive lower ratings from their teachers on academic engagement than white students, but this result is explained primarily by teacher-student racial mismatch (Downey and Pribesh 2004).

It is less clear whether there are racialized returns to engagement. In analysis of elementary students using ECLS-K data, (Li-Grining and colleagues (2010) found that returns to academic engagement are similar for different racial groups. In contrast, Bodovski and Youn (2011) documented Black-White disparities in the returns to engagement in regards to achievement, but they did not find similar disparities between Latino/a and White students. We build on this literature by assessing returns to academic engagement across racial/ethnic categories between kindergarten and fifth grade. We also build on this research by assessing the extent that teachers' perceptions of schools' organizational culture moderates the relationship between engagement and achievement across racial/ethnic groups.

Schools' Organizational Culture

Research on engagement suggests that schools and classrooms can alter engagement, translating engagement into higher achievement (Dotterer and Lowe 2011; Fredericks et al. 2004; Johnson et al. 2001; Marks 2000; Patrick et al. 2007; Wang and Holcombe 2010; Wentzel 1994, 2003; Yair 2000). Yet, no research has examined how elementary schools' organizational culture affects the association between engagement and achievement by race/ethnicity. This is an important line of inquiry given that schools' organizational cultures help shape students' achievement trajectories in elementary schools (Moller et al. 2013).

Schools' organizational cultures are defined by their visible artifacts, underlying assumptions, norms, and espoused beliefs and values (Schein 2010). We follow recent trends in the literature by focusing on shared values and norms as they are quantifiable manifestations of schools' organizational culture, and they are essential to organizational identity and internal control systems (Black 2003; Moller et al. 2013; Pedersen and Dobbin 2006; Schein 2010).

More specifically, we focus on values and norms as they are perceived by teachers because teachers help generate and diffuse organizational culture within schools. Teachers must consent to and promote cultural values because teaching

is the core function of schools, and schools' organizational cultures can only affect student outcomes through teaching practices (Gamoran et al. 2000; Kruse and Louis 2009; Schein 2010). Therefore, we focus on teachers' perceptions of school cultures as an indicator of schools' organizational cultures.

Prior research has suggested that a certain type of organizational culture, referred to as Collective Pedagogical Teacher Culture, enhances achievement and reduces achievement gaps (Moller et al. 2013). A Collective Pedagogical Teacher Culture has two distinctive components 1) the presence of strong professional community and 2) a norm of collaboration among teachers where students' needs are centralized.

The first component of Collective Pedagogical Teacher Culture, professional community, has been the subject of extensive research. While scholarship on professional communities does not always conceptualize these communities as culture, there is a general understanding that professional communities cultivate culture by creating shared languages, values, and expectations among teachers and administrators (McLaughlin and Talbert 2006; Moller et al. 2013). Generally, within schools, the leadership, usually the principal, identifies the organizational mission and communicates the mission to the faculty. The culture is stronger if the faculty agrees on the mission. The culture is also more community-oriented if teachers feel accepted by each other and if they have a sense of pride or spirit, and these communities are most effective when teachers are continually learning and searching for methods to enhance their effectiveness (McLaughlin and Talbert 2006; Patchen 2004; Smey-Richman 1991; Yasumoto et al. 2001). In essence, teachers sense that they are part of strong professional learning communities when they perceive that there is an agreed upon mission, school pride, an orientation toward learning, and a sense of belonging.

The second main component of Collective Pedagogical Teacher Culture is the norm and practice of teacher collaboration. Prior research has established that schools with strong professional communities do not necessarily embrace collaborative teaching where teachers build their lessons cooperatively, eliminating redundancy and increasing compatibility across parts of the curriculum and across grades. This collaboration allows teachers to take collective responsibility for students, and it permits teachers to interactively develop the best strategy for teaching (Bidwell and Yasumoto 1999; Lee and Smith 1996; Louis and Marks 1998; McLaughlin and Talbert 2006; Wood 2007). Research illustrates that students thrive academically in schools where teachers collaboratively develop interventions for individual students (McLaughlin and Talbert 2006; Moller et al. 2013). Collaboration among teachers where the needs of students are prioritized is normative in a Collective Pedagogical Teacher Culture (Moller et al. 2013).

Studies have suggested that schools that have some components of Collective Pedagogical Teacher Culture help students become more motivated, engaged, and connected to school (Lee and Smith 1996; Maehr and Fyans 1990). These studies focus on high school. In contrast, we focus on the elementary years, the period in which students establish both learning trajectories and study habits. Furthermore, previous studies focused on broad reform practices, loosely

correlated with Collective Pedagogical Teacher Culture. We measure our concept directly.

Researchers have also discovered that some components of Collective Pedagogical Teacher Culture augment students' achievement. Notably, Lee and Smith (1996) found that professional communities can establish more equitable learning environments as they can help overcome the effect of SES on achievement in high school. Additionally, Moller et al. (2013) found that when teachers perceive that they work in schools with a Collective Pedagogical Teacher Culture, their students (kindergarten through fifth grade) have smaller gaps in mathematics achievement by race/ethnicity and socio-economic status.[2]

We build on prior research by examining the returns to engagement across racial/ethnic categories using a nationally representative sample. The extant literature does not generate race-specific hypothesis because research on race, engagement, school context, and achievement is inconclusive. For example, in a study of students across grades K-8, Yair (2000) found that Black students' levels of engagement were less responsive to the classroom environment than White students, but Shernoff and Schmidt (2008) found the opposite in a study of high school students. Conchas' (2001) qualitative study found that school contexts with strong collaborative relationships among teachers and students are important for academic engagement and success of Latino students. Despite this, one could conjecture that there may be racial differences in the moderating effects that Collective Pedagogical Teacher Culture might have on the relationship between engagement and mathematics achievement.

We propose to examine this moderating effect because a strong work ethic, signified through academic engagement, is not sufficient for all groups to succeed in a racialized society. It may be sufficient for the dominant racial group, i.e., White students, but not for other groups. This is evident in research that illustrates that teachers have differential perceptions and expectations of students, depending on the students' race and ethnicity (Ferguson 2000; Lopez 2002; McGrady and Reynolds 2013). Indeed, discrimination is pervasive in the United States. While often subconscious, discrimination generates differential treatment across groups that leads to enduring racial/ethnic differences in income, socio-economic status, wealth, achievement, and occupational attainment, even after controlling for human capital (Huffman and Cohen 2004; Lucas 2001; Mickelson 2002; Oliver and Shapiro 2006; Reskin and McBrier 2000; Royster 2003).

We also examine this moderating effect because scholars have suggested that organizations can help minimize racialized outcomes if they are characterized by organizational cultures that are conducive to diverse success. Prior research has established that Black students become more engaged and achieve at higher levels when they study in schools where they feel that they are part of a community and in schools where they perceive that teachers are responsive to their needs (Booker 2006; Ogbu 2003; Walker 1996). This "ethic of care" may also characterize schools that are particularly successful at educating Latino/a students (Valenzuela 1999). For example, Conchas (2001) showed the importance of supportive institutional and cultural processes in schools for the creation of high-achieving Latino students.

