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The Influence of Teacher Collaboration on Perceptions of Normative Culture:
A Network Analysis of Site-Managed High Schools

By

Anisah Waite

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Abstract

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The decentralization of school governance—often blended with market dynamics—has become a prominent strategy for lifting the performance of urban schools. This approach rests upon several assumptions, primarily that freedom from bureaucratic regulation will strengthen teacher community and result in more effective allocation of instructional resources. But do small autonomous high schools host such favorable social-organizational features? What drives collaborative relationships among teachers in decentralized schools? And do these relations help to account for between-school and between-teacher variation in teacher trust and shared responsibility for student learning?

To examine these core questions I draw on social network theory as a theoretical frame and build from the literature on the social organization of efficacious schools. Survey data were collected from 392 teachers in 20 small site-managed charter and pilot high schools located in Los Angeles. First, I used p2 network modeling to determine the extent to which a teacher's position in the school organization and personal characteristics predicted their instructional support relationships. Second, to examine the influence of these instructional support relationships on a teacher's perceptions of normative culture in their schools, I estimated hierarchical linear models (HLM) estimating collective responsibility and relational trust as functions of teacher position in the school organization, teacher personal characteristics, and teacher- and school-level network measures of the instructional support relationships.

Teachers' choice of colleagues to whom they turn for support to improve their teaching practice reflected not only leaders' efforts to shape teacher collaboration, but also preferences for forming ties with a colleague based on their personal characteristics. Teachers were more likely to seek advice to improve their teaching practice from colleagues who taught the same subject. However, teachers were less likely to seek advice from the more experienced teachers in the school. The likelihood of an instructional advice relationship was greater when teachers were of the same race.

Teachers' perceptions of normative culture were influenced by the distribution of these social resources in the school, in that uneven distribution of advice and support relationships was

detrimental for a sense of shared responsibility for student learning but conducive to a high level of trust in the group. For individual teachers, their collaborative activity conditioned the perceptions further: those teachers most often approached for support by colleagues held weaker perceptions of the group's overall shared responsibility.

This approach advances the study of teacher professional community to incorporate the "dyad" as a focus, honing in on an essential building block of cohesive social organizations. The study also demonstrates meaningful variation among teachers within the same school in how they perceive normative culture. The findings contribute to the literature on teacher professional community and have implications for policymakers, districts and school leaders.

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CHAPTER I

INTRODUCTION

In high-performing urban schools, strong interpersonal relationships and professional commitment contribute to a sense of chemistry among members of the organization. We are captivated by the ethos of hard work and dedication to the students and the school organization overall. Students are orderly in halls; lessons are executed with energy and ingenuity. The school building has a hum, a buzz of collective effort. In schools with this cohesive culture, everyone's doing their part. Teachers are earning their keep — they are everywhere and everything, bouncing between each other, sharing information, keeping things in check, all with an air of security: they enact lessons and discipline with the expectation that colleagues and students will respond accordingly. These schools do not resemble the metaphorical egg crate. What works isn't contained within a star teacher's classroom walls. Instead, to execute this dance with such grace, each organization member holds expectations that others similarly pitch in, help out, and build toward the dream.

In highly resourced schools, the collective effort is arguably less vital. Master teachers and mentors ensure novice teachers come to hit their stride after a few years. In many urban schools though, the conditions are more constrained. Students with greater need are challenging for schools with high turnover and so more novice teachers, and in settings where there are fewer resources for PD, coaching, or substitute coverage to go view the master teacher's classroom technique. It isn't enough for individual teachers to be great in their own classrooms. Successful under-resourced schools must make student learning a shared endeavor. In the struggle to improve urban schools, the burning question is how to foster this cohesive effort.

Many policymakers think small schools hold the answer to achieving a strong, cohesive culture with a shared responsibility for student learning: accountability is harder to dodge when you know everyone's name, when your actions are widely visible. Reformers and districts go further and try for this cohesion through charter and other site-managed schools. School leaders in these settings have the autonomy to pull in organizational members who share a common educational philosophy and work orientation to join the coordinated effort. To foster a normative culture of support for school goals, school leaders can organize the day intentionally to maximize collaboration, generate investment by distributing leadership across teachers and teams, and elevate a particular curricular or scholarly focus. Small site-managed schools hold a lot of promise as sites of cohesive school community. But even in small autonomous settings, some schools achieve a shared sense of responsibility for the work and others continue to struggle.

What accounts for variability in the normative culture observed across small site-managed schools? We know little empirically about teacher roles and collaboration in site-managed schools (Fuller, Dauter, & Waite, in press), making it difficult to understand when and under what conditions autonomy delivers its intended benefits. But we can bring to bear what we know from research on normative culture in schools more broadly to the case of site-managed schools. There are clues from this literature that strong teacher relationships and collaboration are key for fostering a culture of trust and responsibility for student learning (Bryk & Schneider, 2002; Coburn & Russell, 2008; Louis, Marks, & Kruse, 1996; Spillane, Kim, & Frank, 2012). Teachers' support from colleagues to improve their instructional practice is necessary for school-wide improvement in student outcomes (Bryk, A. S., Sebring, Allensworth, Luppescu, & Easton, 2010). Furthermore, as the site of the development of shared beliefs about student learning and norms for joint work, these relationships and the factors that drive them have implications for the normative culture of the school.

But while other school improvement strategies that leverage teacher relationships such as distributed leadership and professional learning communities are carefully detailed and normatively pressed, there is weak evidence of mechanisms connecting site-level autonomy to stronger, more cohesive teacher communities. Little is known about how site-managed schools formally structure closer teacher cohesion. Nor do we understand whether innovative structures of teacher leadership and collaboration actually alter social ties that informally evolve inside site-managed schools. To build our understanding, in this study I examine the factors that account for variability in normative culture among teachers across a sample of small, site-managed high schools.

Conceptual Framework — Linking Site-level Autonomy to Teacher and Student Outcomes

As a strategy for lifting the performance of urban schools, more than 20 urban districts, including Boston, Los Angeles and New York, have shifted from bureaucratic regulation to coordinating a "portfolio" of diverse, site–managed schools (Hill & Campbell, 2011). In portfolio districts, schools are formed as traditional district schools, developed within the district in response to proposals by educators or community members (e.g., pilot schools), established by charter management organizations (CMOs), started as independent charters, or converted from traditional district schools into one of these other forms. Schools under this portfolio model are granted autonomy, most notably, control over resource allocation, teacher hiring and firing, and the organization of the school day.

In these districts, the goal is to allow for innovative approaches to school improvement to emerge (Hill and Campbell, 2011). The guiding social theory, often voiced by advocates, is that increased autonomy will enable teachers to unite around school improvement goals and to collaborate closely to accomplish these goals (Chubb & Moe, 1990; Lake & Hernandez, 2011; Wohlstetter, Smith, & Farrell, 2013). For example, the Los Angeles Unified School district—the site of this study—asserts the following in relation to their autonomous schools: "These schools place an emphasis on shared decision-making and responsibility for student achievement. In order to sustain a supportive culture, teachers work in teams and are provided with ample time for professional learning" (Los Angeles Unified School District, 2012). In other words, reformers postulate that radically decentralized schools will create tighter, more collaborative communities marked by trust and shared responsibility for student learning.

