

Abstract Title Page
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Title: The Benefits of Collective Pedagogical Teacher Culture for Diverse Students' Mathematics Achievement by Academic Engagement

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Abstract Body

Limit 4 pages single spaced.

Background / Context:

Most studies of educational organizations have focused on structural features of schools, such as size, resources, and infrastructure. Research on schools' organizational culture is more sparse (Gamoran et al. 2000). Yet, these studies have suggested that the organizational culture of schools can have important implications for teaching practices and student outcomes (Gamoran et al. 2000; Lee and Smith 1996; Louis and Marks 1998). Schools' organizational cultures are critical because they define how teachers interact with each other and students (Powers 2009).

Much of the research that contributes to our understanding of schools' organizational culture has focused on professional learning communities. The exact definition of these communities varies across studies. Generally, they are referred to as communities where teachers have a shared sense of purpose for the school that is spearheaded by a visionary principal; have a sense of belonging, trust and spirit; collaborate and reflect on student learning, and are continually developing professionally (Gamoran et al. 2005; Kruse and Louis 2009; Louis and Kruse 1995; Louis et al. 1996; Stoll et al. 2006). We conceptualize Collective Pedagogical Teacher Culture as a culture where two organizational values, as espoused by teachers, are present: 1) a strong professional community; and 2) collaboration among teachers that centralizes the student. Researchers have established that components of Collective Pedagogical Teacher Culture augment students' achievement; yet it is unclear how teacher culture influences racial and socio-economic gaps in achievement trajectories.

It is also unclear how Collective Pedagogical Teacher Culture moderates the relationship between students' engagement and mathematics achievement. We focus on engagement because it has taken precedence as one of the leading indicators of academic success (Singh et al. 2002; Bodovski and Farkas 2007); and researchers have illustrated that schools can help students translate their engagement into higher achievement (Finn and Cox 1992; Lee and Smith 1993; Marks 2000). Yet, despite the widespread recognition that academic engagement is essential to students' success, researchers have not adequately assessed whether the advantages associated with academic engagement accrue evenly to students depending on the environment in which they study.

Purpose / Objective / Research Question / Focus of Study:

To better understand the impact of organizational culture on students' achievement, we will assess how components of Collective Pedagogical Teacher Culture interact with students' race and SES to shape mathematics achievement trajectories. We will also assess how components of culture moderate the relationship between academic engagement and achievement.

Population / Participants / Subjects:

We analyze data from the Department of Education's Early Childhood Longitudinal Study. 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. 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. Given our research interests, we limit the sample to White, Black, and Latino

students. We also limit our sample to students who attended public schools. Our final sample includes 4,490 students who are demographically comparable to the initial sample.

Mathematics achievement is the dependent variable. We examine achievement scores in mathematics between kindergarten and the fifth grade. We utilize item response theory (IRT) scale scores because these scores permit evaluation of achievement trajectories over time even though the tests changed to reflect age-appropriate measures. Following Bodovski and Farkas (2007) *engagement* is measured with a scale downloaded from the original dataset that measures behavioral, cognitive and emotional engagement. *The measure* is based on teacher responses, and it includes child's attentiveness, task persistence, eagerness to learn, learning independence, flexibility, and organization. We measure engagement in kindergarten because separate analyses (not shown) illustrate little change over time in engagement. Yet, given some changes, we also control for changes in engagement over time. *Race/Ethnicity* is coded as White, Black, and Latino. SES is coded as low, middle, and high SES students. See Table 1 for a list of controls.

We conceptualize Collective Pedagogical Teacher Culture as an environment where teachers perceive 1) a strong community-orientation and 2) teacher collaboration. A strong professional community is measured with five variables: 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 calculated with three variables that measure the extent that individual teachers perceive that teachers within the 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 and they are described in Table 2.

We measure Collective Pedagogical Teacher Culture through exploratory factor analysis (EFA). We use exploratory factor analysis 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. We test this assumption with maximum likelihood exploratory factor analysis with promax rotation. Each of these variables is ordinal (Table 2 lists values), and therefore we ran the EFA on a polychoric correlation matrix. Our analysis produced two factors. The first factor represents strong professional learning communities (as the first 5 measures presented in Table 2 have a moderate to strong loading on this factor), and the second factor represents collaborative, child-oriented planning among teachers (the final three measures have a moderate to strong loading on this factor). We call our factors "Professional Community" and "Teacher Collaboration."