We propose that components of Collective Pedagogical Teacher Culture can help minimize racial gaps in achievement via two mechanisms: teacher perceptions and teaching practices. Teachers, especially white teachers, often perceive that students of color are less motivated, less intelligent, and have bigger behavior problems (Ferguson 2000; Lopez 2002; McGrady and Reynolds 2013). Yet, the social environment can alter these perceptions (Renzulli, Parrott, and Beattie 2011). Professional communities reflect an environment where teachers feel connected to the school, and where there is greater trust and stronger connections among teachers and between teachers and students. Thus, teachers should have more positive and more racially neutral perceptions of students in schools with strong communities and they should be less likely to give up on students. Therefore, we posit that disengaged students who study in schools with strong communities should have higher achievement because these communities should theoretically embrace all members of the community. Black and Latino/a students could also excel in these schools because prior research suggests that they thrive in "communities" and teachers who work in schools with these communities should be more likely than teachers who do not work in these schools to embrace all students, regardless of race or ethnicity. Nevertheless insufficient resources at home could also limit the possibility that disadvantaged students could engage and take advantage of schools with strong communities (Ream and Rumberger 2008).

We also propose that teaching practices in schools with Collective Pedagogical Teacher Culture are more in-tune with the needs of students because teachers are more collaborative. The collaborative component of Collective Pedagogical Teacher Culture allows teachers to jointly develop strategies for individual students. Yet, substantial research has illustrated that teachers prefer to teach and are more responsive to engaged students, while they are inconsistently responsive to disengaged students (Skinner and Belmont 1993; for a review, see Fredricks, Blumenfeld and Paris 2004). We argued above that schools with a community orientation may be more likely to embrace all students, even harder to reach, disengaged students because they identify those students as being part of the school. We do not have the same expectation for collaboration. In the absence of community, collaboration could arguably build on teacher preferences to teach engaged students. Therefore, engaged students in schools with teacher collaboration should be more likely to meet their potential and achieve at higher levels.

Data and Methods

We analyze data from the Department of Education's Early Childhood Longitudinal Study (ECLS-K). This study began in 1998 with a nationally representative sample of 15,970 kindergarteners. Most students were administered follow-up surveys when they were in the first, third, fifth and eighth grades. In each wave students were tested; and parents, teachers and school administrators were surveyed, making this an ideal dataset to examine students' achievement trajectories in light of classroom and school characteristics. Students are included in our sample if they participated in the first four waves

of data collection. We exclude the eighth grade wave because this survey does not include the same measures of organizational culture as the previous waves. 10,670 students participated in the first four waves. We also limit the sample to White non-Latino/a, Black non-Latino/a, and Latino students because these are the only groups with a large enough sample to disaggregate by engagement.[3] This narrows our sample to 8,690 students (68% White, 12% Black, and 20% Latino). We also limit our sample to students who attend public schools because prior research has found that a primary difference between Catholic and public schools is communal organization (Bryk et al. 1993). Therefore, we are interested in determining if teachers' perception of more communal organization in public schools has an effect comparable to what other scholars have found in private schools. Dropping private schools from the analysis ensures that our results are not driven by the private school effect.[4] Finally, we limit our sample to students who attend schools where both the teacher and the school administrator complete questionnaires. Additional missing data are imputed through multiple imputation (Allison 2002; Schafer 1997).[5]

Our final sample includes 5,360 White, Black and Latino/a students who attended public elementary schools between 1998 and 2003. Comparing this final sample to the initial sample of Black, White, and Latino students, the students are comparable in race (13% Black and 17% Latino), socio-economic status (30% of the final sample are lower SES, compared to 34% prior to sample selection; and 32% are higher SES in the final sample compared to 34% in the original sample), and math scores (the average kindergarten and fifth grade scores were 37.5 and 124.7 in the initial sample, and they are 36.4 and 124.3, respectively, in the final sample).

Dependent Variable

The dependent variable is mathematics achievement, measured with item response theory scale scores (IRT) in kindergarten, first, third, and fifth grades. These scores permit evaluation of achievement trajectories over time even though the tests changed to reflect age-appropriate measures. The IRT math scores assess the probability of a correct response by estimating the number of correct answers expected if the students had answered all questions for the math test in all waves (Tourangeau et al. 2009).

Independent Variables

Engagement Following Bodovski and Farkas (2007), we measure academic engagement with a scale downloaded from the original ECLS-K dataset. The measure is based on teacher responses, and it includes child's attentiveness, task persistence, eagerness to learn, learning independence, flexibility, and organization. This measure taps into one component of engagement, notably academic engagement, or "the ease with which children can benefit from the learning environment" (NCES 2002, p. 2-14). Engagement is measured in kindergarten because separate analyses (not shown) illustrate that students' engagement with school is relatively stable over time; and differences over time could reflect

teacher perceptions instead of students' behavior. Yet, engagement does have some variability over time, so the analyses focus on engagement in kindergarten, controlling for changes in engagement in the later time periods. It is appropriate to measure engagement in kindergarten because engagement in the lower grades has long-term implications for students' achievement (Alexander, Entwisle, and Dauber 1997; Fredricks, Blumenfeld, and Paris 2004).

Student race Race/Ethnicity is coded as White non-Latino, Black non-Latino, and Latino/a from parent designations of their child's racial and ethnic group.

Collective Pedagogical Teacher Culture We conceptualize Collective Pedagogical Teacher Culture as an environment where teachers perceive 1) a strong community-orientation and 2) teacher collaboration. We measure the presence of a strong learning community with variables that assess teacher beliefs about their school's cultural environment and the presence or absence of teacher collaboration. Following Moller et al. (2013), we measure a strong professional community with five teacher beliefs about their school: 1) teachers have school spirit; 2) leadership has communicated a shared school mission; (3) teachers agree on a school mission; 4) teachers feel accepted and respected as a colleague; and 5) teachers are constantly engaged in learning. The norm of teacher collaboration is measured with three variables that assess the extent to which teachers perceive that colleagues in their school: 1) collaborate on lesson planning; 2) collaborate on curriculum development; and 3) meet to discuss children. Each of these variables is gathered from the teacher questionnaire described in Appendix A (online).

Two indicators of Collective Pedagogical Teacher Culture ("professional community" and "teacher collaboration") are developed through exploratory factor analysis (EFA). Exploratory factor analysis is necessary because the extant literature does not clearly articulate the extent that professional communities are collaborative or child-centered. There is an assumption in the literature that they flow together, but we test this assumption because community does not necessarily generate collaboration.[6] The EFA is run with a polychoric correlation matrix because each of the indicator variables is ordinal (Appendix A, online, lists values). The EFA is run on teacher-level variables, as opposed to aggregating these variables up to the school-level because teachers instill cultural values within schools, and an individual student's achievement is most directly affected by that student's teacher. Therefore, for each student, in each time period, we have the student's teacher's perceptions of the organizational culture of the school. The EFA analysis produced two factors (see Appendix B, online, for standardized coefficients from the factor analysis). The first factor represents perceptions of strong professional learning communities (the first five variables above load strongly on this factor), and the second factor represents collaborative, child-oriented planning among teachers. Henceforth, the factors are referred to as "Professional Community" and "Teacher Collaboration."

