Instructional Leadership: A Pathway to Teacher Collaboration and Student Achievement

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Abstract

The purpose of this paper was to test the relationship between principals' instructional leadership and teacher collaboration around instruction to determine whether these measures were statistically related and whether, together, they were associated with academic achievement in elementary schools. Data were obtained from 1605 teachers in 96 elementary schools where principals are participating in a randomized control trial to assess the efficacy of a widely disseminated professional development program for school leaders. Using structural equation modeling, we found a significant direct effect of instructional leadership on teacher collaboration and a significant direct effect of collaboration on student achievement. Also, the indirect effect of leadership on student achievement through teacher collaboration was significant. These findings have implications for practitioners and researchers.

Instructional Leadership: A Pathway to Teacher Collaboration and Student Achievement

Recent developments in national accountability standards and changing demographics in schools have led to increased emphasis on the role of principals in leading instructional improvement (Hallinger, 2003, 2005). In fact, emerging research indicates that instructionally focused, transformational leadership affects teachers' instructional practices (Goddard et al., 2010). Good leadership falls within and beyond the scope of the principal, however. Therefore, school leaders should involve teachers in collaborating to bring about school improvement. Indeed, extant research suggests the importance of teacher collaboration to teachers' learning, instructional practice, and differences among schools in academic achievement (Goddard, Goddard, & Tschannen-Moran, 2007; Louis et al., 2009).

The design of this study was to examine whether instructional leadership predicts the degree to which teachers collaborate to improve instruction, and in turn, whether these variables predict student achievement. Our conceptual model suggests that principals influence student achievement, albeit indirectly, by creating conditions supporting instructional improvement. We test not only this relationship but also the link between teachers' collaborative practice and student achievement. More succinctly, the purpose of this paper is to examine the direct link between teachers' collaborative practices and student achievement and the role of the principal in facilitating this relationship.

Literature Review

The more principals work routinely with teachers on instructional improvement, the more likely are principals to be positioned to advise on best practices and keep teachers connected to the core of their work. An effective way to connect teachers is to create structures that encourage

collaboration. Collaboration plays an important role in helping teachers focus on instruction. When collaboration is absent and teachers work in isolation, little professional growth occurs (Pounder, 1999). Successful collaboration requires allocated time and specified goals or outcomes (Friend & Cook, 2009). While teachers may have some control over such factors, school leaders can play a key role in providing the support and structures necessary for effective collaboration. Therefore, we posit that instructional leadership (Marks & Printy, 2003) should positively predict the degree to which teachers work together to improve outcomes for their students. Principals may foster teacher collaboration by providing instructional leadership and, consequently, higher levels of teacher collaboration may lead to improve student achievement.

Notably, most research on collaboration has focused on improved outcomes for teachers, with little attention given to its impact on student achievement (Goddard, Goddard & Tschannen-Moran, 2007). Recent studies have begun to examine this link, but much more research is required to establish the connections between teacher collaboration and student achievement.

To this end, one purpose of this paper is to test whether teacher collaboration impacts student achievement positively. In addition, we posit that instructional leadership is related to the degree to which teachers collaborate. Together these tests allow us to test the indirect link between instructional leadership on student achievement through teacher collaboration. Thus, we conjecture that the more leaders create collaborative opportunities, the more likely are teachers to engage in pedagogical improvement.

In the next sections, we review literature related to each of our hypotheses. First, we discuss principal leadership. Following that, we review teacher collaboration literature and end with connections between leadership and teacher collaboration. We summarize the literature

review by indicating the ways in which our paper contributes important new information to the field.

Principal Leadership

Scholars have demonstrated empirically that the work of school leaders has indirect effects on student achievement, mostly through the support leaders provide to teachers (Hallinger, 2003, 2005; Leithwood & Mascall, 2008; Louis et al., 2009). Walters, Marzano, and McNulty (2003) reported the results of a meta-analytic study of principal leadership and student achievement. They concluded that the average effect size relating leadership to student achievement was .25, with leaders' knowledge of curriculum, instruction, and assessment significant predictors of student learning. Similarly, Leithwood, Seashore Louis, Anderson, and Wahlstrom (2004) concluded that school leadership was second only to teaching among schoolbased factors in capacity to improve student performance.