The lack of fit between the professional community and teacher collaboration variables suggest that schools with a professional community are not necessarily collaborative. This is an important finding since prior research suggests that schools must have both components of Collective Pedagogical Teacher Culture to be effective (Wood 2007).

-Table 1 about here-

Data Analysis:

We examine mathematics achievement over four time periods though cross-classified growth modeling. This technique permits analysis of achievement scores over more than two time periods when the number of time periods is limited, trajectories are nonlinear, and students change schools (Goldstein 1999; 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.

Findings / Results:

Table 3 summarizes our findings for mathematics achievement. Black low and high SES students experience the greatest benefit from studying with teachers who sense strong professional communities. In contrast, White and Latino/a students have higher mathematics achievement trajectories than Black students regardless of SES and teachers' sense of professional community. Latino/a and Black high SES students and White middle SES students experience the greatest benefit from teacher collaboration.

Table 3 about Here

Figures 1 and 2 present a selection of these results. Gray lines reflect the predicted growth in achievement at the tenth percentiles of the Professional Community (Figure 1) or Teacher Collaboration (Figure 2) distributions. The darker lines represent predicted growth in achievement at the ninetieth percentiles of the Professional Community or Teacher Collaboration distribution. Growth in achievement is calculated by subtracting predicted scores (i.e., least square means) in kindergarten from predicted scores in the later years (we are subtracting out predicted racial/ethnic differences in mathematics scores at the beginning of schooling).

It is clear from Figure 1 that the mathematics trajectories of Black low SES students who study in schools where teachers perceive weak professional communities (the gray dotted line) begin to diverge from their peers in the third grade. These students have substantially (and significantly) lower growth in predicted math scores by the fifth grade than any other group (at 67.29), including Black low SES students who study with teachers who perceive strong professional communities in their schools. Yet, while studying in schools with strong professional communities clearly boosts the achievement of Low SES Black students, their growth by the fifth grade trails their Latino/a and White peers. Despite this fact, the graph clearly shows the importance of considering the strength of professional communities when discussing racial gaps in achievement among low SES students.

Figure 2 illustrates that racial disparities in math achievement trajectories are not evident among high SES students who spend their elementary years with teachers who collaborate (as differences in growth are not substantial or significant). Yet, racial disparities are present among high SES students who study in elementary schools where teachers do not collaborate, as White students outperform Black and Latino/a students; and where Black students trail their peers by approximately 15 points (compared to only 5 points when we do not control for collaboration and community, results not shown).

Figures 1 and 2 About Here

Table 4 presents a summary of the results from models that examine interactions between Teacher Collaboration and Students' Engagement. We see that Teacher Collaboration significantly predicts the mathematics achievement trajectories of Black and Latino/a engaged students, but not Black and Latino/a disengaged students. In contrast, Professional Community and Teacher Collaboration significantly predict White disengaged students' achievement trajectories.

Figure 3 presents predicted outcomes for a subsample of Black students. We see that Black academically engaged students who study in schools where teachers collaborate are substantially and significantly advantaged beginning in the third grade, compared to their counterparts in non-collaborative schools. By the fifth grade, Black engaged students who study with teachers who perceive a lack of collaboration only achieve at 89% of the level of Black engaged students who study in collaborative schools. In contrast, disengaged Black students

who spend their elementary years in schools where collaboration among teachers is normative have higher achievement trajectories than Black students who spend the elementary years in schools where collaboration is more sparse, but this gap is not significant.

Figure 4 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 low 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 who spend their elementary years in schools where teachers collaborate score 5 points higher on the mathematics achievement test by the fifth grade, on average.

Figures 3 and 4 About Here

Figures 5 and 6 clearly illustrate that engaged White students (the darker lines) have higher achievement trajectories than white disengaged students; and they are successful irrespective of components of Collective Pedagogical Teacher Culture. Yet, disengaged White students experience a significant boost in achievement by the fifth grade when they spend their elementary years in schools where teachers collaborate and feel a sense of community. Indeed, among disengaged students, a significant gap in math achievement is evident by the third grade between those who study in schools with and without community (see Figure 6); and a significant gap is evident by the fifth grade among disengaged students who study in schools with and without collaboration (see Figure 5). These gaps persist into the fifth grade.

