A Theoretical and Empirical Investigation of Teacher Collaboration for School Improvement and Student Achievement in Public Elementary Schools

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Background/Context: *A review of the literature demonstrates that schools are frequently called upon to improve by developing high levels of teacher collaboration. At the same time, there is a paucity of research investigating the extent to which teachers' collaborative school improvement practices are related to student achievement.*
Purpose: *The purpose of this study was to review the literature and empirically test the relationship between a theoretically driven measure of teacher collaboration for school improvement and student achievement.*
Setting: *The data for this study were drawn from students and teachers in a large urban school district located in the midwestern United States.*
Population: *The population for this study came from the elementary schools in one large midwestern school district. Survey data were drawn from a sample of 47 elementary schools with 452 teachers and 2,536 fourth-grade students.*
Research Design: *Hierarchical linear modeling (HLM) was the primary analytic method. Survey data were collected approximately 2 months before students took the mandatory state assessments, which provided the scale scores that served as dependent variables in this research. HLM accounted for the nested nature of the data (students nested in schools).*

This was a naturalistic study that employed secondary data analysis. There was no intervention, treatment, or randomization. Naturally occurring differences in teachers' levels of collaboration were measured, and statistical controls for school social context were employed. At the student level, the study employed controls for children's social and academic backgrounds.

Teachers College Record Volume 109, Number 4, April 2007, pp. 877–896

0161-4681

Data Collection and Analysis: *Data were obtained from teachers and students in the sampled schools. Teacher data were obtained via a survey assessing teacher collaboration. Student data were obtained from the central administrative office of the school district for all students who attended sampled schools during the year in which we surveyed teachers.*
Results: *Results of HLM analyses indicate that fourth-grade students have higher achievement in mathematics and reading when they attend schools characterized by higher levels of teacher collaboration for school improvement.*
Conclusions: *The authors suggest that the results provide preliminary support for efforts to improve student achievement by providing teachers with opportunities to collaborate on issues related to curriculum, instruction, and professional development. The authors also discuss the need for more research on the effects of different types of collaborative practices using more representative samples.*

From the one-room schoolhouses that characterized schooling in the United States over a century ago to modern multiroom school buildings, teachers have traditionally taught students in isolation. Collaboration among teachers has not been the norm historically (e.g., Lortie, 1975; Rosenholtz, 1989b; Sarason, 1996). Typically, collaboration is neither taught nor modeled in university coursework (indeed, few professors teach collaboratively), nor do practicing teachers receive substantial support from colleagues or administrators. Rosenholtz (1989a) argued that isolation was probably the greatest impediment to learning to teach or to improving existing skills because it forced teachers to rely on trial and error and to fall back on their own memories of schooling for models of teaching.

Recent reform efforts in education have included an emphasis on increasing teacher collaboration (Brownell, Yeager, Rennells, & Riley, 1997; Louis, Marks, & Kruse, 1996). In fact, Morse (2000) suggested that collaboration is an educational reform imperative: "Educators will recognize they are not alone in searching for new modes of human exchange. The fact is, this quest for a new way of human exchange is endemic in the social order…Rejecting collaboration is not an option" (p. xi). A focus on the process of collaboration, however, has preempted emphasis on outcome indicators. Indeed, collaboration is often advocated, yet its effects are less frequently investigated. Many studies have reported positive outcomes of collaboration for teachers, including improved efficacy (Shachar & Shmuelevitz, 1997), more positive attitudes toward teaching (Brownell et al.), and higher levels of trust (Tschannen-Moran, 2001). Little has been done, however, to test the prediction that teacher collaboration is associated with increased student achievement. For example, Marks and Louis (1997) stated that there is no clearly established link between teacher empowerment and student performance.