Using structural equation modeling, Hallinger, Bickman, and Davis (1996) found no direct effects between principal leadership responsibilities and students' academic performance, but they identified mediating school and classroom variables demonstrating an indirect relationship between school leadership and student performance. Principal leadership influenced reports of instructional climate and instructional organization, which in turn were significantly and positively related to student achievement. Witziers, Bosker, and Kruger (2003) found small, direct effects of elementary school principal leadership on achievement but no such effects at the secondary school level.

In a meta-analytic study, Robinson et al. (2008) found that both instructional and transformational leadership are related to student achievement, with instructional leadership having a much greater effect. Principals are responsible for supervising, evaluating, and

monitoring instruction, curriculum coordination, and gauging student learning (Blase, & Blase, 2000). However, the principal cannot be the sole individual charged with improving a school's instructional program. The research on principal leadership indicates that principals are most effective when they focus on instructional improvement and collaborate with teachers, encouraging them to work together actively toward instructional improvement (Marks & Printy, 2003; Supovitz, Sirinides, & May, 2010). In fact, some researchers contend that principals need to engage teachers' professional knowledge and judgments so as to not risk creating a school that is too dependent on one person's vision and leadership (Hallinger, 2003; Lambert, 2002). Thus, leaders should encourage and model collaboration.

Collaboration

For several decades, researchers and practitioners have advocated for teacher collaboration in school settings (Friend & Cook, 2009; Pounder, 1998, 1999). This is logical, given that teachers are professionals, possessing unique knowledge about their students and how they learn. Through teacher training programs, various professional development opportunities, and first hand work with their students, teachers acquire unique knowledge about instructional and classroom management approaches. To maximize opportunities for knowledge diffusion and innovation, they should be intimately involved in collaborating around instructionally related matters that concern improvements in student outcomes.

Much existing literature related to teacher collaboration, however, has focused on discovering the effects of collaboration on teachers, as opposed to examining the direct link between collaboration and student learning. Specifically, positive outcomes for teachers have included improved efficacy (Shachar & Shmuelevitz, 1997), improved attitudes toward teaching (Brownell et al., 1997), greater understanding of students (Pounder, 1999), and higher levels of

trust (Tschannen-Moran, 2001). Perhaps research has converged on teacher effects because teachers face substantial obstacles related to collaboration. Finding time to collaborate is one of the most consistent challenges teachers face (Darling-Hammond & Richardson, 2009; Friend & Cook, 2009). Additionally, teachers may face challenges related to the structure or content of their work together. For example, Darling-Hammond and Richardson (2009) indicate that to focus teachers' work on improving instruction, group members must make their work public and be willing to adjust their practices. Because these obstacles must be addressed at the teacher level, research on overcoming them is important. Nevertheless, the impact of changes that teachers make to their practices as a result of collaborative efforts must be studied as well.

Importantly, emerging research indicates that teacher collaboration is positively associated with the academic performance for students (Goddard et al., 2007; Louis et al., 2009). For example, Goddard, Goddard, and Tschannen-Moran (2007) conducted a study of elementary school teachers in 47 schools in one large urban district and found that, after controlling for student characteristics and school social context, teacher collaboration for school improvement was a significant positive predictor of differences among schools in student achievement. This study is unique in its focus on direct connections between collaboration and student achievement. However, more evidence gathered in different contexts is needed to further establish the link between teacher collaboration and student achievement.

In sum, a review of the literature on teacher collaboration indicates that this approach has been advocated largely for its positive effects on teachers, though more recent research supports that teacher collaboration may also have direct benefits for student learning. However, to fully engage collaboratively, teachers require administrative support to help overcome barriers such as

time and structure. For this reason, we argue that school leaders are key facilitators of teacher collaboration.