Figures 5 and 6 About Here

Conclusions:

This research is designed to clarify how schools' organizational culture impacts achievement and moderates the association between engagement and achievement by race, ethnicity, and SES. We posit that it is not sufficient for teachers to feel that they are part of a community. They must also work together to ensure that lessons and curriculum are appropriate for their students. Yet, collaboration among teachers would not be productive if there is not a sense of mutual respect and belonging, as found in communities.

Importantly, the majority of students are not studying in schools with each of these factors. For fifth grade students in our sample, only 14 percent spent their elementary years in schools where their teachers frequently collaborated with each other (i.e., only 14% of students had a cumulatively lagged score of 1 on the teacher collaboration variable), and few students were fortunate enough to spend all of their surveyed elementary years with teachers who sensed that their school had all of the components of a professional community (a mission, a sense of belonging and respect, continual learning, and spirit for the school).

In light of our findings, these numbers are problematic. In fact, our analysis illustrates that a key method for lowering achievement gaps by race is through altering the organizational culture of schools. Schools can help students turn their engagement with school into higher mathematics achievement if those schools implement Collective Pedagogical Teacher Cultures. Interestingly, and importantly, these schools also don't leave students behind. Only White disengaged students benefit from studying in schools with professional communities and collaborative teachers. This finding is incredibly important given that disengagement is a key predictor of low scores among students.

Appendices

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Appendix A. References

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Table 1. Control Variables

Gender (1=Male)

English as a Second Language

Teacher and Student of Same Race

Professional Community (lagged)

Teacher Collaboration (lagged)

School Size (lagged)

Percent White (lagged)

Teacher's Education (lagged)

Teacher Satisfaction (lagged)

Rural

Suburban

Northeast

West

Midwest

Appendix B. Tables and Figures

Table 1. Measures of Collective Pedagogical Teacher Culture

1. Teacher's perception that staff have school spirit
 - 1 = "STRONGLY DISAGREE"
 - 2 = "DISAGREE"
 - 3 = "NEITHER AGREE NOR DISAGREE"
 - 4 = "AGREE"
 - 5 = "STRONGLY AGREE"
2. Teacher's perception that administrators communicate a mission
 - 1 = "STRONGLY DISAGREE"
 - 2 = "DISAGREE"
 - 3 = "NEITHER AGREE NOR DISAGREE"
 - 4 = "AGREE"
 - 5 = "STRONGLY AGREE"
3. Teacher's perception that teachers agree on school mission
 - 1 = "STRONGLY DISAGREE"
 - 2 = "DISAGREE"
 - 3 = "NEITHER AGREE NOR DISAGREE"
 - 4 = "AGREE"
 - 5 = "STRONGLY AGREE"
4. Teacher feels accepted and respected as a colleague
 - 1 = "STRONGLY DISAGREE"
 - 2 = "DISAGREE"
 - 3 = "NEITHER AGREE NOR DISAGREE"
 - 4 = "AGREE"
 - 5 = "STRONGLY AGREE"
5. Teacher feels that staff are continually learning and seeking new ideas.
 - 1 = "STRONGLY DISAGREE"
 - 2 = "DISAGREE"
 - 3 = "NEITHER AGREE NOR DISAGREE"
 - 4 = "AGREE"
 - 5 = "STRONGLY AGREE"
6. Frequency that teachers meet to collaborate on lesson planning
 - 1 = "NEVER"
 - 2 = "ONCE A MONTH OR LESS"
 - 3 = "TWO OR THREE TIMES A MONTH"
 - 4 = "ONCE OR TWICE A WEEK"
 - 5 = "THREE OR MORE TIMES A WEEK"
7. Frequency that teachers meet to collaborate on curriculum development
 - 1 = "NEVER"
 - 2 = "ONCE A MONTH OR LESS"
 - 3 = "TWO OR THREE TIMES A MONTH"
 - 4 = "ONCE OR TWICE A WEEK"
 - 5 = "THREE OR MORE TIMES A WEEK"
8. Frequency that teachers meet to discuss a child
 - 1 = "NEVER"
 - 2 = "ONCE A MONTH OR LESS"
 - 3 = "TWO OR THREE TIMES A MONTH"
 - 4 = "ONCE OR TWICE A WEEK"
 - 5 = "THREE OR MORE TIMES A WEEK"