Control variables All models control for variables correlated with achievement and the primary independent variables (see Table 1 for the full variable list). The time invariant controls include SES, gender, child care arrangements prior to kindergarten, and English as a second language in Kindergarten. SES

Table 1. Variable Descriptions

Variables	Description	Mean	SD	Min	Max
Dependent variable					
Mathematics achievement	Item response theory scale scores (IRT) in kindergarten, first, third, and fifth grades	78	39	12	171
Primary independent variables					
Student engagement	Based on kindergarten teacher responses about each child's attentiveness, task persistence, eagerness to learn, learning independence, flexibility, and organization	3.17	.67	1	4
Black	Student is Black	.13	.34	0	1
Latino/a	Student is Latino/a	.17	.38	0	1
White (reference category)	Student is White (reference category)	.70	.40	0	1
Teacher professional community[a]	The first component of Collective Pedagogical Teacher Culture developed out of a factor analysis. This factor represents the extent that teachers perceive a strong community orientation in the school.	–.02	.64	–2.05	1.80
Teacher collaboration[a]	The second component of Collective Pedagogical Teacher Culture developed out of a factor analysis. This factor represents the extent that teachers are collaborative.	.01	.62	–3.40	1.25
Control variables					
Student variables					
Gender	Male = 1, female = 0	.50	.50	0	1
Socioeconomic status	A composite of five variables: father's education and occupation, mother's education and occupation, and household income. SES is categorized into low, medium, and high.	.93	.80	1	3
English proficiency	Student has English as a second language in kindergarten	.11	.31	0	1
Change in student engagement	Change in student engagement between kindergarten and each time period	–.08	.59	–2.67	2.69
Head Start	Child in Head Start prior to kindergarten	.14	.35	0	1

Continued

Table 1. ***continued***

Variables	Description	Mean	SD	Min	Max
Center-based care	Child in center-based care prior to kindergarten	.55	.50	0	1
Relative care	Child in relative care prior to kindergarten	.48	.50	0	1
Nonrelative care	Child in nonrelative care prior to kindergarten	.37	.48	0	1
Same-race teacher[a]	A dichotomous variable indicating whether a student shares racial/ethnic identity with the classroom teacher	.75	.40	0	1
Teacher variables					
Teacher's education[a]	A dichotomous variable coded as 1 for master's degree, education specialist, and doctorate	.93	.14	0	1
Teacher's job satisfaction[a]	A dichotomous variable coded as 1 if teacher enjoys teaching in the school	.58	.37	0	1
School variables					
School size[a]	Log of total school enrollment	6.15	.50	1.39	7.63
School racial composition[a]	Percentage of White students in school	69.25	31.17	0	100
Average achievement[a]	Percentage of students scoring above grade level in school	63.42	17.53	0	100
Northeast	Northeast	.18	.38	0	1
West	West	.17	.38	0	1
Midwest	Midwest	.26	.44	0	1
Rural	Rural	.29	.45	0	1
Suburban	Suburban	.23	.42	0	1

[a]All time-varying variables are lagged. See Appendix C (online) for details regarding the lag.

is a composite of five variables: father's education and occupation, mother's education and occupation, and household income. Parents report data on socio-economic status in each wave, permitting us to model changes in socio-economic status over time. Initial analysis suggests that less than 10% of the sample has a substantial, lasting change in socio-economic status over time. Therefore, the analyses control for SES in Kindergarten in order to assess how SES at school entry impacts achievement growth. SES is categorized into terciles, labeled as low SES, medium SES, and high SES. Child care arrangements prior to kindergarten are controlled because they predict achievement scores in elementary school and these child care arrangements vary across racial groups (Magnuson and Waldfogel 2005). Child care arrangements are collected from the parental

questionnaire, and they are categorized as Head Start, center-based care, relative care, nonrelative care, and no non-parental child care arrangement (the excluded category) in the year preceding kindergarten. English language learners clearly face more challenges in the classroom than do other students (Gersten and Baker 2000). This variable is coded 1 for English Language Learners (0 otherwise). Each time-invariant variable is interacted with time in the analysis to establish achievement trajectories.

Time variant controls include same race (coded 1 if student and teacher are of the same race or ethnicity), school size (logged), percent of students in the school who are White, percent of students testing on grade level, teacher's highest education (coded 1 for master's degree, education specialist, or doctorate), teacher enjoys teaching (1 = yes), region (south is excluded) and rural/suburban (urban is excluded). We control for same-race teacher because research shows that same race teachers are better role models and are a source of academic and socioemotional support—especially for minority students (Dee 2004). Furthermore, prior analysis of ECLS-K data found that Black kindergarten students received lower ratings on academic engagement from White teachers than White students received from White teachers (Downey and Pribesh 2004). Therefore, it is important to control for the racial matching of students and teachers, as this controls for potential bias in White teachers' measurement. We control for school size because it influences equitable distributions of learning among students (Lee and Smith 1997). The percentage of students in a school who are White helps to capture the effects of diversity in the student body (Rumberger and Palardy 2005). The measure of percentage of students on grade level captures, at a basic level, the average achievement of the school. This measure is gathered from the administrator questionnaire. Administrators in each wave are asked, "Based on recent standardized tests, what percent of elementary children currently enrolled in this school tested at or above grade level nationally in mathematics or quantitative skills?" Teacher education reflects teacher quality, which has been found to affect student achievement (Nye, Konstantopoulos, and Hedges 2004). Finally, teacher satisfaction affects teachers' organizational commitment and student learning (Park 2005). The time-varying control variables are centered around their grand means.

Given that students' achievement trajectories should reflect students' cumulative experiences through school, time-varying teacher and school-level variables are lagged for each student. We measure these lags via decay curves because this technique permits the effects of variables to fade out over time. Following (Moller et al. 2013), our cumulative lag variables are measured with the following exponential decay curve (see Appendix C, online, for a full description):

$$\text{decay} = 100 \times e^{-.5t},$$

where .5 is the rate of decay and t reflects time elapsed. Solving for this formula suggests that teacher effects decay at a rate of 61% per year. There is no lag given that kindergarten is the first year—100% of the lag variables in kindergarten are based on kindergarten. In the first grade, the lag variables are calculated as 61%

Kindergarten and 39% First Grade. The third grade values are calculated as 29% third, 39% first, and 32% kindergarten. For the fifth grade, the cumulative lag effects are calculated as 26% fifth grade, 33% third grade, 23% first grade, and 18% kindergarten. This measurement allows students' school experiences to cumulate over time. In this way, measures of Collective Pedagogical Teacher Culture reflect students' experiences with all their teachers, as opposed to the effects of a single teacher measured at one point in time. This measure is ideal for the analysis because we are able to better establish a causal link by creating a lag of our key variables.