Researchers have, however, argued the possibility that collaboration may improve teaching and learning (Goddard & Heron, 2001; Pounder, 1998). According to Hausman and Goldring (2001), "teachers must be central to any meaningful change in schools" (p. 44). The more teachers collaborate, the more they are able to converse knowledgably about theories, methods, and processes of teaching and learning, and thus improve their instruction. Evans-Stout (1998), however, concluded that "we still do not have much evidence suggesting which collaborative instructional practices lead to improved student learning" (p. 124). Indeed, of the few empirical studies on collaboration conducted in the 1970s, Evans-Stout noted that most suffered from poor designs and that more recent studies have investigated the advantages of collaboration for teachers rather than students. Furthermore, based on a comprehensive review of the literature on school-based problem-solving teams, Welch, Brownell, and Sheridan (1999) cautioned that we lack empirically based studies that directly link collaboration to student outcomes. Thus, there remains a gap in knowledge regarding the effects of teacher collaboration on student-level outcomes.

This study was designed, therefore, to investigate whether there is an empirical link between teacher collaboration for school improvement and student achievement. Our primary research question addresses whether teacher collaboration positively predicts differences among schools in student achievement. In light of the predominance of state systems of testing that emphasize high standards for all, we believe that our outcome variables, fourth-grade students' achievement on high-stakes state-mandated mathematics and reading assessments, are particularly timely. Indeed, our results are of import for those interested in organizing schools so that teachers can meet the challenges brought by student assessment and school accountability.

Because we studied differences in the achievement of students nested in schools, our data were necessarily multilevel. Thus, to account for heterogeneity of regression among schools and to avoid the misestimated standard errors and aggregation bias that sometimes compromise results when ordinary least squares regression is employed to address multilevel research questions, we employed hierarchical linear modeling (HLM). We turn now to a review of the literature on teacher collaboration for school improvement to ground the research questions we tested.

RESEARCH ON TEACHER COLLABORATION

Hausman and Goldring (2001) view schools as potential "communal organizations" characterized by, among other constructs, "enhanced col-

legiality and collaboration" (p. 31). There are a variety of configurations, both formal and informal, within which collaboration may occur. For example, regular and special education teachers may work collaboratively to meet the needs of students with disabilities who spend a portion of the day in regular education settings. Middle school teachers may follow a team model in which they collaborate to improve instruction. School administrators at any level may establish teams of teachers to "problem solve about students experiencing difficulty, to establish and discuss academic standards, and to create positive working relationships with parents" (Friend & Cook, 2000, p. 16). Moreover, collaboration can occur when teachers talk often about their professional work (e.g., during planning periods). These examples clearly demonstrate that schools can present many opportunities for teachers to collaborate for the improvement of instruction, yet not all schools do. Indeed, not all teachers have opportunities to engage in professional discourse about their own learning and instruction. For example, they may work in schools with no formal mechanisms for collaboration and where administrators tightly control educational decisions involving curriculum, assessment, and student placement.

When educators having unique knowledge of a child operate in isolation, the child's educational experience becomes fragmented, and the child's needs may go unmet (Hart, 1998). Conversely, when teachers have opportunities to engage in professional discourse, they can build upon their unique content, pedagogical, and experiential knowledge to improve instruction. Although many scholars suggest that the combined skills and knowledge possessed by a team of educators should be an asset to school processes and hence student achievement, this argument is mainly theoretical. However, to make effective policy recommendations, researchers must move beyond expositions on the rationale for teacher collaboration to studies of its relationship to student learning (Evans-Stout, 1998; Hughes, 1994; Smylie, Lazarus, & Brownlee-Conyers, 1996; Welch et al., 1999).

In a study of teacher autonomy and control, Smylie et al. (1996) found that individual teacher autonomy was negatively associated with student achievement; conversely, team control over resources and accountability for outcomes was positively associated with student success. Although not related directly to collaboration, their results imply that the mutuality and shared responsibility that emerges when teachers collaborate may actually improve instruction and student learning. Other studies show that schools in which teaming occurs report fewer office-level behavioral problems (such as student office referrals and suspensions) than do those schools in which teaming does not occur (Crow & Pounder, 1997;

Pounder, 1998). A lower incidence of student misbehavior, in turn, provides increased opportunities to learn for all students. The less time teachers spend managing classroom conflict, the more time they are able to spend on instruction, thus improving students' academic outcomes.