Although popular support for the portfolio approach is substantial, guiding research on the pathways by which positive portfolio effects, if any, would extend from its implementation is limited (Huerta & Zuckerman, 2009; Marsh, Strunk, & Bush, 2013). Figure 1 offers a conceptual diagram of factors identified from the literature that may link site-level autonomy to teacher and student outcomes. The focus of this study is to contribute to our understanding of the relationships between teacher characteristics, tighter teacher networks and teachers' shared attention to and responsibility for student achievement. In particular, the study examines questions about two types of "linkages" that may operate in site-run, small schools.
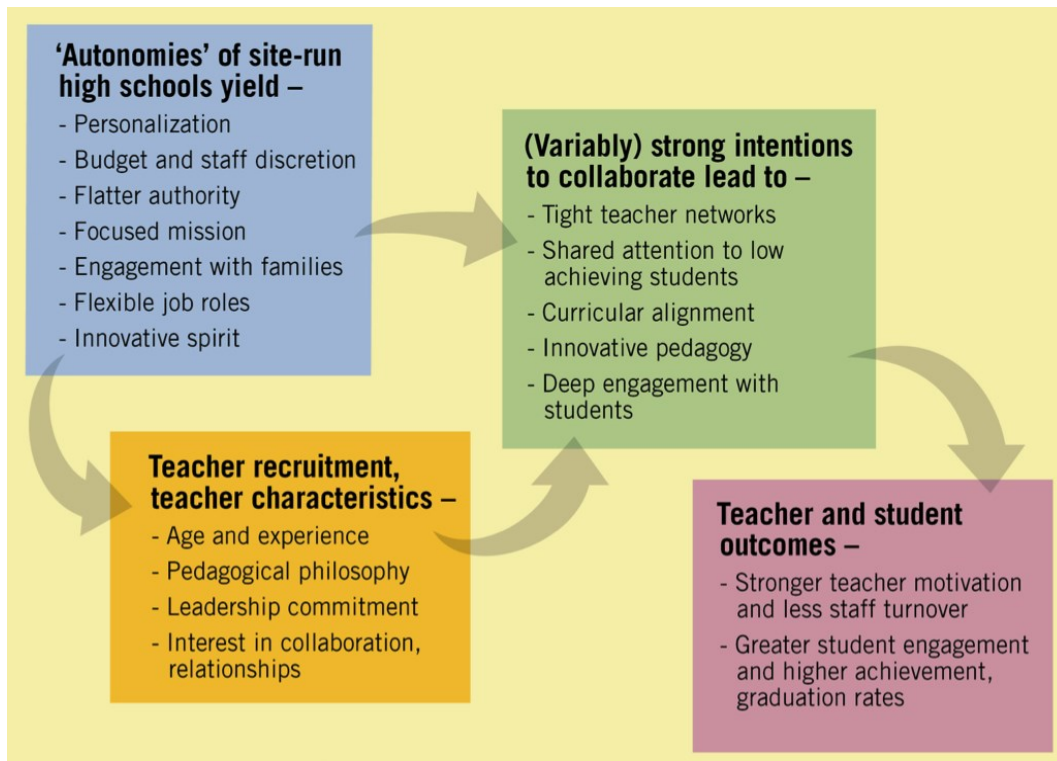
Figure 1. How small site-run schools may strengthen teacher collaboration and student engagement.

Research Questions

First, I examine the factors predicting relationships between teachers pertaining to improving their teaching practice. The first research question is what accounts for the choice of colleagues for instructional support in site-managed high schools? That is, how do dyadic ties form in small schools, the basic building blocks of wider teacher networks? To what extent are these relationships influenced by a teacher's formal positions or roles within the organization? To what extent are these relationships driven by personal characteristics of the teachers?

Then, I examine the influence of teacher collaboration around instructional improvement on their perceptions of their school's normative culture. The second research question is what is the relationship between teachers' instructional support relationships and their perception of normative culture (relational trust and collective responsibility)? That is, the mantra of thicker, more cohesive culture is heard often in small schools. But does it lead to deeper feelings of trust and share responsibility? As with research question one, I delve into how such building blocks of social cohesion emerge, or not. What shares of variance in trust and collective responsibility among teachers is attributable to within or between schools? What characteristics of teachers' networks are associated with higher mean levels of trust and collective responsibility at the school level? Within schools, what is the relationship between a teacher's position in their school's network and his or her perception of the normative culture at the school?

Study Overview

To answer these questions, leaning heavily on social network analysis I examine what factors predict instructional improvement relationships between dyads of teachers within 20 site-

managed charter and pilot high schools in a large urban district. I then examine which characteristics of these relationships are associated with positive normative culture. I show how a teacher's choice of colleagues to whom they turn (for support to improve their teaching practice) reflects not only leaders' efforts to shape teacher collaboration, but also teacher preferences for forming ties with a colleague based on their personal characteristics.

Moreover, I find that the distribution of these social resources across teachers in the school influences perceptions of normative culture. Uneven distribution of advice and support is detrimental for the sense of shared responsibility for student learning but conducive to a high level of trust in the group. For individual teachers, their collaborative activity conditions the perceptions further: those teachers most often approached for support by colleagues hold weaker perceptions the group's overall shared responsibility. These findings contribute to the literature on teacher professional community and have implications for policymakers, districts and school leaders.

In the remaining chapters, I describe the study in detail. In Chapter 2, *Literature Review*, I argue that social network analysis addresses limitations of earlier lenses for the study of teacher professional community. In Chapter 3, *Methods*, I describe the methods used to examine the instructional support relationships and normative culture in 20 site-managed high schools. Chapter 4, *Factors Predicting Instructional Support Relationships*, presents findings from the p2 network modeling. Chapter 5, *The Influence of Teacher Collaboration on Perceptions of Normative Culture*, presents findings from the hierarchical linear modeling (HLM) estimation of collective responsibility and relational trust. In closing, Chapter 6, *Conclusion*, provides interpretation of these findings, implications for theory and practice, limitations and areas for further research.

CHAPTER II

LITERATURE REVIEW

In this study, social network theory and analysis is applied to examine the relationship between teacher collaboration and normative aspects of teacher professional community in a sample of site-managed high schools. In the previous chapter, I provided an introduction leading to the questions motivating this study.

To build a foundation for the study's analysis, in this chapter, I review the relevant literature. I first describe three earlier lenses for the study of teacher professional community: (a) cultural norms of teaching; (b) communities of learners; and (c) norms of collective work and school outcomes. I then expand upon the third framework, norms of collective work and school outcomes, to hone in on scholarship pertaining to two aspects of normative culture identified in the literature with positive links to school and student outcomes: relational trust and collective responsibility. Here I indicate limitations to the study of normative culture in school organizations.

Next, I describe the utility of the social network approach for understanding teacher professional community and review four areas of network literature, framed in terms of advantages the network framework brings. These benefits are (a) its focus on the social-organizational connection; (b) the ability to infer how informal relationships influence organizational outcomes; (c) the attention to factors that contribute to relationships in organizations; and (d) how network characteristics can account for organizational outcomes.

Finally, I argue ways in which the social network lens can directly extend the study of normative culture in promising ways, through its ability to map internal variation in culture and through hypotheses for how network characteristics may explain variation in normative culture.

Earlier Lenses for Studying Teachers Professional Community

A social network approach to the study of teacher community draws from three earlier lines of research on teacher professional community, each describing the facets and antecedents to social cohesion inside these schools. Teacher professional interactions have been studied through the lenses of (a) cultural norms of teaching; (b) communities of learners; and (c) norms of collective work and school outcomes, progressively adding detail to our understanding of the social organization of schooling.

Cultural Norms of Teaching

Early work on teacher professional interactions focused on cultural norms of autonomy and classroom-bound privacy in the profession (Little, 1982, 1990; Lortie, 1975; Westheimer, 1998). Work on the social organization of schools followed from the disaffection with the egg crate model of teaching and the view that teachers are on their own as individual pedagogues.

The joint work of teachers in schools is also undergirded by collective norms, which can be thought of as "prevailing codes of conduct that either prescribe or proscribe behaviors that members of a group can enact" (Lapinski & Rimal, 2005, p. 129). Since the 1980s, scholarship on teacher collaboration has incorporated the role of normative aspects of teacher community including shared beliefs, values, and purposes (Bryk, Camburn, & Louis, 1999; Louis & Kruse, 1995).

Communities Of Learners

Scholars noting the conceptual and normative shift from teaching as private to collective then empirically conceptualized communities of learners: system of engagement

between teachers that facilitate their learning and development (Grossman, Wineburg, & Woolworth, 2001; Lave & Wenger, 1991; Little, 2003). Researchers qualitatively examined representations of teaching, often focused on formal settings for teacher collaboration. Scholars also characterized how the work of teachers is organized in terms of problems of practice, forms of teacher leadership, and cycles of inquiry (Spillane 2006; Spillane, Halverson, & Diamond, 2001).

Research elevated the situated nature of teacher learning, positioning dimensions of teaching and teacher learning within a school-wide social system (in part harking back to Waller, 1932). However, one criticism of this focus is that it does not attend to the influence of informal subgroups within the organization (Penuel, Riel, Krause, & Frank, 2009). Furthermore, while these earlier scholars added complexity to our understanding of the social organization of teachers' work, their frameworks do not widely account for internal variability in the distribution of knowledge or differential access to expertise within the organization.

Norms of Collective Work And School Outcomes

Despite efforts to build the practices of a strong professional community — inquiry circles, distributed leadership — allocating a group of teachers meeting time does not on its own create a truly effective or cohesive professional community. Beyond formal structures for encouraging and examining collaborative work of teaching, scholars investigated how elements of the normative culture of school communities such as trust, collegiality, and collective efficacy serve as resources for organizational goals and ultimately student learning.