Table 3. Groups Who Benefit from Components of Collective Pedagogical Teacher Culture

<u>Professional Community</u>	<u>Teacher Collaboration</u>
Black Low SES	Black High SES
Black High SES	Latino/a High SES
	White Middle SES

Table 4. Components of Collective Pedagogical Teacher Culture that Moderate the Relationship between Student Engagement and Mathematics Achievement

	<u>White</u>	<u>Black</u>	<u>Latino/a</u>
Engaged		Teacher Collaboration	Teacher Collaboration
Disengaged	Professional Community Teacher Collaboration	Professional Community Teacher Collaboration	

Note: Professional community and teacher collaboration are not significant for Black disengaged students, but this could reflect sample size. Therefore, we “lightly” suggest an effect.

Figure 1: Predicted Math Achievement Growth for Low SES Students by Teachers' Perception of Professional Community and by Race/Ethnicity

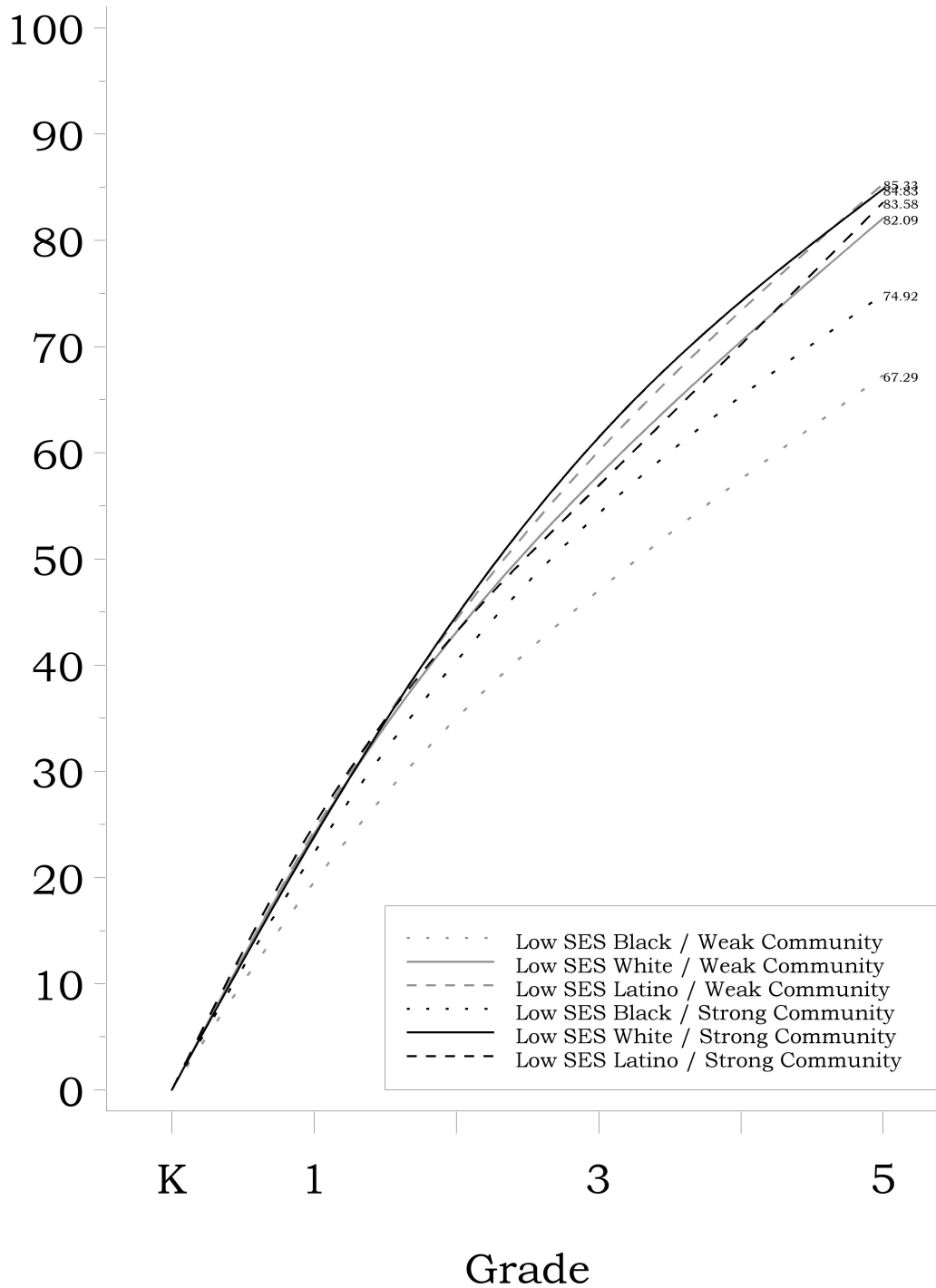


Figure 2: Predicted Math Achievement Growth for High SES Students by Teachers' Perception of Collaboration and by Race/Ethnicity

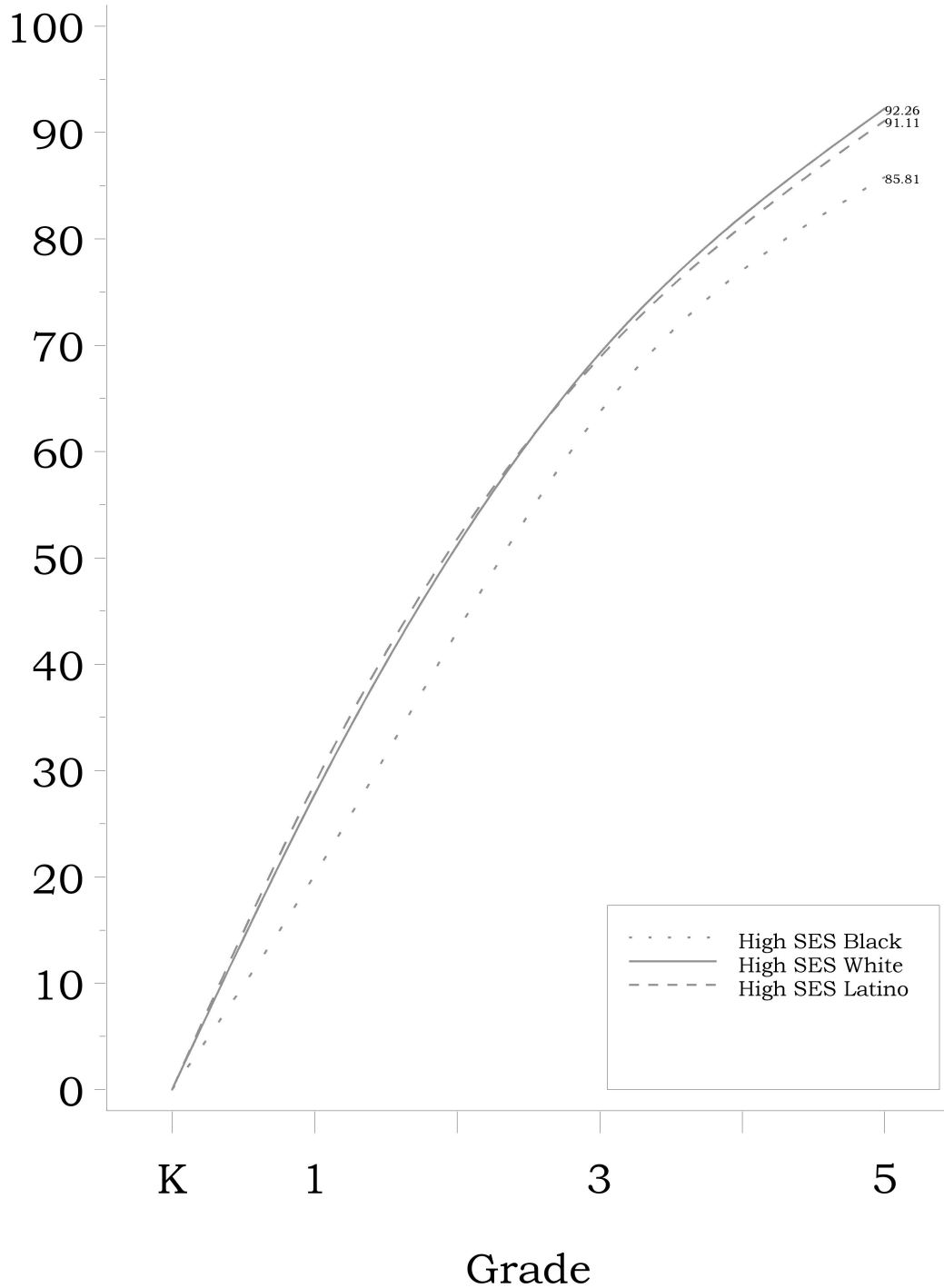


Figure 3: Predicted Growth in Math Achievement for Black Students by Academic Engagement and Teachers' Perception of Collaboration