Other research, although not specifically concerned with student achievement, suggests collaboration has important positive effects for teachers. For example, Erb (1995) found that when teachers work together, they are not only less isolated, but they are also more focused on academic and behavioral outcomes for students than when they work alone. Pounder (1998) examined teacher collaboration by studying teachers who participated formally as middle school team members to coordinate curriculum, interventions, management, and parental communications, as compared with nonteaming teachers. Pounder found that teachers who worked on teams reported more skill variety, knowledge of student performance, contact with parents, and knowledge of other teachers' work. Pounder asserted that when teachers work together on formal teams, there is a "tighter connection between teachers' work and student outcomes" (p. 66). We believe that this is because collaboration provides valuable opportunities for teachers to learn to improve their instruction.

In a review of existing research on educational collaboration, Brownell et al. (1997) concluded that positive outcomes are documented for teachers, including improved affect, heightened efficacy, and improved knowledge base. Shachar and Shmuelevitz (1997) also reported that higher levels of self-efficacy were associated with increases in teacher collaboration. Benefits to students are presumed to result from the positive changes experienced by teachers. For example, teachers' sense of increased efficacy, an outcome supported by research on teacher collaboration, has been linked to improved student achievement (Armor et al., 1976; Ashton & Webb, 1986; Englert, Tarrant, & Rozendal, 1993; Goddard, Hoy, & Woolfolk Hoy, 2000; Moore & Esselman, 1992; Ross, 1992). In sum, researchers believe that there is a link between teacher collaboration and student achievement, but the theory remains in need of testing.

RATIONALE FOR HYPOTHESIS

Our review suggests that when teachers collaborate to address important instructional issues, teaching and learning may be enhanced (e.g., Crow & Pounder, 1997; Erb, 1995; Goddard & Heron, 2001; Pounder, 1998; Putnam & Borko, 1997; Smylie et al., 1996). In light of this, we decided to examine the extent to which teachers work collectively to influence

decisions about school improvement, curriculum, instruction, and professional development. Specifically, we wanted to know whether teacher collaboration around these fundamental issues positively predicted the unequal distribution of student success among schools. Next, we briefly explain the possible benefits that accrue when teachers collaborate to solve problems and make decisions in each of these areas.

School improvement

Hausman and Goldring (2001) stressed the importance of teachers' influence over school decisions. Teachers are, after all, the school personnel most frequently and directly in contact with students. "They are thus a school system's primary reservoir of organizational knowledge about means and ends" (Conley, Schmidle, & Shedd, 1988, pp. 262–263). Other researchers contended that giving teachers responsibility for making key school decisions is important to developing professional communities among teachers (Louis et al., 1996; Marks & Louis, 1997).

Curriculum and instruction

The involvement of teachers in the selection of instructional methods and activities and the evaluation of curriculum and programs is also important. Englert et al. (1993) found that teachers who were given a voice in curricular development claimed ownership of the process and thus were able to sustain changes that were decided in a team context. In a survey of practicing teachers, Melnick and Witmer (1999) found that teachers believed so strongly in the importance of sharing instructional strategies and ideas that they often made time during nonschool hours to meet in teams to discuss these issues. Rosenholtz (1989b) supported these views and further stated that teachers should be involved collectively in instructional decision making.

Professional development

Hausman and Goldring (2001) stated that professional development opportunities, when offered at the level of individual schools, are indicators of school community. Melnick and Witmer (1999) contended that teachers must become actively involved in their own professional development. Such involvement provides opportunities for teachers to learn with colleagues. Further, Melnick and Witmer stated that encouraging active teacher involvement through professional development may allow

teachers to bring about systemic reform. Professional development may be key to improving instruction and fostering a strong sense of professional community (Louis et al., 1996). Moreover, teachers who find challenge and personal accomplishment, often through continued professional development, are more likely to remain in the teaching profession and to work hard to help their students succeed (Rosenholtz, 1989b). Our operational measure of teacher collaboration tapped each of the above areas and was employed to test the following hypothesis:

> H_1: Teacher collaboration is positively and significantly related to differences among schools in fourth-grade achievement on state-mandated assessments of mathematics and reading achievement.