Analytic Technique

We utilize cross-classified growth models to examine mathematics achievement over four time periods. Cross-classified growth models permit analysis of the dependent variables over more than two time periods when the number of time periods is limited, trajectories are nonlinear, and students change schools (Goldstein 2011; Raudenbush and Bryk 2002). We are able to predict both initial scores in kindergarten and growth in scores between kindergarten, first, third, and fifth grades. This permits an examination of how professional community, student engagement, and teacher collaboration affect achievement in school, controlling for students' initial scores:

$$y_{t(ij)} = \beta_o + \sum_{q=0}^{3} \pi_{q(ij)} x_{qt(ij)} + \sum_{p=1}^{p} \lambda_p w_{pi} + \sum_{p=1}^{p} \beta_p z_{pj}$$
$$+ \sum_{q=0}^{3} \pi_{q(ij)} x_{qt(ij)} \left(\sum_{p=1}^{p} \lambda_p w_{pi} + \sum_{p=1}^{p} \beta_p z_{pj} \right) + e_{t(ij)} + u_{1i} + \mu_{2j}$$

The outcome variable is measured at time t for student i in school j, $y_{t(ij)}$, where i and j are placed in parentheses to reflect cross-classification. For example, math scores are a function of time, $x_{qt(ij)}$, student variables, $\lambda_p w_{pi}$, and school variables, $\beta_p z_{pj}$. Time is included as a categorical variable to permit nonlinear achievement trajectories, and it is interacted with student and school variables. The direct effects of the student and school variables, then, are the effects at time 0, when students are in kindergarten. The interactive effects reflect the impact of student and school variables at each time period, representing the nonlinear growth in achievement over time. Interactions between race/ethnicity and time measure growth in achievement by race/ethnicity. The effects of professional communities on achievement for each race are measured through interactions between race/ethnicity, time, and professional community. The effects of professional communities on achievement trajectories by engagement for each race are measured through interactions between race/ethnicity, engagement, time, and professional community. A similar strategy is used to test teacher collaboration. The equation includes a between-student error term, $e_{t(ij)}$, and random components for students and schools, u_{1i} and u_{2j} (Raudenbush and Bryk 2002).

Results

Table 2 presents results of the primary independent variables from a cross classified growth model predicting mathematics achievement, controlling for all variables listed in Table 1. In this model, time is interacted with all time-invariant variables. All time-varying variables, with the exception of components of Collective Pedagogical Teacher Culture, are centered around their grand means. Components of Collective Pedagogical Teacher Culture are uncentered and interacted with time. The results of primary variables, presented in Table 2, include the effects of time interacted with engagement, professional community, and teacher collaboration, as well as the effects of teacher collaboration and professional community interacted with engagement, which is further interacted with time. The effects in kindergarten reflect the main effects (without interactions with time) because time is coded 0 in kindergarten. Table 2 illustrates that academic engagement is a strong predictor of mathematics achievement in all grades and for all racial groups. This suggests, not surprisingly, that the most attentive, persistent, eager, independent, flexible, and organized children have the greatest success in math. Students without these skills are highly disadvantaged in every year, and this disadvantage cumulates over time. Indeed, in kindergarten, academically engaged students have a 7 point advantage over students who are academically disengaged. Engaged students have a 10 point advantage by the fifth grade.

The results also illustrate, as expected, that students do not benefit from components of schools' organizational culture immediately. These benefits also cumulate over time. Professional community and its interaction with student engagement become significant in the third and fifth grades. Given the challenges of interpreting multiple interactions in growth models, Figure 1 presents predicted math achievement growth (from Table 2) when all control variables are constrained to their means. The light gray lines reflect the predicted growth in achievement at the tenth percentile of the academic engagement distribution, and the darker lines represent predicted growth in achievement at the ninetieth percentile of the academic engagement distribution. Solid lines reflect growth when Professional Community is strong (i.e., the ninetieth percentiles of the distribution); Dotted lines reflect growth when Professional Community is weak (i.e., the tenth percentiles of the distribution). Growth in achievement reflects the differences in predicted scores between each year and kindergarten.

The graph clearly illustrates that engaged students (the darker lines) have higher achievement trajectories than disengaged students; and engaged students are successful irrespective of professional community. Yet, professional community helps predict the growth in mathematics achievement for disengaged students. Among disengaged students, a significant gap in math achievement emerges in the third grade between those students who study in schools where teachers perceive a professional community versus students who study in schools without this sense of community. By the fifth grade, when most students have been exposed to six years of schooling, disengaged students experience a signifi-

Table 2. Parameter Estimates from Cross-Classified Growth Models Predicting Mathematics Achievement, Kindergarten to Fifth Grade

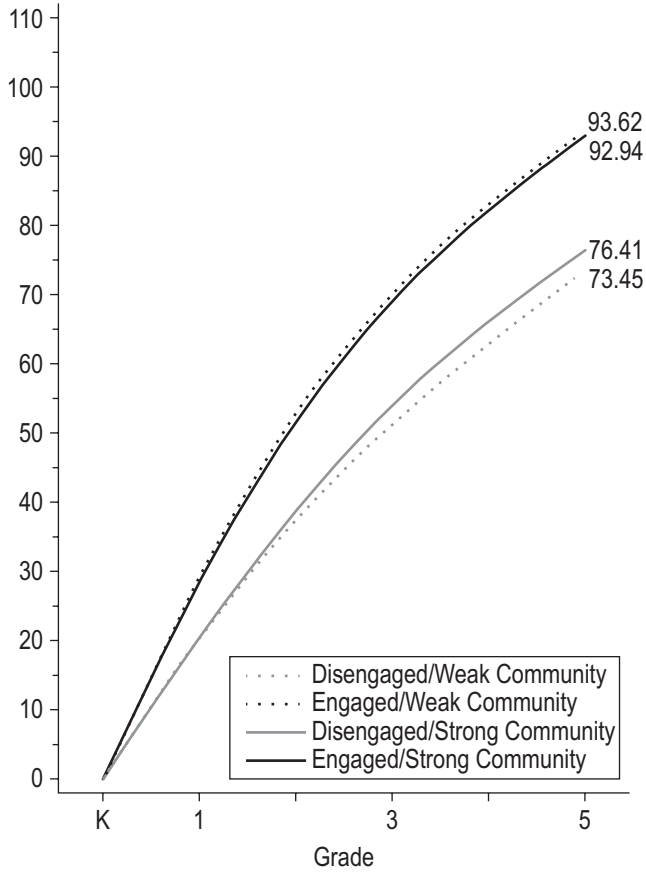
Effects in kindergarten		
Time	14.84	(1.20)***
Engagement	6.92	(.31)***
Teacher collaboration	–.95	(1.11)
Professional community	–.66	(1.08)
Engagement × teacher collaboration	.35	(.34)
Engagement × professional community	.19	(.34)
Effects in first grade		
Time	10.99	(1.08)***
Engagement	4.69	(.30)***
Teacher collaboration	1.58	(1.26)
Professional community	.70	(1.39)
Engagement × teacher collaboration	–.54	(.40)
Engagement × professional community	–.35	(.43)
Effects in third grade		
Time	32.99	(1.20)***
Engagement	9.50	(.33)***
Teacher collaboration	–.50	(1.92)
Professional community	5.66	(1.72)**
Engagement × teacher collaboration	.77	(.62)
Engagement × professional community	–1.63	(.53)**
Effects in fifth grade		
Time	53.85	(1.33)***
Engagement	10.14	(.38)***
Teacher collaboration	4.99	(2.40)*
Professional community	5.04	(2.13)*
Engagement × teacher collaboration	–1.13	(.71)
Engagement × professional community	–1.37	(.65)*

Note: Controls for all variables in table 1; standard errors in parentheses; *** $p < .001$ ** $p < .01$ * $p < .05$; interactions between engagement, teacher collaboration, and time and interactions between engagement professional community, and time are significant (*F*-statistics range from 2.6 to 4.7).

cant boost in achievement (nearly 3 points) when they spend their elementary years in schools where teachers feel a sense of community.