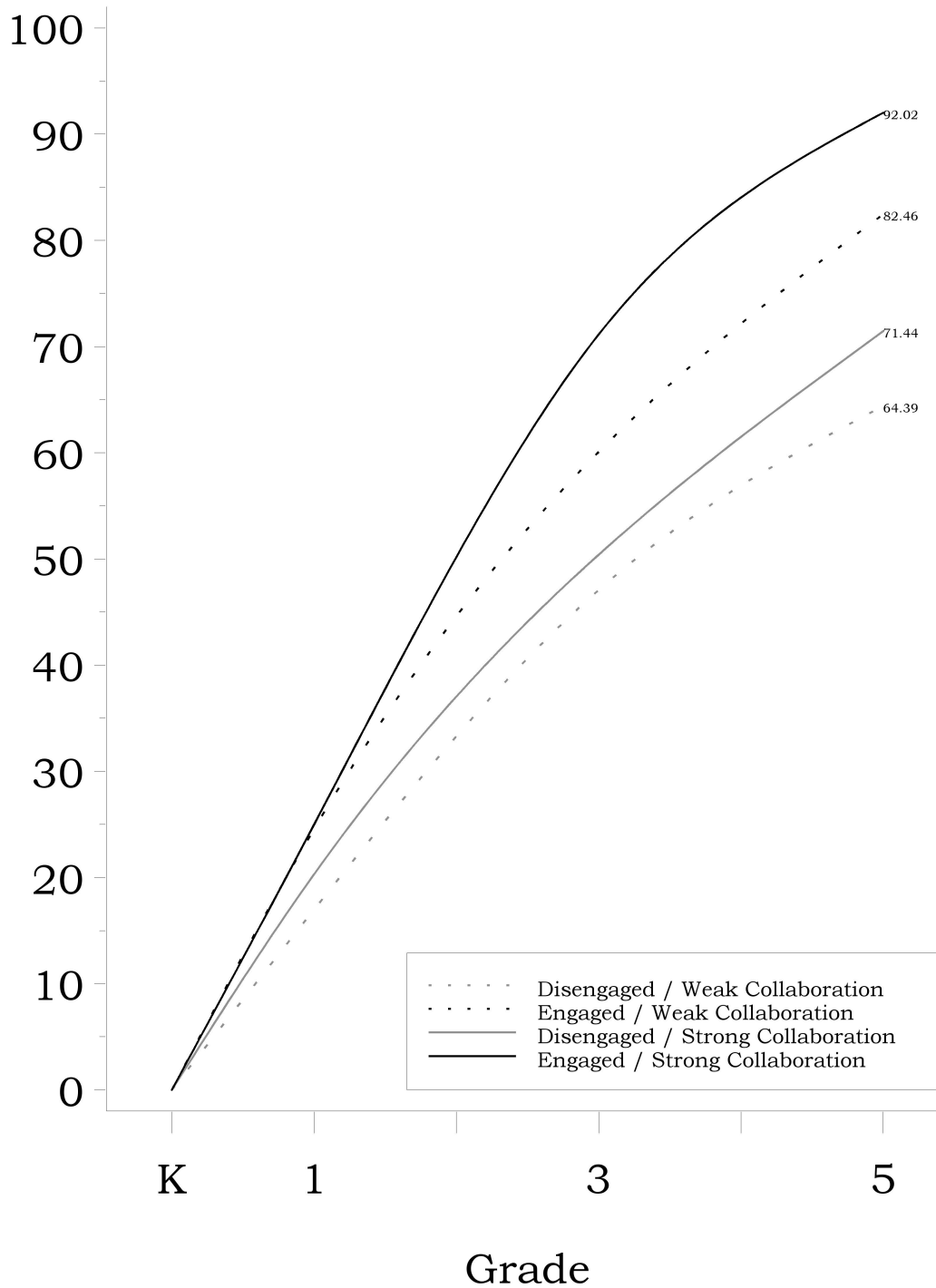


Figure 4: Predicted Growth in Math Achievement for Latino Students by Academic Engagement and Teachers' Perception of Collaboration