These normative aspects of teacher communities came to be viewed as elements of school organization used to account for school outcomes (Bryk & Schneider, 2002; Goddard, Hoy & Hoy, 2000; McLaughlin & Talbert, 2001). Under this framework, qualitative case studies were matched with survey examination across multiple schools. This focus is in line with growing interest in factors that contribute to school improvement beyond an emic understanding of the collegial interactions of educators. A major limitation of this approach methodologically and conceptually is that normative culture is treated as a global property of the organization, still without regard to internal variability in teachers' beliefs, attitudes and orientations regarding the collective (Van Houtte & Van Maele, 2011).

Normative Culture as a Resource for School Improvement

Researchers in education, like in other organizational settings, have acknowledged the role of normative culture in organizational effectiveness. In education, researchers have found that certain elements of the normative culture, such as relational trust and collective responsibility, are essential for schools to support gains in student achievement (Bryk & Schneider, 2002; Bryk et al., 2010; Frank, 2009; Goddard et al., 2000). Two particular powerful normative culture levers lie in the strength of the teacher and school community, in particular, one undergirded by a supportive climate of collective responsibility and relational trust. Shared expectations for commitment to the joint work of educating students supports instructional improvement: trust allows teachers to reveal vulnerability and seek help from colleagues; likewise a normative culture of shared responsibility for student learning compels teachers to support colleagues in the development of their teaching practice. Strengthening these elements of the school organization holds promise for schools organizing for improvement (Tschannen-Moran &, Hoy, 2000; Lee & Smith, 1996). Here, I discuss literature on relational trust and collective responsibility.

Relational Trust

Relational trust, or a mutual regard and respect between colleagues, is one dimension of normative culture known to aid school improvement efforts and support schools' ability to reach students (Bryk & Schneider, 2002). Relational trust, based on shared understanding built from prior exchanges, supports organizational coordination and change.

Trust in schools has been studied for decades. What we know about trust in schools stems from our understanding of organizational behavior and management literature, as well as from social-psychology. A robust line of work on trust in educational organization by Hoy, along with Tschannen-Moran and Goddard, has developed; Forsyth is another scholar of this lineage. Given the developed state of the literature of trust, a detailed explication is not necessary here. A great review of the multidisciplinary roots of trust can be found in Tschannen-Moran and Hoy (2002). *Collective Trust* (Forsyth, Adams and Hoy, 2011) has also chronicled the history of trust in educational research and major findings from this work.

Bryk & Schneider's (2002) *Trust in Schools* was particularly influential. It provided a framework for how trust operates in school settings and contributes to positive school outcomes. Bryk and Schneider's conception of trust as an essential school support is rooted in notions of social capital, in particular those of Coleman. Schooling is framed as "an intrinsically social enterprise" (p. 19); both within the technical core and with regard to the cooperative efforts central to the work of teachers. In this way, attention to teacher social relations would aid the study of school-wide improvement efforts. Bryk and Schneider emphasized the nature of teachers' work: "the aims of schooling are multiple, and the mechanisms for addressing them are complex, diffuse, and not simply specified. Organizational operations under these circumstances demand frequent context specific decision making, and success depends heavily on cooperative efforts around local problem solving" (p. 20). Particular aspects of the social structure of schools (that is, their social networks) would support or hinder work of this type. Furthermore, the vulnerability associated with the types of practices teachers engage in as part of school improvement efforts requires a level of trust among colleagues. Bryk and Schneider argue that for such efforts, there is a particular need for trust and normative supports. The work of schools characterized by Bryk and Schneider calls for both certain types of collegial relations as well as the presence of a normative culture that support those interactions.

In the literature on trust more broadly across disciplines, it has been found that between individuals, trust builds through repeated interactions during which there is an expectation of benevolence in future encounters and a willingness to be open and vulnerable (Tschannen-Moran & Hoy, 2000). An individual's experience of their relationships and interactions are a main source of their perception of trustworthiness. Between individuals trust depends on an alignment between the expectation a person holds for the behaviors in that context and how well individuals present those expectations (Tschannen-Moran & Hoy, 2000). Taken to the organizational level, education policy research is not detailed about what must transpire for someone to hold a global impression of the trusting nature of the collective. Is it an extrapolation of the average experience of trust in across their individual relationships? Is the global impression hampered or skewed by the presence of any particularly negative experiences with one or more individuals? More information on the variability in perceptions across the organization would help us understand this better.

It is important to note, by viewing relational trust as an organizational property such as by Bryk and Schneider, the presence of trust is attributed to all colleagues in general. While trust has been studied in several different ways over time, to get information about trust within an organization, survey methods are often used that aggregate up individual perceptions of the collective. Less is know, however, about the extent to which individual perceptions vary within an organization. Without an understanding of what accounts for variation in perceptions across the organization it is hard to truly understand how trust develops in organizations and what they may do to foster trust.

Collective Responsibility

Collective responsibility is an element of normative culture that is less developed in the literature than relational trust. It is currently used in the education literature to refer to a shared sense of responsibility to one's colleagues for student learning in the school outside of one's own classroom. As a construct it indicates teachers' perceptions of their faculty's willingness to take responsibility for student learning (LoGerfo & Goddard, 2008).

Like relational trust, collective responsibility is also related to positive school outcomes although there are fewer studies that examine collective responsibility. There is evidence linking collective responsibility to student learning and greater educational equity (Lee & Smith, 1996; Loeb & Lee 2000). Diamond, Randolph and Spillane (2004) also reveal how beliefs about student learning, including whether teachers "blame" classroom problems on students, can have implications for how teachers pick up reforms intended to improve teaching and learning in urban settings.

Collective responsibility was the term used by scholars Lee and Smith (1996) after a component analysis of Chicago Public Schools survey data revealed a construct distinct from efficacy that tapped into how teachers attribute student learning. These and other scholars have highlighted how collective responsibility pertains to one's perception of both efficacy and locus of control. Teacher responsibility for student learning is closely related to a teacher's sense of efficacy, that is, the individual's belief in their ability to achieve certain goals by performing actions successfully (Bandura, 1977). However unlike collective responsibility, efficacy is task-specific; teacher efficacy is the teacher's belief in his or her ability to teach effectively and for this teaching to produce student learning (LoGerfo & Goddard, 2008). While closely related to efficacy, however, the concept of teacher responsibility also includes the element of locus of control, or how teachers attribute the consequences of their actions. Teachers may attribute student outcomes to external factors (ability or effort) or internal factors (luck, circumstances or the teacher's own instruction). Teacher responsibility is not this attribution alone and is different than a teacher's belief in his own effectiveness of instruction, but adds willingness to take action given a belief of internal control and efficacy (LoGerfo & Goddard, 2008).

Teacher collective responsibility indicates the extent to which teachers accept responsibility for student learning, and finds that the teaching is worth the effort (Lee & Smith, 1996; LoGerfo & Goddard, 2008). This perception of the teachers overall can be viewed as a part of the school's organization and culture. Collective responsibility according to LoGerfo and Goddard is "part of a normative school environment communicated by expressed beliefs and perceived practices" (p. 78) and reflects teachers' perceptions of their colleagues willingness to accept responsibility for student learning.

There are potential mechanisms for its development on the collective level. Teacher individual attitudes about student capabilities along with their colleagues' perceptions of the school's responsibility for shaping student learning are embedded within the culture of the school organization (Diamond et al., 2004); from this embedded nature, norms of responsibility may be sustained through formal or informal sanctions that in turn shape group expectations for teachers. The relationship is posited as positively linked and reciprocal (LoGerfo & Goddard, 2008) though prevailing norms may run against a teacher's individual sense of responsibility. The link between collective responsibility and positive student outcomes prompts further exploration of the nature of the social interactions leading to social control via sanctions or reinforcement. One caution is that some collectively held beliefs, such as ones that do not reflect positive beliefs about student ability or that position responsibility for student learning elsewhere are likely not effective for schools.

The literature is not extensive on how strong collective responsibility contributes to positive school outcomes. Because collective responsibility represents mutually held beliefs and expectations, it may serve as a social control within schools organizations. Collective responsibility is a helpful aspect for understanding the joint work of teachers and school improvement efforts. Outstanding questions include when would a shared sense of responsibility for student learning constitute a true social control? Examining between-individual variation in the perceptions of differing teachers would improve our understanding of the idea of consensus in perception as a shared expectation and norm for social behavior.