Notably, the state in which the data were collected was engaged in a large-scale accountability effort through which aggregate student achievement scores were publicized in local school "report cards." Results of the fourth-grade assessments employed as dependent variables for this study were publicly reported in this manner. The public reporting of the results underscores the high-stakes nature of the assessment. Hence, we believe that the relationship between teacher collaboration and our dependent variables is highly relevant to those seeking to improve schools, particularly in the context of student assessment and accountability policy.

METHODOLOGY

The data for this study were drawn from students and teachers in a large urban school district located in the midwestern United States. The sample, data collection procedures, student-level variables, teacher collaboration measure, and multilevel analytic methods employed to test our research questions are described below.

SAMPLE

The elementary schools in a midwestern urban school district served as the population for our study. Because this study focused on schools in just one district, there was no possibility for uncontrolled between-district effects. Moreover, this design feature also held constant any differences that might be related to organizational structure (i.e., elementary, middle, secondary) of the schools. To schedule times for the administration of surveys to school faculties, a researcher contacted the principal of each

of 52 randomly selected schools. Principals in three of the selected schools declined to participate. Our decision rule for including schools in the final sample was that each school had at least 4 faculty respondents. The sample includes data from 47 elementary schools, with 452 teachers and 2,536 fourth-grade students.

DATA COLLECTION

Data were obtained from teachers and students in the sampled schools. Teacher data were obtained by a researcher who administered a survey assessing teacher collaboration to faculty groups during a regularly scheduled faculty meeting. At this time, other data beyond the scope of the present study were also collected. For this reason, half of the teachers in the room, selected at random, received a survey with questions assessing teacher collaboration, whereas the other half received a survey with different questions. Teacher surveys were anonymous; hence, we did not attempt to track the grade level that teachers taught or teacher demographics such as age or gender. We obtained student achievement and demographic data from the central administrative office of the school district for all students who attended sampled schools during the year in which we surveyed teachers.

STUDENT-LEVEL VARIABLES

Our student-level control variables included gender, race/ethnicity, free and reduced-price lunch status (a proxy for socioeconomic status [SES]), and prior student achievement. In the sampled schools, approximately 99% of the student population was either Black or White, so race was dummy-coded such that non-White = 1 and White = 0. Gender and SES were coded similarly (female = 1, free/reduced lunch = 1). The dependent variables for this study were fourth-grade students' scaled scores on state-mandated mathematics and reading assessments. The assessments were administered to students in our sampled schools approximately one month after we surveyed teachers in the spring. Reliability and validity evidence for the state-mandated achievement test was obtained from the state department of education. Cronbach's alpha suggested that the dependent measure was acceptably reliable. Further, content validity for scores on the assessment was suggested in two ways: (1) the involvement of expert educators in the development and selection of test items, and (2) the school district from which our sample was drawn followed the state model curriculum for which the mandatory assessment was developed.

As a statistical control for prior student achievement, we employed the Metropolitan Achievement Test (seventh edition) mathematics and reading normal curve equivalent scores obtained by the sampled students one year earlier, as third graders. Finley (1995) reported adequate reliability for scores on the Metropolitan Achievement Test, and Hambleton (1995), Nitko (1994), and Rogers (1994) indicated that adequate concurrent and construct validity evidence exists for scores on the assessment. Because of student mobility, we expected that we would not obtain a prior achievement (third-grade) measure for every fourth-grade student in our sampled schools. However, because we obtained data from the central office of the district, we were able to obtain third-grade mathematics and reading scores for students who, although mobile, made only intradistrict school changes. For this reason, although our research was conducted in an urban district in which mobility is problematic, our missing data rate for prior achievement was just under 14%. We standardized the prior achievement scores to a mean of 0 and a standard deviation of 1 for use in the multilevel hypothesis tests.