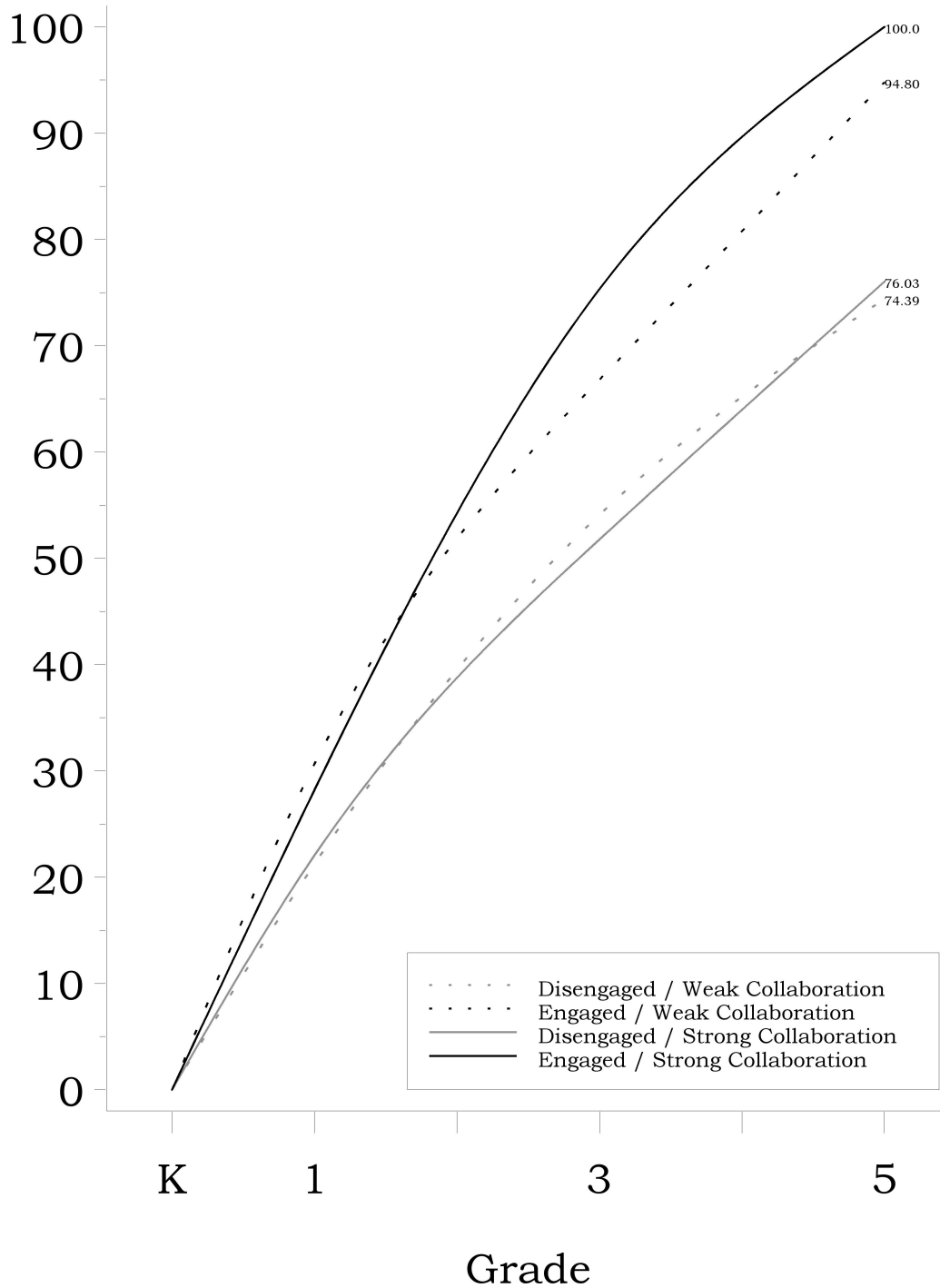


Figure 5: Predicted Growth in Math Achievement for White Students by Academic Engagement and Teachers' Perception of Collaboration