Turning to teacher collaboration, Table 2 illustrates that students who spend their elementary years with collaborative teachers significantly outperform their counterparts by the fifth grade. Yet, the interaction between teacher collaboration and engagement is not significant in the fifth grade. Therefore, all students

Figure 1. Predicted growth in math achievement for all students by academic engagement and teachers' perceptions of community



(regardless of engagement) who spend their elementary years in schools where teachers sense a norm of collaboration also have higher achievement.[7]

To summarize the main results from Table 2, (1) engagement is a strong predictor of mathematics achievement; (2) regardless of engagement, students benefit if they learn from teachers who perceive a norm of collaboration; and (3) disengaged students are somewhat shielded from the negative consequences of their disengagement when they spend their elementary years in schools where teachers perceive the norm of professional community.

Table 3 builds on the results presented in Table 2 by adding interactions between time, engagement, race, and components of Collective Pedagogical Teacher Culture. Again, the effects of professional community and teacher collaboration on students' achievement trajectories begin to surface in the third grade. Interestingly, the interactive effects of professional community and engagement, presented in Table 2, do not vary by race. Therefore, professional community helps to support disengaged students, regardless of race or ethnicity.

Table 3. Parameter Estimates from Cross-Classified Growth Models Predicting Mathematics Achievement, Kindergarten to Fifth Grade

Effects in kindergarten		Effects in third grade	
Time	14.35 (1.38)***	Time	34.21 (1.37)***
Engagement	7.21 (.39)***	Engagement	8.96 (.40)***
Professional community	.77 (1.27)	Professional community	5.22 (2.22)*
Teacher collaboration	1.03 (1.30)	Teacher collaboration	.63 (2.30)
Engagement × professional community	–.16 (.40)	Engagement × professional community	–1.40 (.68)*
Engagement × teacher collaboration	–.21 (.40)	Engagement × teacher collaboration	.21 (.73)
Black	.07 (2.44)	Black	–13.76 (2.53)***
Black × engagement	–.97 (.78)	Black × engagement	1.67 (.83)*
Black × professional community	–1.37 (2.62)	Black × professional community	2.62 (5.29)
Black × teacher collaboration	–3.15 (2.57)	Black × teacher collaboration	–4.26 (4.74)
Black × engagement × professional community	.15 (.86)	Black × engagement × professional community	–.42 (1.67)
Black × engagement × teacher collaboration	.71 (.83)	Black × engagement × teacher collaboration	2.01 (1.52)
Latino/a	–1.45 (2.57)	Latino/a	–7.11 (2.89)*
Latino/a × engagement	–.54 (.77)	Latino/a × engagement	1.67 (.92)^
Latino/a × professional community	–3.78 (2.82)	Latino/a × professional community	.50 (5.72)
Latino/a × teacher collaboration	–4.16 (2.96)	Latino/a × teacher collaboration	–8.06 (5.12)
Latino/a × engagement × Professional community	1.07 (.91)	Latino/a × engagement × professional community	–1.03 (1.81)
Latino/a × engagement × teacher collaboration	1.30 (.93)	Latino/a × engagement × teacher collaboration	3.12 (1.61)^

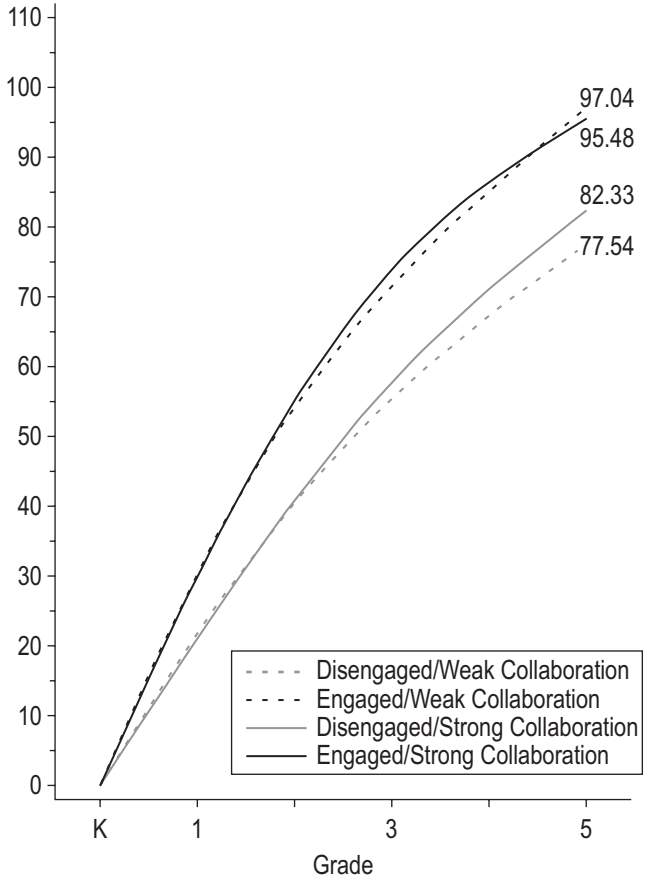
(Continued)

Table 3. ***continued***

Effects in first grade		Effects in fifth grade	
Time	10.19 (1.24)***	Time	58.22 (1.51)***
Engagement	4.87 (.37)***	Engagement	8.83 (.48)***
Professional community	.61 (1.63)	Professional community	6.74 (3.41)^
Teacher collaboration	–.62 (1.65)	Teacher collaboration	7.02 (2.88)*
Engagement × professional community	–.42 (.50)	Engagement × professional community	–1.82 (1.02)^
Engagement × teacher collaboration	.06 (.51)	Engagement × teacher collaboration	–1.97 (.85)*
Black	–1.81 (2.23)	Black	–25.34 (3.02)***
Black × engagement	–.55 (.73)	Black × engagement	4.45 (.96)***
Black × professional community	1.41 (3.63)	Black × professional community	–.92 (5.58)
Black × teacher collaboration	5.20 (3.22)	Black × teacher collaboration	–10.00 (5.82)^
Black × engagement × teacher collaboration	–1.36 (1.09)	Black × engagement × professional community	.75 (1.79)
Black × engagement × professional community	.14 (1.14)	Black × engagement × teacher collaboration	4.11 (1.87)*
Latino/a	2.14 (2.33)	Latino/a	–9.35 (3.09)**
Latino/a × engagement	–.67 (.72)	Latino/a × engagement	3.00 (.97)**
Latino/a × professional community	–2.80 (3.53)	Latino/a × professional community	–9.98 (8.45)
Latino/a × teacher collaboration	3.50 (3.44)	Latino/a × teacher collaboration	–10.15 (6.19)
Latino/a × engagement × professional community	.91 (1.16)	Latino/a × engagement × professional community	2.40 (2.53)
Latino/a × engagement × teacher collaboration	–1.05 (1.11)	Latino/a × engagement × teacher collaboration	3.97 (1.93)*

Note: Controls for all variables in table 1; standard errors in parentheses; *** $p < .001$ ** $p < .01$ * $p < .05$ ^ $p < .1$; *F*-statistics for the interaction between engagement, teacher collaboration, race, and time are significant (ranging from 2.39 to 3.72). *F*-statistics for the interaction between engagement, professional community, race, and time are not significant.