Links Between Leadership and Collaboration

Research indicates that school leaders influence teachers' practice. For example, Louis et al. (2009) found that leaders had a direct impact on teachers' professional community (which measured teacher collaboration, among other constructs). Further, professional community was associated with improvements in math achievement on state assessments. This work supports the view that instructional leadership requires principals to collaborate in meaningful ways with others in the school (Hallinger, 2003). In any organization, skill sets and expert knowledge are typically dispersed across all personnel and do not reside with just one, or even a few individuals. Therefore, it is important for school principals to work collaboratively with teachers to maximize the outcomes of collective expertise. This notion is supported by Marks and Printy (2003) who found that effective principals combine transformational leadership - which involves building a positive school culture through such approaches as participatory decision-making and collaboration – rather than unilaterally exercised instructional leadership.

Similarly, Blase and Blase (2000) observed that effective principals work to develop connections between teachers socially and in the exchange of professional knowledge. Good school leaders encouraged open communication, guiding teachers to reflect critically on their own learning and teaching practice. Performing an instructional monitoring function, principals provided feedback to teachers post-observation and through informal day-to-day interactions. Teachers reported that effective principals modeled teaching practices in classrooms and that collaboration with principals increased teacher motivation, efficacy, reflective practice, and instructional innovation.

Research on school leader effects shows mostly indirect impact on student achievement, largely through leader support of teachers (Hallinger, 2003, 2005; Leithwood & Mascall, 2008). Additionally, recent research provides support for the notion that teacher collaboration, sometimes included as a subset of professional community, as in Louis et al. (2009) affects student achievement positively (Goddard et al., 2007; Louis et al., 2009; Supovitz, Sirinides, & May, 2010).

In summary, our review of the literature identified areas needing more research. For example, although emerging research connects teachers' collaborative practices to student achievement, much more exploration is required to confirm and extend these findings in different contexts. Further, while evidence supports the impact that leaders have on teachers' work and emerging evidence shows that leaders impact student achievement indirectly, research in these areas is just beginning as well. Therefore, the work we present here supports and extends the knowledge base linking instructional leadership and teacher collaboration to students' academic achievement. Specifically, we hypothesized that 1) instructional leadership is positively and significantly associated with teacher collaboration; 2) teacher collaboration is positively and significantly associated with math and reading achievement for third grade students; and 3) instructional leadership has indirect, but significantly positive, effects on student achievement through its effect on teacher collaboration.

Methods

In this section, we described the methods used to collect and analyze our data. First, we describe our participants and the procedures used to collect our data. Following that, we describe our measures. Finally, we describe our study design and primary analytic method.

Participants and Procedures

To test our conceptual ideas about linkages between leadership, teacher collaboration, and student achievement, we used data from the first year of the School Leadership Improvement Study (SLIS), a large-scale, longitudinal, randomized control study to evaluate the design, implementation, and effectiveness of the Mid-Continent Research for Education and Learning (McREL) Balanced Leadership® (BL) program. The sample for this study was 96 elementary schools located in the northern regions of a Midwestern state serving students in rural areas. McREL staff provide Balanced Leadership training to principals in treatment schools. Principals in control schools did not receive Balanced Leadership training. Because the data employed for this study were collected at baseline before principals received BL training, the impact of the treatment is not considered in this analysis.

The analyses presented here draw from teacher surveys administered to 1,605 teachers as part of the first round of data collection for the SLIS study, collected during the 2008-2009 school year. Surveys were mailed by SLIS staff to treatment and control schools. At each school, principals selected one teacher to be a "point person" to distribute and collect surveys. All teachers received a nominal stipend to complete the surveys. They were asked to seal their completed surveys in a provided envelope and return them to the point person, who returned all collected surveys to a designated SLIS staff member. School level data, including each school's mean achievement IRT scale scores by grade and subject area, were drawn from a state accountability public information system.