What also remains unclear from the literature is how distinct collective responsibility and relational trust are as characteristics of the normative culture of an organization. In fact, in the literature, trust and collective responsibility are often conflated. Trust is discussed in terms of a sense of responsibility. Both relational trust and collective responsibility conceptually involve expectations. One empirical question is whether relational trust and collective responsibility operate differently.

Current Work and Some Limitations

Most recently on this front, *Organizing Schools for Improvement* (Bryk et al., 2010) is a widely influential source of evidence about urban school improvement. Its framework, reflecting decades of work examining decentralization in Chicago Public Schools, is comprehensive and the evidence is sophisticated. The framework delineates numerous "essential supports" for improving schools. Indeed, many schools already engage in various improvement efforts in the vein of Bryk and colleagues' prescriptions through some combination of strong school leadership, curricular alignment, parent involvement, a student-centered learning climate, and teacher professional capacity and work orientation. But part of the inherent appeal of *Organizing Schools for Improvement* is its presentation of a coherent vision for schools organized for improvement – a well-oiled machine of sorts. Similar to the preceding literature on school organization, in addition to structural elements, the "oil" of the machine is described in terms of cultural features of the normative culture of the school environment. Many schools struggle to create this well-oiled machine. Researchers and policymakers understand a good amount about curricular design, the importance of and hindrances to parental engagement and how crucial having a strong instructional leader is for the endeavor. Districts can centrally support improvements in these areas. When it comes to the intangibles, the culture and ethos of the school, the path to improvement is less clear.

Given the link to positive school outcomes, an outstanding question is how do these important components of teacher community come about. What underlies a teacher professional community with these norms and expectations? In education, when it comes to fostering relational trust and developing strong teacher professional communities marked by collective responsibility, there are numerous practitioner guides to help individual school leaders take on the work, aided by decades of research on culture and climate. These research-based books and practitioner guides translate the literature, though often through vignettes and general guidelines for school leaders to mind.

I argue that a network approach would be helpful here. The literature establishes that trust and shared responsibility for student learning are relational notions, rooted in beliefs, regards and expectations derived from interactions with colleagues. Instead of stopping at identifying associations between normative culture and immovable measures like school size or poverty, we should consider the social mechanisms -- the implications for culture of the interactions between organization members themselves.

More broadly, a network perspective offers an opportunity to understand how school social organization enables and hinders the collective work of teachers and addresses some limitations of prior studies of teacher community and offers fresh ways of capturing social ties. The following section first describes several advantages of the network approach for understanding teacher professional community. I then close with how the network the social network lens can directly extend the study of normative culture in promising ways. In particular, I describe specific network characteristics whose examination may help account for variation in normative culture outcomes.

Utility of Social Network Analysis for Studying Teacher Professional Community

The study of teacher collaboration has moved beyond a focus on formal roles and structure to examining informal patterns of everyday interaction, most recently using social network analysis (Coburn & Russell, 2008; Daly, Moolenaar, Bolivar, & Burke, 2010; Moolenaar, Daly, & Sleegers, 2011; Penuel et al., 2009; Penuel et al., 2010). Social network analysis is the work of measuring and representing these interactions, explaining why they occur, fueled by differing resources, and understanding the consequence of these relations (Knoke & Yang, 2008).

Network theory is informed by earlier work on social ties and social capital, which illuminates how resources and expertise are embedded within social networks. It is through social relationships that individuals both accumulate and draw down these resources to promote action (Coleman, 1990; Lin, 2001; Portes, 1998). Teacher social networks consist of formal and informal interactions -- in meetings, over lunch, in one's classroom or after a lesson. Teachers seek to improve instruction through these interactions, engaging with resources and the expertise they need to achieve their professional goals.

A network perspective offers an opportunity to understand how school social organization enables and hinders the collective work of teachers. Furthermore, a network approach addresses some limitations of prior studies of teacher community and offers fresh ways of capturing social ties. Four features of the network approach that are beneficial to the study of teacher community are (a) its focus on the social-organizational connection; (b) the ability to infer how informal relationships influence organizational outcomes; (c) the attention to factors that contribute to relationships in organizations and (d) how network characteristics can account

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for organizational outcomes. A brief examination of each of these four benefits of network analysis in the study of teacher community follows.

Focus on the Social-Organizational Connection

One advantage of a network approach to studying teacher community is that social network theory is inherently structural-relational in nature: it attempts to capture and represent relationships among individuals within a bounded social-organizational space. In this way, the social network lens sheds light on the connection between the micro and the macro: it incorporates individual behaviors, the structures in which they are embedded, and how these actions may shape these structures (Borgatti & Foster, 2003; Knoke & Yang, 2008). In an early and influential piece in this literature, Coburn and Russell (2008) found that formal structuring of the collaboration between coaches and teachers influenced their closeness and frequency of interaction with sources of expertise. The authors call for increased attention to how policy and leaders enable and hinder social cohesion that supports instructional improvement.

How Informal Relationships Influence Organizational Outcomes

But formal efforts to structure teacher collaboration and collegial support are not the only social connections that play a role in teachers' joint work. A second benefit of network analysis of teacher community is that it extends beyond formal settings of teacher collaboration to incorporate informal interactions and subgroups. For instance, one example of an informal relation or tie between two teachers can be when one teacher seeks instructional advice from another teacher. If we consider for a particular group all of the connections between each teacher and the other teachers he goes to for advice (and similarly, the teachers who seek advice from him), we could call that these teachers' advice network.

Network studies in education have adopted this focus on advice relationships from the broader network literature and are beginning to explore how teacher advice seeking and provision helps or hinders organizational outcomes, and school improvement efforts in particular (Coburn, Russell, Kaufman, & Stein, 2012; Frank, Zhao, & Borman, 2004; Garrison Wilhelm, Chen, Frank, & Smith, 2014). Network studies in education have established that these collegial connections matter to support the diffusion of knowledge, for example around technology use in instruction (Frank et al., 2004). As a second example, Sun, Penuel, Frank, Gallagher, & Youngs (2013) found that the effect of professional development on teaching practices spread through the helping network. By attending to informal collegial interactions, the network approach in Sun et al. (2013) revealed a link between teacher learning and instructional improvement.

Attention to Factors that Contribute to Relationships

Third, increasingly in education network studies there is a focus on the determinants of collegial relationships. Teachers instead seek out others for reasons outside of formal structures such as leadership roles and teaching assignments, although those do have some influence. To address this, some network analyses only recently applied in education have the dyad or relationship as the unit of analysis (c.f., Spillane et al., 2012). It is a natural unit for thinking about a relationship but a departure from study of organizational behavior in terms of the individual/organization dichotomy. Honing in on the dyad especially allows consideration of what shapes the formation of the relationships rather than the focus on the organizational consequences of the connections that do exist. Given this is an emerging aspect of how teacher

community is explored it is helpful to bring in lessons from the broader network literature to understand the factors that influence teacher collaborative relationship formation.

The prior literature identifies several factors that may influence the specific colleagues from whom teachers seek advice to improve their teaching practice. Both positions within the formal organization and individuals' personal characteristics play a role. Schools attempt to nurture teacher collaboration by assigning teachers to subject-area or grade-level groups and by appointing teachers to leadership roles or other collaborative positions. While schools intentionally organize teacher collaboration in this way, individuals' personal characteristics such as gender and ethnicity would likely influence the colleagues from whom teachers seek advice and support.

The formal organization both enables and constrains collaboration opportunities among its members (Blau 1955; Blau & Scott, 1962). Subject-area and grade-level assignments are basic aspects of the formal organization of schools that bring members together. Empirical evidence suggests teachers interact more with others of the same grade-level or department (Bidwell & Yasumoto, 1999; Bryk & Schneider, 2002; Daly et al., 2010). Although teachers enter schools at the secondary level with a particular subject-area expertise that defines the organizational role they can occupy, some high schools also try to create cohesive grade-level teams. Schools also designate teachers to various leadership roles and to school programs such as special education. Teachers in these roles have responsibilities that promote or require greater interaction, and may be more likely to provide advice. The responsibilities of special education teachers may also influence their relationships with other teachers at their schools, if they are seen as a resource for instructional techniques that address the needs of struggling students. Differentiating these roles within the formal organization adds nuance to the study of teacher collaboration and the potential role of special education teachers as a social support for instructional improvement, and warrants further investigation.