SCHOOL-LEVEL VARIABLES

Teacher collaboration was measured by teacher responses to a six-item Likert-type scale. The items are reported in the appendix. The items tap aspects of teacher collaboration recommended in the extant literature as discussed earlier in the rationale for the hypothesis.

School-level SES, constructed as a continuous variable representing the proportion of students in a school receiving a free or reduced-price lunch, was designed as a control for school social context. In addition, we constructed variables representing school size and the proportion of students who were minority.

MULTILEVEL ANALYSIS

Because our research question involved the effects of school practices on students, we employed HLM to account for the nested structure of the data we collected. Our within-school model included dummy variables for student gender, race, and SES, and a continuous variable representing students' prior-year academic achievement. At the school level, teacher collaboration for school improvement was tested as a predictor of differences among schools in students' mathematics and reading achievement. As controls for school context, we also modeled the effects of school SES, proportion of minority students, and size. These variables

were included as controls for aspects of organizational context that might also help to explain differences among schools in student achievement. At Level 2, only the prior achievement slopes were set to vary randomly among schools because variance in these slopes was statistically nonzero. The slopes for the other student-level predictors did not vary significantly among schools, so these effects were fixed. Thus, the equations for our full model are as follows:

1. $Y_{ij} = \beta_{\cdot 0j} + \beta_{\cdot jFEMALE} X_{ijFEMALE} + \beta_{\cdot jAFAM} X_{ijAFAM} + \beta_{\cdot jSES} X_{ijSES} + \beta_{\cdot jMISS\ PRIOR\ ACH.} X_{ijMISS\ PRIOR\ ACH.} + \beta_{\cdot jPRIOR\ ACH.} X_{ijPRIOR\ ACH.} + r_{ij}$

2. $\beta_{\cdot 0j} = \gamma_{00} + \gamma_{0NUMSTD} W_{jNUMSTUD.} + \gamma_{0SES} W_{jSES} + \gamma_{0PCT.BLACK} W_{jPCT.BLACK} + \gamma_{0COLLABORATION} W_{jCOLLABORATION} + U_{0j}$

3. $\beta_{\cdot jPRIOR\ ACH} = \gamma_{50} + U_{jPRIOR\ ACH.}$

RESULTS

Of the 49 participating schools, there were two in which too few faculty members were available to complete the questionnaires. Therefore, these two schools were dropped from the sample, leaving 47 schools, or 90.4% of the 52 schools randomly selected for inclusion. A total of 452 teachers completed the surveys, and over 99% of the forms returned were useable. The final sample included 2,536 students and 452 teachers in the 47 sampled elementary schools from one large urban school district. Descriptive statistics for both the student- and school-level variables appear in Table 1. Nearly 60% of the fourth-grade students in our study

Table 1. Descriptive Statistics

Student Level (n = 2,536)				
	M	*SD*	Minimum	Maximum
Mathematics achievement	0	1	-4.00	5.25
Reading achievement	0	1	-3.92	3.95
Prior math achievement	0	1	-1.94	2.45
Prior reading achievement	0	1	-2.15	2.59
Free or reduced price lunch	.67	.47	0	1
Black	.57	.49	0	1
Female	.48	.50	0	1
School Level (J = 47)				
	M	*SD*	Minimum	Maximum
Teacher collaboration	0	1	-2.08	1.83
Proportion F/R lunch	.62	.20	.10	.89
Proportion Black	.56	.28	.08	1.00
Number of students	401.40	107.26	229.00	710.00

were Black, and about two thirds received a free or reduced-price lunch. Notably, the school-level descriptive statistics indicate considerable variability across schools in the distribution of disadvantaged students.

Note: In the final analysis, all school-level predictors were standardized to have a mean of 0 and a standard deviation of 1.