Measures

The measures of instructional leadership and collaboration represent teacher reports taken from the survey data, which were developed using an iterative process involving knowledge of

prior research, principle components factor analysis and judgments of theoretical fit. We developed a single measure instructional leadership that include teachers' reports of principals' intensive instructional leadership, Collaboration was measured by reports of formal structures supporting teacher collaboration, the frequency with which instructionally focused collaboration occurs among staff, and the extent to which teachers work collectively to establish instructional policy. The items and the resulting factor scores and measurement properties are shown in Appendix A. In a final step, these scales were aggregated to the school level in preparation for the structural equation model (SEM) analysis described below.

Design and Data Analysis

We used structural equation modeling (SEM) to test the relationships between principals' instructional leadership, teacher collaboration and 3rd grade students' achievement in reading and mathematics. Structural equation modeling provides rich descriptive and diagnostic information about model fit, along with the simultaneous statistical execution of confirmatory factor analysis, linear regression and path estimates for variables appearing in a covariate or correlation matrix (Bollen, 1989; Gefen et al., 2000; Long, 1983; Maruyama, 1998; Schumacker & Lomax, 1996). In addition to calculating 'path' coefficients, which are equivalent to regression beta coefficients, SEM allows mediating relationships, or an indirect effect, to be measured. This is especially relevant to our work, given that leadership effects have often been found to be indirect in previous research. To take advantage of this battery of statistical techniques, we used AMOS to analyze the data.

Results

All three of our research hypotheses were confirmed, as demonstrated in our path model (Figure 1). We tested whether teacher collaboration, and instructional leadership mediated by

collaboration, increased mean school achievement in 3rd grade reading and math after accounting for the influence of percent minority enrollment, percent of students receiving free/reduced price lunch, school size, and schools' prior mean achievement. Specifically, Figure 1 demonstrates statistically significant links between instructional leadership and collaboration, collaboration and achievement, and indirectly from instructional leadership through collaboration to achievement. Acknowledging the literature describing leader effects as primarily indirect, the path diagram illustrated in Figure 1 shows instructional leadership as a latent factor correlated to teachers' reports of collaboration; in turn, collaboration contributes to achievement outcomes in 3rd grade mathematics and reading. The estimates of each reported effect are detailed below.

Before proceeding to our model of collaboration and instructional leadership, we conducted basic descriptive work to confirm assumptions needed to develop a valid SEM: normality of the endogenous variables, linear relationships between the variables, independence, no outliers, and very low missing data---or multiple imputations to manage missing data (Kline, 2005). This analysis was found to meet these assumptions. This dataset had few missing data points. Histograms and scatterplots of the endogenous variables and their relationships with the covariates were examined and no large departures from normality, outliers, or non-linear relationships were detected. The variables and their descriptive statistics are found in Table 1. The correlation of the variables can be found in Table 2.

The research model shown in Figure 1 allowed us to test whether teacher collaboration and instructional leadership mediated by collaboration made a unique positive contribution to the explanation of school achievement in 3rd grade reading and math after accounting for the influence of the percent of minority students in schools, the percent of students who receive subsidized lunch, school size as measured by total enrollment, and the school's prior

achievement. The model also allowed the covariance between reading and math in previous achievement, the covariance between the reading and math error in current achievement, the covariance between percent free lunch and total enrollment, and the observed factor 'Instructional Leadership' to vary (Figure 1). Table 3 shows that the achievement measures are positively associated with an R^2 of 40% (2007) and 31% (2008) for previous and present achievement, while enrollment and percent free- or reduced-price lunch are negatively associated with an R^2 of 13%. The SEM diagnostics also showed that the model fits well (X^2/df= 1.99, CFI=.904, TLI=.84, RMSEA=0.025), which, depending on the statistical standard, exceeds or is just slightly lower than the standard cutoff values (Bentler, 1990; Bentler & Bonett, 1980; Browne & Cudeck, 1993; Marsh & Hocevar, 1985).