Figure 2. Predicted growth in math achievement for White students by academic engagement and teachers' perceptions of collaboration



In contrast, by the fifth grade, there are significant interactions between race, engagement, and teacher collaboration, suggesting that the insignificant results of the interactions between engagement and teacher collaboration (from Table 2) were masked by racial and ethnic differences in trajectories.

Figures 2 through 4 present predicted mathematics achievement trajectories for students by academic engagement and teacher collaboration, based on the findings presented in Table 3. We do not present graphs by professional community because Table 3 suggests that community does not significantly interact with race. Figures 2 through 4 are formatted similarly to Figure 1. Figure 2 plots results for White students, Figure 3 presents results for Black students, and Figure 4 shows results for Latino/a students. Figure 2 illustrates that by the fifth grade there is a significant gap among disengaged White students (77.54 versus 82.33) who spend their elementary years in schools with and without collaboration; yet engaged white students have similar achievement trajectories regardless of teachers' perceptions of collaboration (see the darker lines).

Figure 3. Predicted growth in math achievement for Black students by academic engagement and teachers' perceptions of collaboration

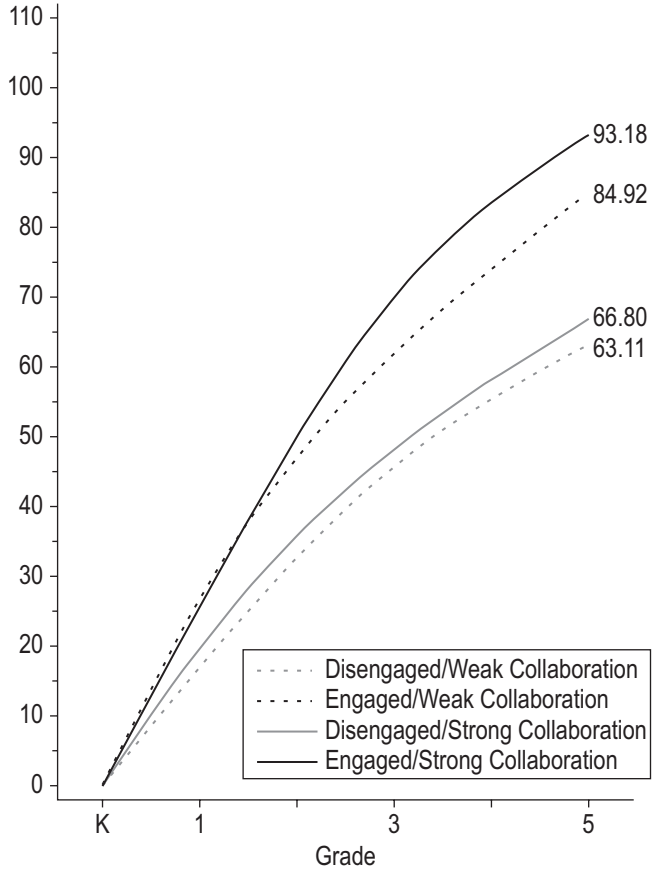
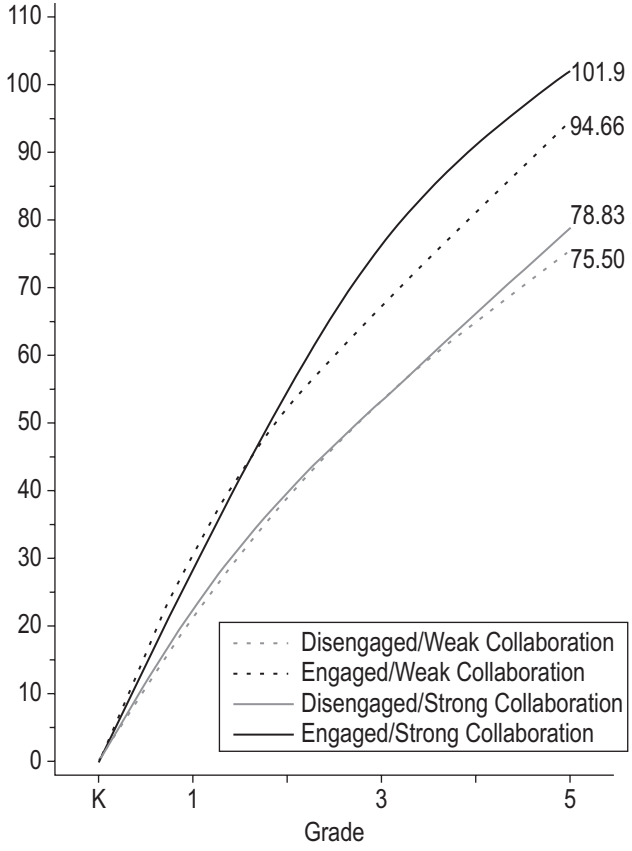


Figure 3 plots the effects of teacher collaboration on mathematics achievement trajectories by Black students' engagement with school. The graph illustrates that, in contrast to White students, Black disengaged students have comparable growth in achievement regardless of whether they spend their elementary years in schools where collaboration among teachers is normative, as the difference in the average math achievement in very collaborative and slightly collaborative schools is not significant. The gap among engaged Black students, however, is significant. Importantly, Black academically engaged students who study in schools where teachers collaborate are substantially and significantly ahead in mathematics achievement beginning in the third grade, compared to their counterparts in non-collaborative schools. Moreover, by the fifth grade, Black engaged students who study with teachers who perceive a lack of collaboration in their schools experience an eight point deficit (93.18 versus 84.92) in achievement growth compared to Black engaged students who spend their elementary years in collaborative schools.

Figure 4. Predicted growth in math achievement for Latino/a students by academic engagement and teachers' perceptions of collaboration



The final figure presents mathematics learning trajectories for Latino/a students by collaboration. When considering the importance of teacher collaboration for Latino/a students' learning trajectories, it is clear that disengaged students have lower achievement regardless of collaboration, but engaged students push ahead when they spend their elementary years in schools where teachers collaborate. In fact, engaged Latino/a students who spend their elementary years in schools where teachers collaborate experience 7 points greater growth on the mathematics achievement test by the fifth grade, on average. These patterns are very similar to those seen for African-American students.