The mean size of the elementary school faculties surveyed was just over 21. By design, we intended to measure teacher collaboration for school improvement by obtaining responses from approximately half of the faculty. However, because there were uncontrollable events (e.g., teacher absences and schedule conflicts), not every teacher attended the meetings in which surveys were administered. Our research team did not attempt to collect data from teachers who were absent. On average, across the schools in the study, we obtained responses from approximately 45% of the teachers in the sampled schools, with between 4 and 20 responses per school, depending on school size. In no case did teachers present at the faculty meetings we attended refuse to complete the surveys. The elementary schools we sampled were K–5, and teachers from all grades attended the meetings in which we collected our data.

Because we conceptualized the level of teacher collaboration as an important dimension of schools' normative and behavioral environments, we conducted our psychometric analysis of the five collaboration items at the school level. We began by aggregating the five teacher collaboration items to the school level, which resulted in a mean score for each school on each item. Next, we submitted these items to a principal axis factor analysis. Results indicated that all of the items loaded on a single factor with an eigenvalue of 4.25. This single factor explained 85% of the total variance in the items, and item loadings ranged from .79 to .95.

Table 2. Correlations Among Student-Level Variables (n = 2,536)

	Math achievement	Reading achievement	Prior math achievement	Prior reading achievement	Black	Free or reduced-price lunch	Female
Mathematics achievement	-						
Reading achievement	.73**	-					
Prior math achievement	.72*	.67**	-				
Prior reading achievement	.63**	.69**	.72**	-			
Black	-.31**	-.28**	-.29**	-.26**	-		
Free or reduced price lunch	-.31**	-.31**	-.33**	-.34**	.27**	-	
Female	.01	.08**	-.05**	-.07**	.00	.00	-

*$p < .05$. ** $p < .01$.

Internal consistency for the five items was also quite strong (alpha = .96). Based on the high reliability of scores on the scale and the strong single factor that was extracted, teacher collaboration for school improvement was operationalized as the factor score calculated for each school.

Table 3. Correlations Among School-Level Variables (n = 47)

	Teacher collaboration	Proportion Black	Proportion F/R lunch	Number of students
Teacher collaboration	-			
Proportion Black	-.19	-		
Proportion free or reduced-price lunch	-.23~	.52**	-	
Number of students	-.09	.06	.19	-

~$p < .10$. *$p < .05$. **$p < .01$. ** $p < .001$.

Correlations among the student-level variables are reported in Table 2. The results reveal a strong and significant negative association between being a student of color or receiving a subsidized lunch, and mathematics and reading achievement in fourth grade. Conversely, students' prior performance on the Metropolitan Achievement Test (in third grade) was significantly and positively related to their fourth-grade achievement in the same content areas. Table 3 reports correlations among the school-level variables. Among all the school contextual variables, the proportion of students receiving a subsidized lunch ($r = -.23$, $.05 < p < .10$) was the variable most strongly associated with the extent to which teachers reported influencing school improvement decisions. Notably, however, the magnitude of the relationship is not large, and the statistical significance is marginal.

Given that 14% of our student sample was missing prior achievement, we decided to conduct a missing data analysis to determine whether these prior achievement scores were missing randomly. Our analysis revealed that students who were missing prior achievement had significantly lower current achievement scores in both reading and mathematics, which may result from interdistrict mobility. To account for this, we created a student-level dummy variable called *missing prior achievement*, which we employed to adjust our multilevel models for the nonrandom nature of the missing data.

TEACHER COLLABORATION MODELS

We employed HLM to test our main hypothesis: that teacher collaboration for school improvement is related to differences among schools in students' mathematics and reading achievement. We began the multi-

Table 4. HLM Unconditional Model Characteristics: Variation Between Schools in Teacher Collaboration for School Improvement (n = 452 teachers in 47 schools)

	Teacher Collaboration
Intercept (school average)	.011
Between-school parameter variance	.279[a]
Within-school parameter variance	.711
HLM reliability estimate for intercepts	.772
Proportion of variance between schools	.282

[a]Chi-square = 207.11, *df* = 46, *p* <.001.