Creating Instructional Leadership and Teacher Collaboration Latent Variables

To develop measures of instructional leadership and teacher collaboration, observed factors were created. 'Instructional Leadership' is represented by a single observed factor ,with factor loadings ranging from .81 to .90 explaining 90% of variance across the items. Teacher collaboration is composed of three separate observed factors loaded into a single latent factor. Table 4 shows that the Formal Collaboration observed variable loaded the highest at 1.0, Teachers Collaboration on Instructional Policy loaded of .62, and Frequency of Teacher Collaboration had a loading of .47. The model explained 91%, 39%, and 23% of the variance across Formal Collaboration, Teachers Collaboration on Instructional Policy, and Frequency of Teacher Collaboration, respectively.

Predicting Teacher Collaboration

A hypothesized relationship between Instructional Leadership and Collaboration was modeled and demonstrated. Leadership predicts teacher collaboration after controlling for the

proportion of minority students, proportion receiving subsidized lunch, total enrollment and past achievement (see Figure 1). Among all predictors shown on Table 5, only instructional leadership was found to be significant. Specifically, a standard deviation (*SD*) increase in instructional leadership was associated with a .70 SD increase in collaboration. The model explained 54% of the variance in teacher collaboration.

Predicting Achievement

A graphical representation of the relationships we tested to predict achievement of 3rd grade reading and math is found in Figure 1; the related path coefficients are reported in Table 6. Collaboration and past achievement were found to be significant predictors of current math achievement. A one standard deviation (*SD*) increase in Collaboration was associated with a .21 SD increase in current math achievement. The indirect effect of Instructional Leadership on math, mediated by Collaboration, was also significant. A one *SD* increase in Shared Instructional Leadership was associated with a .15 *SD* increase in current math achievement. Collaboration and Instructional Leadership were marginally significantly related to reading achievement (P<.1), where a one *SD* increase in collaboration was associated with a .18 *SD* in reading achievement and a one SD increase in instructional leadership was indirectly associated with a .13 *SD* increase in reading achievement. Among the control variables predicting reading achievement, past achievement was significant and percent free or reduced price lunch was negatively significant. The model explained 50% and 34% of variance for current math and reading achievement, respectively.

In previous work (Goddard et. al, 2010), we formulated an alternative model, in which we imagined that instructional leadership, despite the research evidence supporting its effects, was unimportant to its mediated outcome, achievement. This model omitted Instructional

Leadership and only Collaboration is linked with student achievement. The purpose of this analysis was to determine whether the model fit better and whether collaboration was a strong predictor of students' achievement without instructional leadership included in the model. The results from this second model show the model does not fit as well (X^2/df= 1.89, CFI=.919, TLI=.823, RMSEA=0.102) with two of the fit indices falling outside their preferred range (Goddard et. al, 2010). More importantly, the results showed that taking shared instructional leadership out of the framework diminished the predictive power of collaboration alone. This suggests that instructional leadership is an important predictor that strongly explains the influence of collaboration on student achievement.

Discussion

Our findings suggest that in schools where the principal provide instructional leadership, higher rates of teacher collaboration occurred. Further, the more time teachers spent collaborating on instruction, the greater their students' learning. Finally, instructional leadership had an indirect, but statistically significant impact on student achievement. Statistical fit for the model that positioned teacher collaboration as mediator of the relationship between principal leadership and student achievement was strong. However, when instructional leadership was omitted from the model so that only the direct link between teacher collaboration and student learning was modeled, several indicators of model fit declined to the degree that fit was weak. This suggests that instructional leadership is important to our understanding of both teacher collaboration and its impact on student learning. These findings are consistent with the work of Bryk et al. (2010) who position school leadership as the key driver of school improvement processes based on their research on school improvement in Chicago during the 1990s.

All three of our hypotheses were confirmed. First, a one standard deviation increase in instructional leadership was associated with a .70 standard deviation increase in teacher collaboration. In turn, a one standard deviation increase in collaboration was associated with a .21 standard deviation increase in mathematics achievement and a .18 standard deviation in reading achievement. The indirect effect of instructional leadership on mathematics, mediated by collaboration, was also statistically significant. Specifically, a one standard deviation increase in instructional leadership was associated with a .15 standard deviation increase in mathematics achievement and a .13 standard deviation increase in reading achievement.