Still other factors that influence teacher advice relationships have less to do with the school's formal organization than with individual characteristics. People are often drawn to others who are similar to them in various ways. The term homophily is used to describe this tendency to form relationships with others who have similar personal characteristics (for review, see McPherson, Smith-Lovin, & Cook, 2001). People are more likely to form ties with people of the same gender or of the same ethnicity (Ibarra, 1992; Mehra, Kilduff, & Brass, 1998; Mollica, Gray & Trevino, 2003; Monge & Contractor, 2003). Based on this literature, we would expect teachers of the same gender or ethnicity to be more likely to seek advice from each other.

Years of teaching experience and the number of years a teacher has been at the school are other personal characteristics that may influence advice-seeking ties. Evidence suggests more experienced teachers are more likely to provide advice to colleagues than less experienced teachers, and that teachers would seek advice from those with more teaching experience (Spillane et al., 2012). A teacher's tenure at the school is a less explored personal characteristic in the literature on teacher collaborative relationships. Teachers with longer tenure at the school may be seen as members with valued knowledge for organizational norms and expectations. Though not directly related to improving teachers' instructional practice, veteran members of the community are a valuable resource especially in settings with high levels of turnover. Though not widely established empirically, teachers new to the school may seek advice more than teachers who have been at the school for longer.

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Network Characteristics and Organizational Outcomes

A fourth and final way that a network approach is useful in studying teacher community is in relating organizational outcomes to overall network structure. For teacher community, network analysis yields the ability to bring inferences about behavioral components (i.e. social relations, interactions, and collegial practices) in concert with those regarding normative aspects (i.e. shared beliefs, values, or purposes)(Cannata, 2007). Several tools from social network theory help this understanding.

Understanding characteristics of social networks provides insights into the social organization of schools. Overall, network structure matters because it is closely linked to an organization's performance and its ability to meet its goals (Guzzo & Shea, 1992); a focus on the actual social ties that form networks of teachers within school organizations would reveal information about how resources, information, and practices flow within a school. When characterizing the network of a group of actors, several measures are used to describe the pattern of social relations between these actors. These features of social networks are particularly salient for understanding the social organization of schools. Here I discuss density, centrality and reciprocity.

The density of a network describes the proportion of the possible relationships between individuals in the network that exist. Density of a whole network is calculated as the ratio of existing ties to possible ties. A dense network is one where many of these potential relationships are present. Higher density increases opportunities for meeting collective goals (Balkundi & Harrison, 2006) and often leads to higher levels of performance than sparser networks (Reagans & Zuckerman, 2001). However, an increase in density can also lead to greater redundancy, lower access to novel information, and decreased flexibility of the organizational response (Burt, 1992; Hannan & Freeman, 1984).

The centrality of networks matters for the outcomes of the network as well. The centrality of the network indicates the extent of a network's dispersion, and indicates how prominent actors are relative to one another (Knoke & Yang, 2008). A measure of centrality for a network quantifies the relative involvement, activity or visibility among actors. When actors within a network each have a similar number of relations, the network is more dispersed. A centralized network is one where one or a few actors are more prominent or highly connected than others (Knoke & Yang, 2008).

Highly centralized networks can also be described as core-periphery networks, in that the structure consists of "a dense, cohesive core with a sparse, unconnected periphery" (Cummings & Cross, 2003, p. 200). Highly centralized networks with this type of structure are good for diffusing routine noncomplex information, but are a hindrance for complex tasks including knowledge sharing across organization (Tsai, 2001) and leading systemic change (Kilduff & Tsai, 2003; Tenkasi & Chesmore, 2003).

Cummings and Cross' results suggest that structures that allow for the integration of unique expertise within a group are more effective for achieving non-routine, complex work (2003). The authors' inclination is that the structural benefit of networks that are less centralized is that they are that are not overly dependent on any individual and contain enough ties among participants to support the flow of information (2003). In school organizations, a centralized network may limit transfer of knowledge between teachers necessary to implement school improvement efforts or maintain teacher communities of practice, particularly when those efforts

require reflective practices, discourse around a problem of inquiry and other complex and non-routine exchanges. For members at the outskirts, a core-periphery structure limits the contributions of and access to information of these peripheral members. Across a group of teachers each actor must access information about the curriculum and would be responsible for enacting school-wide policies; to the extent that their information needs are undifferentiated, peripheral members would be at a disadvantage with limited access to information for these tasks.

Ties may also be mutual between two individuals. With these mutual or reciprocal ties actors are more likely to build and maintain ties with others that they share resources toward a workflow or have a task completion relationship with (Brass, 1995). This reliance or mutual dependency is maintained if it is viewed as valuable (Monge & Contractor, 2003). In teacher social networks, mutual ties may have a role in the promotion of trust or shared understanding. On the other hand, achieving organizational goals through specific instrumental ties (such as when a teacher seeks advice to improve instructional practice) may be less dependent upon the ties being reciprocal provided the expertise is a directional resource (i.e., if expertise is of a nature that it is commonly acquired by certain individuals and transmitted to other less knowledgeable individuals).

A Network Extension to the Norms of Collective Work Lens

Returning then to the conception of teacher community as a set of joint behaviors undergirded by a normative culture, I now consider the bases of elements of normative culture and the consequences for school outcomes.

Internal Variation in Organizational Culture

The network lens has the potential to address limitations with organizational inferences that stem from individual observations in studies of school culture and climate. Network scholars interrogate interactions and choice of alter for relationships rather than assuming that affiliation is uniform, undifferentiated, and falling along formal organizational lines, such as by department or grade-level in the case of schools. Analytic tools from the social network field allow us to map and see how these elements of culture are manifested in teachers' networks, giving traction to questions of how schools may foster tighter, more cohesive social ties between teachers.

Often studies aggregate teachers' individual perceptions of their own relationships to form a school level measure of culture and climate. An improvement over this is to ask teachers to report their perception of the organization's overall culture by wording questions to ask about the collective rather than the individual. "I trust colleagues" becomes "Teachers here trust one another." This is an improvement, and some argue that the individual perceptions are multiple data points that measure the culture, treating culture as a latent variable. Even with this approach, internal variability in perceptions of the culture can be significant — and meaningful. Rather than seeing variability as noise to overlook when capturing the "true" culture, I see the variability in individuals' perceptions of the collective as a liability in the effectiveness of a positive normative culture for school improvement efforts. If the expectation to work toward student learning outside of one's classroom is not universally felt, it does not function as a social norm. Teachers are not wholly compelled to support school improvement efforts. Thus I propose examining internal variability in normative culture within schools.

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The variability in perception may not be random but instead may be attributable to particular experiences (or expectations) teachers have in the positions they hold within the organization. The variability may also be attributable to teachers' experience of support from colleagues or the draws on them for support [measured in network terms as in- and out-degree]. By examining the factors that drive teachers' individual perceptions of the collective, we can better understand what influences a shared sense of responsibility and belief in the collective trust among colleagues. Certain teacher positions within the formal organization or their position within the informal social network may be associated with a more positive perception of the culture. Identifying the teacher collaboration experiences and network configurations that contribute to a higher perception of elements of normative culture are leads for understanding what builds positive culture.

Relationship Between School-level Network Characteristics and Normative Culture

How do teacher social relations shed light on where and how these elements of normative culture are fostered? In the network literature, there is a tradition of considering the consequences for organizational effectiveness of different network configurations. Given what is established in social network theory about the patterns of interaction as they function for the transfer of knowledge, information, beliefs and norms, I begin to consider the relationship between teacher collaborative interactions and levels of relational trust and collective responsibility.

As mentioned previously, the centrality of a network may influence not only operational tasks of schooling, but also normative and cognitive exchanges between teachers in a school. Prior literature suggests that a more centralized network structure may hinder the development of shared theories of action (Agullard & Goughnour, 2006), learning partnerships (Copland & Knapp, 2006) and effective resource brokerage (Honig, 2006; Knapp et al., 2003). We would expect the perception of collective responsibility for student learning to be hindered by more centralized network structures. Separate from the operational tasks of schooling described in the previous section, processes of this sort contribute to the normative and cognitive exchanges that are key elements of normative culture, making the centrality of school networks an important feature to consider.

Network density offers another factor relevant to the formation of elements of normative culture such as relational trust and collective responsibility. The density of the network tells us the proportion of all possible connections that are present in a network. Admittedly, density is then driven by network size. The size of the school, and in the case of teacher networks, the number of teachers, can be seen as a "structural factor" enabling or inhibiting the development of relational trust (Bryk & Schneider, 2002). As the number of nodes (in this case, teachers) in a network increases, the possible linkages grow exponentially. Then, for the shared understanding that is at the root of relational trust to form, information must flow over a number of ties, and misinformation is more easily transmitted. Thus, the presence of more linkages, creating a higher density, increases the ease with which information flows across the network, also conditioning the creation of relational trust. Therefore, after controlling for size, more dense networks, that is, those with a greater percentage of possible linkages, may support greater shared understanding among actors, and lead to greater relational trust.