Sensitivity Analysis

In separate analyses, not shown, we ran regressions separately for each racial/ethnic group because the analyses presented in Tables 2 and 3 require a four-way interaction between time, race, engagement, and the measures of Collective

Pedagogical Teacher Culture. Given that potential model instability could arise from this approach, we tested the results separately for each racial and ethnic category, and our results were identical. In addition, we ran diagnostics to ensure that individual cases and groups of cases by child or school did not unduly influence our results. We deleted outlying and influential observations, and our key results were robust.

Finally, we replicated our analysis with an engagement variable that varies over time. The engagement variable presented in the preceding tables and figures was measured in kindergarten. We chose kindergarten because measures of academic engagement are based on teacher assessments of students. If we had used these assessments in each grade then our measure of engagement would conflate students' engagement with teachers' perceptions and biases. Therefore, we measured engagement in kindergarten while controlling for changes over time in teachers' perceptions of each student's engagement. To ensure that our results for engagement are robust to measurement, we ran additional models where engagement was allowed to vary over time (i.e., where engagement is measured in each grade). Our results (not shown) are remarkably similar to those presented above. The only notable difference is that collaboration does not consistently enhance the achievement of engaged Latino/a students. There is a benefit in third grade, but it dissipates by the fifth grade. Yet, this could simply reflect teachers' biases in assessing Latino/a students' engagement. We maintain the position that measuring engagement in kindergarten is the best approach for operationalizing this concept because (1) it minimizes the effect of teacher biases influencing our results; (2) results are generally robust to measurement; and (3) fit statistics (AICC and BIC) are substantially stronger (i.e., smaller) for the models where we measure engagement in kindergarten, while controlling for change over time.

Discussion

Academic engagement is an important attribute among children. Students who are more attentive, organized and focused in school are undeniably the students who have the greatest academic success. This finding is sensible and fits quite nicely with the American ethos of hard work and individualism. Yet the purity of the ethos is challenged when considering the contributions of school organizational culture to achievement. We show that Collective Pedagogical Teacher Culture moderates the impact of engagement on mathematics achievement trajectories during elementary school. If an orientation toward hard work were the sole source of underperforming students' undistinguished achievement, then a school's organizational culture would be irrelevant. Yet, organizational culture clearly matters, and matters more, for some students. For engaged White students, academic engagement is sufficient for high achievement. For Black and Latino/a students, engagement is clearly necessary, but not sufficient (see Table 4). These academically engaged students of color also require an organizational culture where collaboration among teachers is normative. Without this organizational environment, many Black and Latino/a students do not meet their full potential.

Table 4. A Summary of Results from Tables 1 and 2 and Figures 1 through 4

	White	Black	Latino/a
Engaged		Teacher collaboration	Teacher collaboration
Disengaged	Professional community Teacher collaboration	Professional community	Professional community

Note: Professional community does not significantly interact with race/ethnicity.

Another route through which organizational culture has the potential to alter students' achievement trajectories is by supporting the most academically disengaged students, and helping them to succeed in school. The results suggest that one component of Collective Pedagogical Teacher Culture, professional community, functions in this way for disengaged students. Indeed, disengaged students, regardless of race, have higher achievement when they spend their elementary years with teachers who sense that a professional community is valued and informs the normative culture of the school.

So, a key question remains. Why do components of Collective Pedagogical Teacher Culture moderate the relationship between engagement and mathematics achievement? We propose two mechanisms: teacher perceptions of students and teaching practices. Table 5 presents descriptive statistics to help explain why professional community supports disengaged students. This table focuses on third grade teachers, who are categorized into three groups, depending on teachers' perceptions of community in the school. We refer to these groups as weak community, moderate community, and strong community. We also examined descriptive statistics in other grades and the results are robust. All teachers in the third grade are asked whether they agree with the statement that children are incapable of learning the material. They respond on a five point scale from strongly disagree to strongly agree. We recoded this variable, to assess the extent that teachers agree or strongly agree with this statement. In schools with weak community, 15.8% of teachers agree or strongly agree with this statement; only 9.5 percent of teachers in schools with a strong community agree or strongly agree with this statement. Next, we further divide schools by the percentage of students in the school that are White. Again, this variable is ranked into three categories, primarily non-White, mixed race, and primarily White. We ranked this variable, rather than using another strategy for defining the racial composition of the school, because we are conducting significance testing within categories of school. These tests are sensitive to sample size. By creating three equal size categories, we are able to hold sample size constant. The results indicate that regardless of the overall racial composition of the school, teachers who perceive that they are in schools with stronger communities are less likely to agree with the statement that children are incapable of learning the material. In schools where less than 70% of the students are White, 19.7% of teachers feel that these students are incapable of learning when the community is weak, compared to 9.1% of teachers when the community is strong. When the school

Table 5. Percent of Third-Grade Teachers Who Perceive That Children in the School Are Incapable of Learning the Material Presented to Them by Racial Composition of the School

	Panel A: Community		
Schools	**Weak**	**Moderate**	**Strong**
All	15.8	13.0	9.5***
Less than 70% White	19.7	15.9	9.1***
70–91% White	12.2	10.1	4.5***
Greater than 92% White	11.9	7.8	5.4***
	Panel B: Collaboration		
Schools	**Weak**	**Moderate**	**Strong**
All			
Less than 70% White	14.6	13.8	16.0
70–91% White	7.3	7.4	11.4*
Greater than 92% White	9.5	10.5	5.0***

*** $p < .001$ * $p < .05$

is predominantly White (i.e., greater than 92% White, only 11.9% of teachers feel that students can't learn the material when community is weak, compared to 5.4% when community is strong. Clearly, racial composition of the school affects teachers' perceptions of students overall ability in third grade, but the presence of a professional community generates greater confidence in students' ability, regardless of the racial composition of the school, and especially in schools that are more racially diverse.

These findings fit with the notion of community and help explain the regression results. Professional learning communities reflect an atmosphere where teachers feel connected to the school. These communities generate greater trust and stronger connections among teachers and between teachers and students. Our results indicate that these communities protect disengaged students from low achievement because disengaged students who spend more of their elementary years studying with teachers in these schools have higher achievement than other disengaged students, and one of the reasons for this is that teachers are less likely to give up on students in these schools. Disengaged students are difficult students to teach. They are the easiest students to give up on and define as incapable. Yet, when teachers work in schools characterized by a community-orientation, they are less likely to define students as incapable, and this is true across schools with different racial compositions. Thus, professional communities protect disengaged students because teachers in these schools, on average, have a stronger perception of students' capabilities.