Notably, when we ran our model without instructional leadership in previous work, our effects were not nearly as strong as when we included it. Thus, we conclude that instructional leadership plays an indirect, but key, role in teachers' collaborative practices, which directly affect student achievement positively. The more principals perform as knowledgeable instructional leaders, the more likely are teachers to collaborate formally, frequently and around instruction. This finding is significant in its contribution to the literature. Several scholars (e.g., Hallinger, 2003; Hallinger et al., 1996; Louis et al., 2009; Marks & Printy, 2003; Robinson et al., 2008) have linked the work of principals to teachers' practices. Our work adds to this body of knowledge by demonstrating that the effect of instructional leadership is mediated by teacher collaboration.

Our work also contributes new knowledge regarding the effects of teacher collaboration on student achievement. Our findings are consistent with prior literature on collaborative learning communities, which find that student achievement improves when teachers have more time to plan together, with a focus on instructional improvement (Darling-Hammond & Richardson, 2009; Louis et al., 2009). Our study also extends the work of Goddard et al. (2007)

by demonstrating that teacher collaboration is linked to student achievement in not only urban schools but also rural schools. For practitioners, our findings suggest that one lever for encouraging teacher collaboration and thereby improving student achievement is to help principals provide instructional leadership in their schools. When principals are deeply involved in the instructional life of the school, our model suggests that they help put in place the kinds of support structures that are necessary for active collaboration among the staff. Thus, our work extends that of Marks and Printy (2003) and Robinson et al. (2008) by examining in detail the effects of instructional leadership on student achievement.

In sum, our findings provide evidence of important links between instructional leadership, teacher collaboration, and student achievement. Future research should focus on replicating and extending these findings with different populations of schools, teachers, and students, especially at the secondary level. Implications for practitioners include encouraging leaders to focus on instruction in their schools and to support teachers' leadership and their collaborative practices.

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Figure 1

PATH diagram of SEM model for Collaboration, Leadership, and 3rd grade student achievement