The extent to which ties are reciprocated may have consequences for normative culture. Mutual ties are more likely to be maintained with whom one shares resources toward a workflow

or have a task completion relationship with (Brass, 1995). In teacher social networks, mutual ties may have a role in the promotion of trust or shared understanding. On the other hand, achieving organizational goals through specific instrumental ties (such as when a teacher seeks advice to improve instructional practice) may be less dependent upon ties being reciprocal due to the nature of expertise as a resource that is likely to be directional.

Furthermore, under portfolio reform efforts, the distinct ways in which schools are formed may have implications for the resulting social network and elements of normative culture such as collective responsibility and relational trust. The prior experiences of teachers and aspects of the governance structure or autonomy granted to these schools may complicate the findings beyond what network characteristics alone might predict. For example, schools may be formed by groups of founding teachers who craft and submit a proposal to form a semi-autonomous pilot school within the district. The collective experience of forming a proposal for a school (as is the case with pilots that are started by a core group of teachers or charters with founding teachers) has a strong bearing on the shared knowledge of participants in the group, and this shared knowledge in part forms institutionalized behaviors.

In the case of creating systems of social control or rules for behavior then, participants would be less likely to deviate from systems that they have created than from systems that were created by others (Berger & Luckmann, 1967). Teachers in pilot schools who participate in this experience are likely to perceive a high level of collective responsibility relative to teachers in the school network who were not part of the design team. In this case, differences in perceptions of teachers in the social network may be based on this attribute of individual teachers.

Summary and Key Questions

Under charter and portfolio district school policies, schools are given greater autonomy over features such as teacher selection and socialization, which theoretically support greater levels of trust and collaboration. This autonomy, when exercised to promote a shared purpose across the school's teaching staff, can be used to promote commonly held organizational goals, which support institutionalized behaviors, greater coordination, and alignment within the group. Here, conduct is taken for granted by participants, and participants are more likely to act predictably. Schools that coordinate in this manner are likely to foster greater collective responsibility. This is one potential mechanism that links the policy choices to outcomes of interest. But again, granting autonomy to schools alone does not guarantee these desired outcomes. We would need to examine where these elements of normative culture emerge across various schools formed under decentralization policies. Looking at not only the reported perception of normative culture in the aggregate but also considering the linkages between teachers in these particular schools contributes to an understanding of how or whether these reforms produce their purported benefits.

The purpose of this study is to contribute to our understanding of the relationships between teacher characteristics, tighter teacher networks and teachers' shared attention to and responsibility for student achievement. I use a social network approach to consider the ways in which teacher collaborative relationships may contribute to a positive normative culture in 20 site-managed charter and pilot high schools in one urban district. To do so, I first examine what factors predict instructional improvement relationships between dyads of teachers within each of the schools. I then examine which characteristics of those relationships are associated with positive normative culture. The chapters that follow describe the study.

CHAPTER III

METHODS

As argued in chapter 1, while other school improvement strategies that leverage teacher relationships such as distributed leadership and professional learning communities are carefully detailed and normatively pressed, there is weak evidence of mechanisms connecting site-level autonomy to stronger, more cohesive teacher communities. Based on the review of the literature, chapter two argued that social network analysis addresses limitations of earlier lenses for the study of teacher professional community.

In response to these limitations identified in the literature, this chapter describes the methods used to examine the instructional support relationships and normative culture in 20 site-managed high schools. I first provide a brief overview of an analytic plan for the study. I then describe the data, including sample selection and the unique social network data at the heart of the study. Third, I present the measurement and estimation strategy for (a) modeling factors predicting instructional relationships; and (b) estimating the influence of teacher collaboration on perceptions of normative culture. Finally, I give details about the measures used in both analyses.

Analytic Plan

This study explores how teacher collaborative relationships influence their perceptions of the normative culture of the teacher community in their schools. I pursue two lines of analysis to this end using quantitative survey data from a sample of 20 small site-managed charter and pilot schools in a large urban district.

First, I examine what factors predict instructional support relationships between 11,526 pairs of teachers within the 20 schools. I use a p2 network model (Van Duijn, Snijders & Zijlstra, 2004) to determine the extent to which both teacher position in the school organization and teacher personal characteristics predict teachers' instructional support relationships.

Second, to examine the influence of these instructional support relationships on teachers' perceptions of normative culture in their schools, I estimate hierarchical linear models (HLM) estimating (a) collective responsibility and (b) relational trust as a function of individual teacher position in the school organization, personal characteristics, as well as teacher-level and school-level network measures calculated from the aforementioned instructional support relationships.

In the discussion of the measures and methods that follows, I will draw attention to the respective lines of inquiry by referring to the "p2 analysis" and "HLM" when appropriate for clarification.

Data

Data for this study were obtained from a survey of teachers in 20 site-managed high schools in Los Angeles Unified School District in 2012. All teachers in a sample of 10 charter schools and 10 pilot schools from LAUSD were surveyed. A total of 392 pilot and charter school teachers were surveyed with a 92% response rate. The survey consisted of four components: (a) social network questions; (b) collective responsibility scale; (c) relational trust scale; and (d) demographic variables.

 The sample represents a variety of small, site-managed public secondary high schools in the Los Angeles area. No traditional public schools are included because the focus of the study is on variability in teachers' perceptions of normative culture *within* and *across* site-managed schools, and not on a comparison between site-managed and traditional schools. Charter and pilot schools are chosen as a case of education reforms intended to strengthen teacher

community, in other words, where the phenomena of interest are likely to appear, but where we have little evidence of the variability in this intended benefit and what contributes to it.

Sample Selection

The survey was conducted in the spring of 2012 in 10 pilot and eight charter schools, and in the fall of 2012 in the remaining two charter schools. The 10 charter schools in the study were selected from the universe of non-conversion autonomous charter schools in 2011-12 serving high school grades that were authorized by LAUSD, that had been in operation for at least one year. This included charters designated as high schools or as schools whose grade span included 9-12 (for example, K-12 schools). Schools that intended to serve grades 9-12 but were in their first, second or third cohort were included, in which case the school may have had for example only have 9th grade students at the time of the selection. Autonomy was determined by the designation given by The California Charter School Association based on the school's funding arrangement being independent of the district.

The total number of charter schools during the 2011-12 school year that were authorized by LAUSD was 184. Of these, 58 fit the criteria above of non-conversion, autonomous schools serving high school grades that had been open for at least one year. These schools were categorized as CMO, Network and freestanding charter by CCSA based on the school's affiliation to a managing organization (if CMO) or affiliation to other schools that are not jointly operated (if Network). Four freestanding, four CMO-run and two network-associated charters (because of the proportion of these schools that were CMO, Network and freestanding) were selected at random from the schools in each category using a random number generator in Microsoft Excel. Schools were contacted to participate in the study. Four network schools, and two freestanding schools declined participation.

The 10 pilot schools were selected by purposive sampling from 14 eligible schools. At the time of sample selection in July 2011, there were 15 pilot schools serving high school grades operating in LAUSD. Schools had to have been open for at least one school year prior to administration of the survey in school year 2011-2012 so all schools in the sample opened in school year 2010-2011 or prior; none of the pilot schools opening in 2011 were considered for the study. One school was disqualified from possible selection into the sample after we learned that it was not teacher initiated "in the spirit" as other pilots were developed. Of the remaining 14 schools, 10 schools were invited to participate and also received letters of introduction from the LA Small Schools Center and LAEP. Only one of the three pilot schools operating at the Esteban Torres campus was chosen to increase geographical variation. For further detail on the sample characteristics, Appendix A includes a table with student and teacher characteristics across the 10 charter and 10 pilot schools.

Social Network Data

The two lines of inquiry presented in this study rely heavily on the use of social network data from the survey of teachers within the sample of 20 site-managed high schools. Because social network data is collected and analyzed somewhat differently than individual attribute survey data, this section first explains what constitutes the network data for this study and how they were prepared. Later in the measures section, the relevant network measures will be described in more detail.

Social network data from the survey of all teachers in the sample schools (*n*=20 schools; 392 teachers) were used to observe the distribution of social support for instructional improvement among teachers at each school. A bounded network approach was used. To accomplish this, the network survey question, "How often do you go to this person for advice on how to strengthen your teaching practice?" was accompanied by a school-specific roster of teachers' names.