Table 5. HLM Unconditional Model Characteristics: Variation Between Schools in Students' Mathematics and Reading Achievement (n = 2,536 students in 47 schools)

	Mathematics	Reading
Intercept (school average)	.039	.019
Between-school parameter variance	.265[a]	.195[b]
Within-school parameter variance	.786	.846
HLM reliability estimate for intercepts	.943	.919
Proportion of variance between Schools	.261	.194

[a]Chi-square = 742.04, *df* = 46, *p* <.001.
[b]Chi-square = 509.31, *df* = 46, *p* <.001

level tests with two unconditional models to estimate the extent to which both teacher collaboration and student achievement varied among schools. The results of the unconditional models are shown in Tables 4 and 5. The chi-square tests of significance indicated that, as expected, the proportions of variance among schools in both teacher collaboration (28%) and student achievement (26% mathematics, 19% reading) was statistically nonzero. Hence, we continued our multilevel modeling.

At Level 1 in our multilevel models, we adjusted average levels of school achievement (i.e., the intercepts) for the effects of student demographics (race, gender, and SES) and prior achievement. The within-school findings show that student achievement was significantly and negatively associated with both minority status and disadvantaged socioeconomic status, whereas prior achievement had a significant positive effect. At Level 2, we entered measures of school SES, minority proportion, and size as statistical controls for school social context. In addition, we added our measure of teacher collaboration for school improvement.

Consistent with our main hypotheses, teacher collaboration was a statistically significant predictor of variability among schools in both mathematics and reading achievement. Specifically, a one-standard-deviation increase in the extent to which teachers collaborated on school improve-

ment was associated with a .08 *SD* increase in average school mathematics achievement and a .07 *SD* increase in average school reading achievement. Thus, even with school means adjusted for student characteristics and school social context controlled, teacher collaboration for school improvement was a significant positive predictor of differences among schools in student achievement (see Table 6).

Table 6. HLM Analysis of the Effect of Student and School Characteristics and Teacher Collaboration on Students' Achievement in Mathematics and Reading Assessment (n = 2,536 students in 47 schools)

	Mathematics	*p* value	Reading	*p* value
Intercept (average achievement)	.24***	.00	.23***	.00
	(.04)		(.04)	
Teacher collaboration	.08*	.02	.07*	.02
	(.03)		(.03)	
Proportion of students receiving free or reduced-price lunch	-.08	.13	-.09*	.01
	(.05)		(.03)	
Proportion minority	-.01	.88	.02	.58
	(.05)		(.03)	
School size	-.08*	.04	-.04	.11
	(.04)		(.02)	
Student receives free or reduced-price lunch	-.13**	.00	-.13*	.00
	(.03)		(.03)	
Female	.05*	.03	.08	.00
	(.02)		(.03)	
Black	-.21***	.00	-.23***	.00
	(.03)		(.03)	
Prior math achievement	.64***	.00		-
	(.03)		-	
Prior reading achievement	-	-	.60***	.00
			(.02)	
Missing prior achievement	-.32***	.00	-.29***	.00
	(.05)		(.07)	
HLM variance parameters				
Unconditional between school parameter variance	.26		.19	
Full model between-school parameter variance	.05[a]		.03[b]	
Proportion of between school variability explained by model	81%		84%	

[a]Chi-square = 276.445, *df* = 42, *p* < .001.[b]Chi-square = 132.13, *df* = 40, *p* <.001.

~*p* < .10. *p <.05. ** *p* <.01. *** *p* <.001.