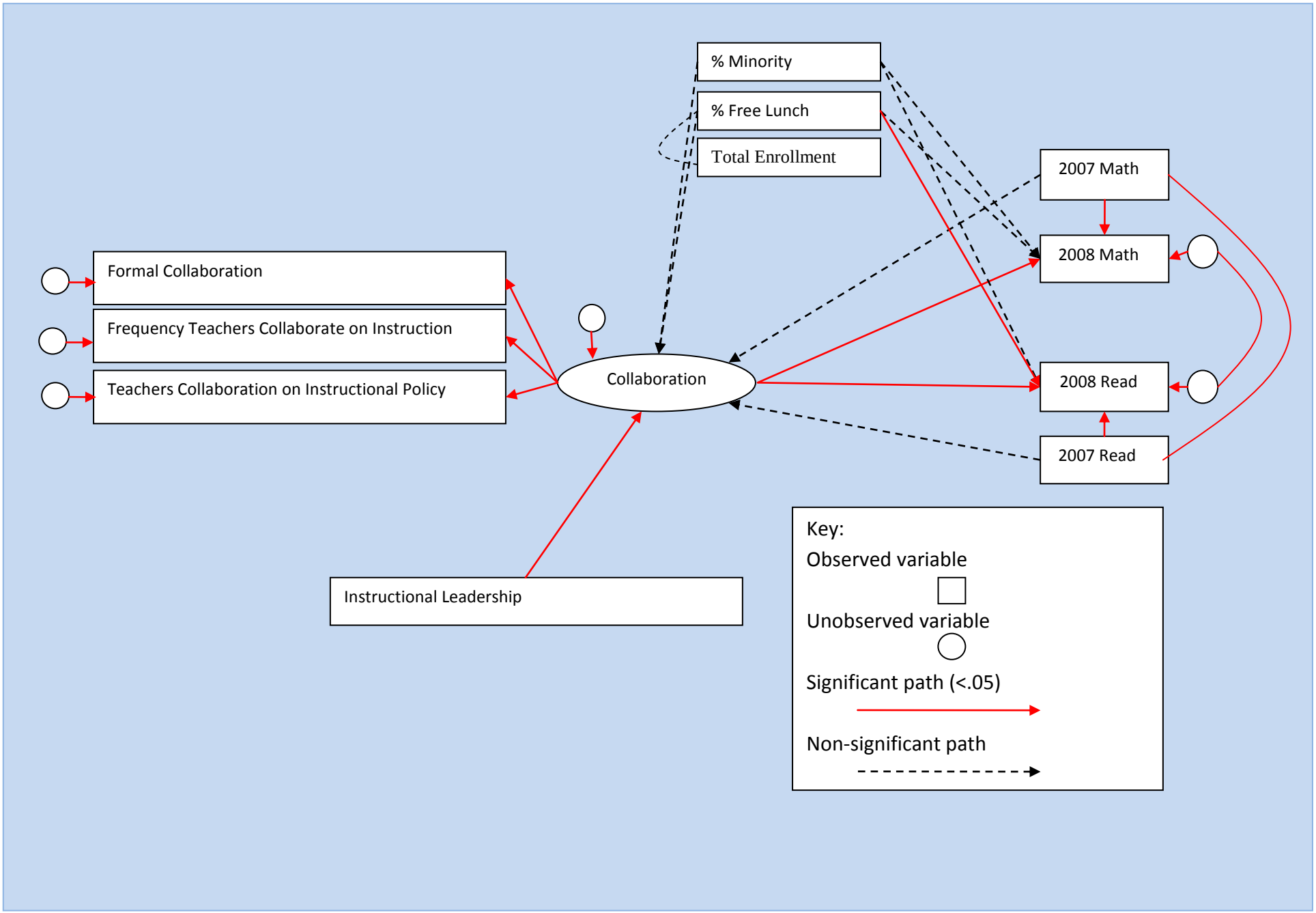

Table 1
Descriptive statistics
(n=96 Schools)

Variable	Min	Max	Mean	SD
3rd Grade Math Scores 2008	314	350	331.47	7.56
3rd Grade Math Scores 2007	312	348	327.63	6.98
3rd Grade Reading Scores 2008	317	347	333.54	5.85
3rd Grade Reading Scores 2007	314	347	332.31	7.08
Percent Minority	0%	74.40%	10.75%	14.50%
Percent Free or Reduced Lunch	14.10%	83.30%	51.20%	14.77%
Total Enrollment	31	1063	296.57	147.50
'Collaboration'[a]	-3.53	2.00	0.00	1.00
'Formal Collaboration'[a]	-1.44	1.14	-0.02	0.51
'Frequency Teachers Collaborate on Instruction'[a]	-1.46	1.08	-.0250	0.42
'Teachers Collaboration on Instructional Policy'[a]	-1.34	1.23	0.02	0.47
'Instructional Leadership'[a]	-1.85	1.15	-.02	0.57

[a]Factor Scores

Table 2

Correlations
(n=96 schools)

Variable	% Minority	Enrollment	% Free Lunch	2007 Math	2008 Math	2007 Read	2008 Read	Collaboration
Total Enrollment	-.071							
%Free Lunch	.115	-.358*						
2007 Math	.018	-.037	-.202					
2008 Math	-.114	.044	-.234*	.703*				
2007 Read	-.071	.058	-.281*	.635*	.377*			
2008 Read	-.132	.046	-.347*	.433*	.603*	.434*		
'Collaboration'	.109	.132	-.107	.155	.262*	.084	.106	
'Instructional Leadership'	-.029	.300*	-.045*	.176*	.305*	.089*	.182*	.528***

* p<.05

Table 3

Covariances in Model

Covariance Relationship			Covariance	S.E.		R^2
% Free Lunch	<-->	School Size	-7.885	5.58	***	.129
2007 Math	<-->	2007 Reading	32.65	7.85	***	.309
2008 Math	<-->	2008 Reading	12.80	2.98	***	.402