Teachers rated on a 4-point scale (less than once a month, once or twice a month, every week, or two or more times a week) how frequently they went to each of their colleagues for advice on how to strengthen their teaching practice. The data were dichotomized to reflect the higher frequency ties (responses of "every week" or "two or more times a week"), which in network analysis are commonly viewed as more enduring and reliable reports of social ties.

Network scholars refer to data from a question asking to whom respondents turn for advice as the "advice network" I also refer to the within-school teacher advice network pertaining to strengthening ones' teaching practice as the school's *instructional support network*.

Measurement and Estimation Strategy

The following section describes the data analytic methods used to prepare the data and to address the major research questions. I organize the methods by the research questions they address and follow this section with details on the specific measures these strategies involve.

Modeling Factors Predicting Instructional Relationships — p2 Network Analysis

Research questions:

1) What accounts for the choice of colleagues for instructional support in site-managed high schools?

   a. To what extent are these relationships influenced by a teacher's formal positions or roles within the organization?

   b. To what extent are these relationships driven by personal characteristics of the teachers?

What accounts for teacher instructional support relationships in small, site-managed high schools? How does that compare with the formal organization of collaboration in these schools? To answer these questions, I use a particular form of social network analysis that uses teacher position in the school organization and teacher personal characteristics to estimate the likelihood of an instructional support relationship between two teachers. Factors pertaining to position in the formal organization included grade-levels taught, subject-area assignment, leadership roles held, and special education program participation. Personal characteristics of teachers that were analyzed included years teaching at one's school site, years of teaching experience, gender and race. I used a p2 network model (Van Duijn et al., 2004) to determine the extent to which these factors predict teachers' instructional support relationships.

The p2 model for directed graphs is a generalized linear model with crossed-nested random effects (Van Duijn et al., 2004). The parameters for the multilevel model are estimated using a Markov Chain Monte Carlo (MCMC) algorithm (Zijlstra, Van Duijn, & Snijders, 2005, 2006). The p2 model can be thought of as a logistic regression model for the presence (1) or absence (0) of ties between any two actors in a network. The model expresses the pattern of reported ties in the "advice" network (representing an instructional support relationship) as a

function of dyadic-level characteristics as Level 1 and individual-level characteristics as Level 2. As such, dyads are nested within the seekers and providers of advice, creating a cross-nested multilevel model.

The dependent variable is the existence of an instructional support tie between two teachers. For every pair of teachers i and j, if i turned to j for advice to improve their instructional practice every week or more, the $i \rightarrow j$ relationship was assigned a value of 1 and 0 otherwise. I included individual-level and dyadic-level measures in the model. Specifically, individual-level measures refer to the characteristics of the individual teachers (e.g., subject-area assignment; years of teaching experience), whereas dyadic-level measures focus on similarities and differences between the pair of teachers i and j (e.g., number of subjects taught in common; difference in years of teaching experience). The model regards advice-seeker and provider effects as latent or unobserved random variables that are explained by the advice-seeker and provider characteristics, as well as characteristics of the teacher pair.

In the model, the presence of an advice network tie (representing an instructional support relationship) was used as the dependent variable, indicating whether i reported receiving advice from teacher j. Then $advice_{ij}$ is modeled as a function of the tendency for teacher i to seek advice (α_i) and the tendency for j to provide advice (β_j). The model at Level 1, for the pair of teachers i and j, also includes seven variables describing the pair of teachers, including the count of grades taught in common, count of subjects taught in common, dummy variables indicating whether teachers were a leader/non-leader pair, special ed/general ed teacher pair, the difference in years at school and difference in years of experience between the advice-seeker and provider, and dummy variables indicating whether teachers were a male/female pair and whether they were of the same race.

The level 1 model is:[1]

$$\log\left(\frac{p[advice_{ij} = 1]}{1 - p[advice_{ij} = 1]}\right)$$

$$= \alpha_i + \beta_j + \delta_1(\text{count grades in common})_{ij} + \delta_2(\text{count subjects in common})_{ij}$$

$$+ \delta_3(\text{leader/non-leader pair})_{ij} + \delta_4(\text{special ed/general ed pair})_{ij}$$

$$+ \delta_5(\text{difference in yrs. at school})_{ij} + \delta_6(\text{difference in yrs. experience})_{ij}$$

$$+ \delta_7(\text{male/female pair})_{ij} + \delta_8(\text{same race})_{ij}.$$

The tendency of teachers to seek (α_i) and provide (β_j) advice is modeled at a second level. To estimate what individual-level attributes of the advice-seeker predict a tie, at level 2, holds a leadership role, special education teacher and female teacher dummy variables were included as advice-seeker (α_i) effects, and holds a leadership role and special education teacher dummy

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[1] The equations presented here draw from conventions in the notation used in Spillane et al. (2012). The model is originally proposed in Van Duijn et al. (2004) using slightly different notation.

variables, years at school, years of experience, and a female teacher dummy variable were included as provider (β_j) effects.

The Level 2 model is:

$$\alpha_i = \gamma_0^{(\alpha)} + \gamma_1^{(\alpha)}(\text{holds leadership role})_i + \gamma_2^{(\alpha)}(\text{special education teacher})_i$$

$$+ \gamma_3^{(\alpha)}(\text{female})_i + u_{0i}.$$

$$\beta_j = \gamma_0^{(\beta)} + \gamma_1^{(\beta)}(\text{holds leadership role})_i + \gamma_2^{(\beta)}(\text{special education teacher})_j$$

$$+ \gamma_3^{(\beta)}(\text{yrs. at school})_i + \gamma_4^{(\beta)}(\text{yrs. experience})_i + \gamma_5^{(\beta)}(\text{female})_i + v_{0i}.$$

where u_{0i} and v_{0j} are random effects for the dependencies across all relationships for teachers i and j, representing their latent tendency for seeking (u_{0i}) and providing (v_{0j}) advice. The seeker and provider random effects and are assumed to have a bivariate normal distribution, with (co)variances σ_α^2, σ_β^2, $\sigma_{\alpha\beta}$ and zero means.

The model parameters are estimated using a Markov Chain Monte Carlo procedure.[2] A Bayesian interpretation of the parameter estimates is used to determine significance by inspection of the quantiles. The parameter estimate is considered statistically significant when the quantiles between 2.5 and 97.5 do not include zero, in a manner analogous to use of a confident interval under a frequentist approach (Zijlstra et al., 2005).[3]

The findings from the p2 models tell us the factors associated with a tie between any two teachers in the sample schools by estimating effects for covariates at the individual and dyadic levels. Positive effects of the individual- and dyadic-level characteristics indicate that the characteristics increase the probability of a tie. The larger the value of the coefficient, the more we would infer that collaboration patterns are affected by that characteristic.

The p2 modeling approach assumes that pairs within the network are independent conditional on latent individual propensities for forming ties. This dyadic independence assumption may not be ideal for social networks. Other estimation procedures that are able to account for whole network processes (e.g., Exponential Random Graph Models) are in development but frequently encounter convergence problems and are theoretically less relevant to the research question of what teacher characteristics drive instructional support relationships. Furthermore if the model captures much of the variation in tie formation, higher-order network features may be less explanatory in this case.

Estimating the Influence of Teacher Collaboration on Perceptions of Normative Culture — HLM

Research questions:

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[2] The models were estimated using the p2 module in the StOCNET software system (Boer et al., 2006). A multilevel version of the p2 model is used when analyzing multiple networks simultaneously (Zijlstra et al., 2006).
[3] The use of Bayesian or frequentists approaches to interpretation of the parameter estimates is a matter of debate. Caution is used when interpreting quantile results that do not correspond with a frequentist approach using a t-statistic based on the standard errors. One reason in favor of interpretation by the quantile approach is that it takes into account any deviation from normal in the distribution of the parameter.

2) What is the relationship between teachers' instructional support relationships and their perception of normative culture (relational trust and collective responsibility)?

    a. What shares of variance in trust and collective responsibility among teachers is attributable to within or between schools?

    b. What characteristics of teachers' networks are associated with higher mean levels of trust and collective responsibility at the school level? (Level 2, $n = 20$)

    c. What is the relationship between a teacher's position in their school's network and his or her perception of the normative culture at the school? (Level 1, $n = 392$)

I used a two-level HLM because the teacher survey data are nested within schools. Two outcomes — relational trust and collective responsibility — were used to study the effects of teacher collaborative relationships on teachers' perceptions of normative culture in site-managed high schools. The outcome measures were standardized to a mean of zero and standard deviation of one. I group-mean centered all the level 1 predictor variables, including the dichotomous variables, used in the analysis. Group-mean centering is beneficial for interpreting the coefficient estimates as within-school differences. Teacher-level network measures were normalized so that the interpretation of the effects for collaboration activity would be comparable for teachers with different numbers of potential alters, due to different number of teachers. A full list of all level 1 and 2 variables is included as Appendix B. Appendix B also includes descriptive statistics about the distribution of the variables in Table B1.