DISCUSSION

When teachers collaborate, they share experiences and knowledge that can promote learning for instructional improvement. From the perspective of organizational theory, collaboration is a form of lateral coordination that can improve organizational performance by fostering "creativity and integration around specific problems" (Bolman & Deal, 2003, p. 55). Such learning can help teachers solve educational problems, which in turn has the potential to benefit students academically. "Of the many resources required by schools, the most vital are the contributions—of effort, commitment, and involvement—from teachers" (Rosenholtz, 1989b, p. 421). It is important to note that the results of this study indicate that teacher collaboration is associated with increased levels of student achievement. After controlling for the effects of student characteristics (race, gender, SES, and prior achievement) and school context, we found that teacher collaboration for school improvement was positively related to differences among schools in both mathematics and reading achievement. These results are important given that most prior research on teacher collaboration has considered results for the teachers involved, rather than student-level outcomes. This study thus offers original evidence of a positive and statistically significant relationship between teacher collaboration and student achievement.

Our results indicate that a one-standard-deviation increase in the extent to which teachers reported collaborating predicted just less than a .1 *SD* increase in differences among schools in student mathematics and reading achievement. Hence, although the main hypothesis of this study was confirmed, it is important to note that the relationship between teacher collaboration and differences among schools in student achievement was moderate. That it is not to say that most schools would not opt for such improvement; however, we believe that further research is needed. For example, one explanation for the magnitude of our findings may pertain to the restricted range of the schools in our sample. Indeed, our findings generalize to the elementary schools of one large urban district. This restriction in range quite likely restricts variability in the social context, collaborative practices, and achievement of the schools we studied. In other words, although our findings are promising, the generality of these results is somewhat limited. Thus, future investigators may wish to employ research designs that draw data from schools that are more broadly representative in terms of social context, urbanicity, and grade levels.

Although the findings are moderate, they are substantively important. In fact, the finding of a positive link between student achievement on

high-stakes assessments and teacher collaboration is timely and significant, particularly in light of the heavy emphasis that accountability policy places on such assessments. Moreover, this was a naturalistic study. We did not examine the effects of a specific program aimed at increasing collaboration for instructional improvement among teachers. Based on our results, however, we suggest that such systematic efforts to enable collaboration among teachers may be rewarded with improved student achievement. The design, costs, and effects of such programs are, however, questions for future researchers and school reformers. Based on the results of this study, we believe that if teachers in urban elementary schools have the potential to raise student achievement on high-stakes mathematics and reading assessments through collaboration, such efforts should be encouraged and supported. The extant literature already indicates that collaboration yields positive outcomes for teachers. Those findings, in conjunction with the important results of this study, further substantiate the need for teachers to be involved in collaborative efforts aimed at improving instruction for their students.

CONCLUSION

This study contributes important new knowledge to the existing research base regarding teacher collaboration. To our knowledge, this is the first study linking teacher collaboration for school improvement to student achievement on high-stakes assessments. Our findings suggest that teacher collaboration may improve schools' ability to foster student achievement.

From our perspective, the relationship between teacher collaboration for instructional improvement and student achievement is likely indirect. That is, the most important outcome of teacher collaboration may be that teachers learn how to improve their instructional practice. On the one hand, low levels of collaboration may indicate teachers' unwillingness to take personal risks, especially those teachers who have worked in isolation for many years. Collaboration, on the other hand, encourages teachers to move beyond reliance on their own memories and experiences with schooling and toward engagement with others around important questions of teaching and learning. The level of achievement envisioned for all students today is unprecedented, and scholars have argued that teacher learning is key to the success of this reform effort (e.g., Cohen & Hill, 2001). Although we did not study teacher learning directly, it is not unreasonable to speculate that the explanation for our results is that teacher collaboration fostered learning that improved instruction. At the very least, our results suggest that schools with greater

levels of teacher collaboration did indeed have significantly higher levels of student achievement. Thus, not only is collaboration good for teachers—quite possibility by fostering teacher learning—but it is also positively related to student achievement.

Appendix

Teacher Collaboration Scale

To what extent do teachers work collectively to influence these types of decisions?

Not at all					Not Very Much
1	2	3	4	5	6

Planning school improvement

Selecting instructional methods and activities

Evaluating curriculum and programs

Determining professional development needs and goals

Planning professional development activities

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