* p<.05, ** p<.01, *** p<.001

Table 4

'Collaboration' Factor Loadings

	β		Standard errors	Standardized β[a]	R^2	
'Teachers Collaboration on Instructional Policy'	1		NA	0.62	0.39	***
'Frequency Teachers Collaborate on Instruction'	0.66	***	0.15	0.47	0.23	***
'Formal Collaboration'	1.81	***	0.38	1.002	0.91	***

* p<.05, ** p<.01, *** p<.001. [a] Equivalent to standardized factor loadings

Table 5

Predictors of 'Collaboration'

	β		Standard errors	Standardized β
'Instructional Leadership'	0.34	***	0.07	0.70
Percent Minority	0.05		0.21	-.05
Percent Free or Reduced Lunch	-.12		0.15	-.05
2007 Math	0.01		0.01	0.19
2007 Read	-.01		0.01	-.17
R^2	0.54	***		

* p<.05, ** p<.01, *** p<.001

Table 6

Predictors of 2008 Math and 2008 Reading achievement
(n=96 Schools)

	2008 Mathematics			2008 Reading		
	β	Standard Error	Standardized β	β	Standard Error	Standardized β
'Collaboration'	5.67 ***	2.79	0.21	3.84 **	2.49	0.18
'Instructional Leadership'[a]	1.89 **	0.84	0.15	1.29 **	0.72	0.13
Past Achievement	0.65 ***	0.07	0.60	0.38 **	0.08	0.47
% Minority	-6.61	4.34	-.11	-2.69	0.10	-2.69
% Free Lunch	-7.17	3.42	-.12	-7.17 **	4.52	-.17
R^2	0.50 ***			0.34 ***		

[a] Indirect effect.
**p<.05, *** p<.001

Appendix A

Leadership and Collaboration Factor Scale Measurement Properties

Instructional Leadership (rating scale 1-6; strongly disagree to strongly agree) Cronbach Alpha = .96 (9 items)	Factor Loading
The principal at this school provides conceptual guidance for the teachers regarding effective classroom practice.	.90
The principal at this school is very knowledgeable about effective classroom assessment practices.	.89
The principal at this school is very knowledgeable about effective instructional practices.	.89
The principal at this school is very knowledgeable about classroom curricular issues.	.89
The principal at this school sets high standards for teaching.	.86
The principal at this school sets high standards for student learning.	.86
The principal at this school is directly involved in helping teachers address instructional issues in their classrooms.	.82
The principal at this school helps me with my instructional practices.	.82
The principal at this school pushes teachers to implement what they have learned in professional development.	.81
Formal Collaboration (rating scale 1-6; strongly disagree to strongly agree) Cronbach Alpha = .74 (4 items)	
The principal, teachers, and staff collaborate to make this school run effectively.	.82
Collaboration in this school occurs formally (e.g., common planning times, team meetings).	.77
When teachers in this school collaborate, our collaboration time is typically structured; we stick to an agenda and/or we systematically work on a particular goal.	.76
The principal at this school participates in instructional planning with teams of teachers.	.67
Frequency of Collaboration on Instruction (6 pt. scale: 1 not at all, 2 once or twice a year, 3 several time this year, 4 monthly, 5 weekly, 6 almost daily) Cronbach Alpha = .85 (4 items)	
This school year, how often have you worked with colleagues to Develop materials or activities for particular classes/lessons.	.89
This school year, how often have you worked with colleagues to Develop instructional strategies.	.88
This school year, how often have you worked with colleagues to Make teaching decisions using student assessment data.	.79
This school year, how often have you worked with colleagues to Discuss what helps students learn best.	.76
Teachers Collaborate on Instructional Policy (rating scale 1-6; strongly disagree to strongly agree) Cronbach Alpha = .89 (5 items)	
Teachers in this school work collectively to evaluate curriculum and programs.	.88
Teachers in this school work collectively to determine professional development needs and goals.	.87
Teachers in this school work collectively to select instructional methods and activities.	.80
Teachers in this school work collectively to plan school improvement.	.80
Teachers in this school work collectively to plan professional development activities.	.79

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