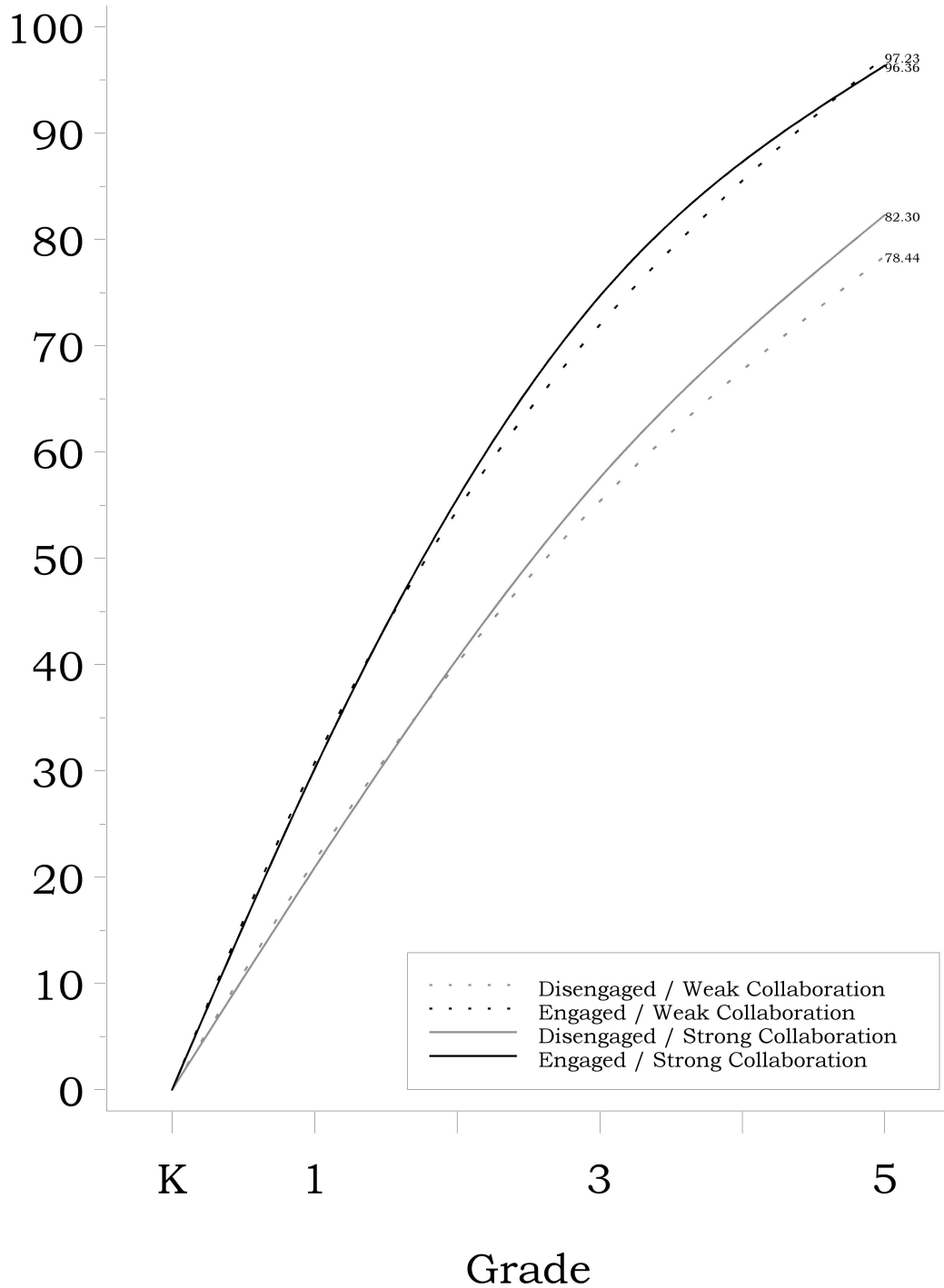


Figure 6: Predicted Growth in Math Achievement for White Students by Academic Engagement and Teachers' Perception of Community