Importantly, we did not get the same results when examining collaboration, instead of community, in Panel B of Table 5. When examining across schools by racial composition, collaboration is not associated with the perception the children are incapable of learning in schools with less than 70% White students. Teachers in schools with 70–91% White students are more likely to think that

Table 6. Percent of Third-Grade Students Who Receive Extra Assistance, by Levels of Teacher Collaboration

	Collaboration		
Schools	Weak	Moderate	Strong
Black disengaged students	37.5	41.56	43.85
Latino/a disengaged students	32.5	40.45	34.97
White disengaged students	21.4	23.27	25.78
Black engaged students	21.33	21.51	40.22**
Latino/a engaged students	21.21	20.83	24.81
White engaged students	12.74	11.63	13.15

** $p < .01$

children are incapable in the presence of teacher collaboration. In contrast, teachers are less likely to think that students are incapable in the presence of teacher collaboration at predominantly white schools. These descriptive results reiterate the distinction between community and collaboration and help explain why professional community helps disengaged students while teacher collaboration only helps white disengaged students.

While teachers' perceptions of community in the school help augment the perceptions of students' abilities in the school, providing an atmosphere where even disengaged students can flourish, the question still remains, why does collaboration help Black and Latino/a engaged students? We point to teaching practices. Table 6 presents data on the percent of third grade students who receive extra assistance by levels of collaboration in the school. This extra assistance includes individual tutoring, group pull out, and assistance before or after school. The teacher is not necessarily the person providing these services, but in most schools teachers are instrumental in identifying children in need of these services. This table illustrates that only Black engaged students receive extra assistance in the presence of teacher collaboration. Separate analyses, not shown, illustrate that most of the additional help received by Black engaged students in collaborative schools is in the form of individual tutoring. Therefore, components of Collective Pedagogical Teacher Culture may influence Black students' mathematics achievement through teaching practices due to the fact that teachers who perceive stronger Collective Pedagogical Teacher Cultures spend more time assisting individual children. Notably, the results don't adequately explain why Latino/a students thrive in these schools. Therefore, although the pattern of results was similar to that of African-Americans, another mechanism must be at work. Ideally, given the diversity of the Latino/a population, we would examine mechanisms across schools by engagement, immigrant status and ESL status. However, the number of cases in the cells are too small to offer meaningful results. Future research should further explore the mechanisms explaining why teacher collaboration benefits engaged Latino/a students.

Conclusions

In this study, we examined how the organizational culture of schools moderates the relationship between engagement and mathematics achievement for elementary students from different racial/ethnic groups. We conceptualized school organization in terms of a Collective Pedagogical Teacher Culture, defined as one where teachers perceive the presence of a professional learning community and where collaboration on lesson planning focusing on individual children is normative. Prior research has established that both components of Collective Pedagogical Teacher Culture impact mathematics achievement and help to reduce achievement gaps. Our findings reaffirm and extend prior research by demonstrating, through analysis of a nationally representative sample of elementary students, how the two dimensions of Collective Pedagogical Teacher Culture interact with student engagement, a strong predictor of mathematics achievement. It has also helped establish the mechanisms explaining the results, a step notably absent in previous studies (Gamoran et al. 2000).

A professional community is an important component of school culture because these communities provide an atmosphere where teachers protect the most disengaged students from floundering. The extent that teachers are able to protect these students is modest, but any protection for students who enter elementary school inattentive, disorganized, and unfocused is noteworthy. Importantly, our analyses suggest the modest effects cumulate over time. It is important to keep disengaged students "in the game" of schooling so that potential late bloomers may continue to have opportunities to flourish. The U.S. educational system is theoretically designed to provide opportunity for all. Building an organizational culture that values a community among teachers is clearly a path toward providing this opportunity.

Yet, professional community is not sufficient to ensure that all students are maximizing their achievement. Rather, it must be accompanied by a norm of teacher collaboration. Schools that lack this component of Collective Pedagogical Teacher Culture overlook the potential of some of their most academically engaged students. The norm of teacher collaboration is clearly building momentum in the U.S. education system, but many schools have not embraced this norm. In fact, while many scholars have assumed that professional community is accompanied by teacher collaboration, we find that students experience this coupling more infrequently than expected. Indeed, in kindergarten only 13% of students attend schools where teachers sense both a strong value of community and a norm of collaboration (where teachers fell in the top third of both distributions). Another 20% of students study with teachers who sense either a strong value of community or a norm of collaboration, but not both. In addition, while students' exposure to teachers who perceive a collaborative environment is similar across racial and ethnic groups, White students are more likely to be exposed to teachers who perceive strong professional communities in their schools. Thus, while professional communities boost the achievement of all groups, White students are disproportionately

exposed to this educational environment and therefore disproportionately benefit from greater opportunities to learn in schools with Collective Pedagogical Teacher Cultures.

This research takes an important step toward better understanding the role of school organization in student outcomes. This study indicates that improving student engagement alone is not a panacea for improving mathematics achievement in elementary school. The organizational cultures of schools moderate students' ability to turn their engagement into achievement. Clearly, teacher collaboration is the most important component when considering the extent that the organizational culture of the school helps translate students' engagement with academic work into greater success, as seen in mathematics achievement growth from Kindergarten through Grade 5; but the findings also indicate the key role of professional community in fostering achievement for many students, particularly those who are less engaged.

Our findings are also important because they highlight the interaction between human agency and social structure. This study's findings suggest that exhibiting the attributes that are valued in American Society, i.e., a strong ethic toward working academically, is not sufficient for the mathematics achievement of many students—especially underperforming minority youth. Results suggest it is also necessary that educational institutions be organized in ways that supplement, nourish, and capitalize upon those individual attributes. Providing students with schools characterized by Collective Pedagogical Teacher Cultures is one approach toward maximizing student engagement, but our findings suggest that many schools fail to meet this standard.

Notes

1. This measure is called "approaches to learning" in ECLS-K.
2. It is important to note that Phillips (1997) concluded that communal organization is not associated with enhanced math achievement in middle school.
3. Race data are gathered from the parent surveys. Parents were able to indicate that their children were one or more of the following: White, Black or African American, Alaska Native or American Indian, Asian, and Pacific Islander or Hawaiian. Parents were also asked if their children were Hispanic). These two variables were then combined. We limit the sample to students who were identified as: White race only, non-Hispanic; Black race only, non-Hispanic; and Hispanic. We limit the sample to these groups because their sample sizes are sufficiently large (note: in this article we use the term Latino/a).
4. In separate analyses (not shown) we examined levels of professional community across private and public schools. We found large, significant differences in levels of community, in the expected direction, across sectors. This further supports our decision to drop private schools from the analyses.
5. Scaled variables are imputed with the Markov Chain Monte Carlo method because we have an arbitrary missing data pattern (Schafer 1997). Categorical variables are imputed with a logistic regression method. The imputation is greater than 93% efficient for all imputed variables. The dependent variable, math achievement, was included in the imputation. Cases with missing math scores were then deleted

prior to the analysis because deleting these cases provides more efficient estimators (Von Hippel 2007).

6. The maximum likelihood EFA is conducted with an oblique rotation (promax) because theoretically, factors should be correlated. Thus, oblique rotations are generally more appropriate than orthogonal rotations (Conway and Huffcutt 2003; Fabrigar et al. 1999).
7. F-tests from the interaction between time, engagement, and teacher collaboration and the interaction between time, engagement, and professional community are significant (ranging from 2.39 to 3.72).

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