Model building was carried out in steps for each of the two normative culture outcome measures. Variable selection was informed by the existing research. For each normative culture outcome, I first estimated a fully unconditional model with the no covariates to estimate the proportion of variance in teacher perception of normative culture attributable to within schools and between schools. The second set of models established the teacher-level model. I first controlled for teacher personal characteristics and position in the formal organization by adding teacher background characteristics and then leadership roles. I then tested whether teacher collaborative network activity influences teachers' perception of the normative environment by including teacher network measures. I then explore two collaboration indices in the teacher-level model, including level-1 interaction effects between the collaboration indices and the network measures. The results of this model are used to determine whether experience of collaboration mediates perceptions the impact of teacher background and collaboration activity. I used two collaboration indices. The first index measured the teacher's rating of the collaboration experience, including the extent to which they believe they share information effectively with colleagues and that they work with other teachers to improve my instruction. The second index measured the expectation for collaboration at the school as perceived by the teacher. The background variables and leadership roles are typically accumulated before their interactions with colleagues and so were estimated prior to adding in the network measures and collaboration experiences.

The third set of models establishes school-level controls for the level 2 model. I controlled for school background characteristics of network size, pilot vs. charter status, and student poverty (as indicated by free and reduced priced-meals).

The fourth and final set of models were used to investigate the impact of school-level network characteristics on teacher perceptions of the normative culture after controlling for teacher background, teacher collaboration, and school characteristics. The results of this model are used to determine which school network characteristics are associated with a stronger normative culture at the school.

The general equations for the hierarchical linear models used in this study are presented below.

Equations [1] and [2] represent the teacher-level and school-level models:

[1] $(normative\ culture)_{ij} = \beta_{0j} + \beta_{1j}\ (teacher\ background)_{ij} + \beta_{2j}\ (teacher\ network\ measures)_{ij} + \beta_{3j}\ (collaboration\ experience)_{ij} + r_{ij}$

[2] $\beta_{0j} = \gamma_{00} + \gamma_{01}(school\ characteristics)j + \gamma_{02}(school\ network\ measures)_j + u_{0j}$
       $\beta_{1j} = \gamma_{10}$
       $\beta_{2j} = \gamma_{20}$

In building the models presented here, I did several exploratory steps to identify which variables to retain for the models. I tried to balance parsimony with comprehensiveness and retaining both significant predictors and those with theoretical implications for the research questions. I considered a few criteria for inclusion: (1) theoretical reasoning; (2) significance; and (3) goodness of fit. I used the likelihood ratio test to determine whether removal of a variable was significant and also noted when change in BIC of the new model corresponded with moderate or strong evidence in support of inclusion.

Although not presented here, additional exploratory analyses were conducted to determine the effect of teacher racial composition on normative culture with no significant associations found. It is of interest to explore whether racial match has implications for teacher individual perception of normative culture, possibly through cross-level effects with teacher race and racial composition variables. White, black, and Latino population, pilot school status, and student poverty level as measured by free and reduced-price meal status were correlated, making it difficult to disentangle racial composition and racial match effects with 20 level-2 clusters.

Measures

A description of the measures used in the p2 and HLM analyses appears next. For further detail on measure construction, see Appendix C.

Outcome Measures (HLM) — Normative Culture

Two measures of organizational outcomes were used to reflect teachers' perception of the normative culture: (a) relational trust and of (b) collective responsibility.

Teachers' perceptions of *collective responsibility* were measured using a scale developed by the Consortium of Chicago School Research at the University of Chicago (Bryk, Sebring, Allensworth, Luppescu, & Easton, 2009). The scale measures the degree to which the teachers perceive a shared understanding that as a group, teachers are animated around the same goals related to student learning (Bryk and Schneider, 2002). For example, teachers were asked, "How many teachers in this school: Feel responsible to help each other do their best?" and could respond none, some, about half, most, or nearly all. Principal component analysis showed that the seven items loaded highly on a single factor that explained 54.0 percent of the variance (α =

.88).[4] A composite collective responsibility score (standardized to mean zero and unit variance and weighted with the factor loadings from the seven items) was created for each teacher using the 'factor" and "predict" command in Stata version 11.2. Table 1 includes the individual collective responsibility scale items and their factor loadings.

The *relational trust* among teachers in the school was measured using items from the faculty trust in colleagues scale designed by Hoy and Tschannen-Moran (2003). Relational trust indicates a teachers' perception that their colleagues are able to be vulnerable to one another due to their perception that their colleagues are honest, reliable, competent and benevolent (Hoy, W. K. & Tschannen-Moran, M., 2003). The items were scored on a 6 point scale from strongly disagree to strongly agree. For example, teachers were asked to respond with the extent to which they agreed with the statement, "Even in difficult situations, teachers in this school can depend on each other." A composite trust score (standardized to mean zero and unit variance and weighted with the factor loadings from the seven items) was created for each teacher using the 'factor" and "predict" command in Stata version 11.2. Principal component analysis showed that the seven trust items loaded highly on a single factor that explained 75.4 percent of the variance ($\alpha = .96$).[5]

Outcome Measure (p2 analysis) — Presence Of Instructional Advice Tie

In the first line of analysis, the p2 network analysis of factors predicting instructional support relationships between teachers within a school, data on the network ties served as the outcome measure. The dichotomous dependent variable of the model consisted of the presence (1) or absence (0) of a tie between two teachers in the advice network for every pair of teachers in the school. In other words, in the first line of analysis, the goal was to predict the advice/instructional support network based on the remaining observed teacher attributes.

Predictors (HLM; Levels 1 and 2) — Network Measures

In the second line of analysis, the advice network data were further analyzed using UCINET network analysis software (Borgatti, Everett, & Freeman, 2002) to create teacher- and school-level network variables, which serve as predictors in the HLM of relational trust and collective responsibility. I will describe the teacher and school measures in turn.

Two network-data derived measures of each teacher's collaboration activity were included as teacher-level (level 1) predictors. *Normalized out-degree* is the number of others the teachers reported going to for advice (divided by number of teachers in school). *Normalized in-degree* is the number of others who reported going to the teacher for advice (divided by number of teachers in school). In- and out-degree are basic individual network measures that reflect a person's prominence and activity within their network.

Four organization-level network measures (level 2) that characterize the school's network structure overall were included as school-level (level 2) predictors.[6] *Density* is calculated as the proportion of the existing relationships to the maximum number of relationships possible in the

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[4] High alphas could be due to response set bias. CCSR publishes Rasch scores for the collective responsibility measures that may be used to determine the presence of bias.

[5] In Hoy, W. K., Gage, C. Q., & Tarter, C. J. (2006) authors report alpha coefficients of reliability for this scale "are consistently above .90". Our items performed similarly in this administration.

[6] For additional information about these network concepts including their implications for the study of school organizations, see chapter 2.

network. *Degree centralization* is a measure of the extent to which the network resembles a perfectly centralized network i.e., a star with all teachers tied to one central node. *Closure* reflects the triadic clusters that exist out of the possible triads for network of size N. Finally, *dyad reciprocity* is the ratio of the number of pairs with a reciprocated tie relative to the number of pairs with any tie.

Predictors (HLM; Level 1) — Collaboration Experience

Two indices were created by exploratory factor analysis (EFA) of five survey items pertaining to teachers' experiences of collaboration at their school. The first represents the individual teacher's personal reported *rating of the collaboration experience (level 1)*. The second is from the individual teacher's point of view, the *perceived expectation of collaboration (level 1)* at the school. For further detail about the individual survey items and results of the EFA, see Appendix C.

Predictors (HLM; Level 2) — School Characteristics

Three school characteristics were included in the HLM analysis. Information on the socioeconomic status of students in the school through free and reduced price lunch eligibility (*FRPM*) was obtained from the California Department of Education. The *network size* was the number of teachers in the school. A dummy variable for whether the school was a *pilot* school or charter school as also used. The number of level 2 predictors with 20 clusters must be limited in HLM analysis. In past studies, school size was negatively associated with collective responsibility (Lee socioeconomic status was found to be related to collective responsibility (Lee & Loeb 2000). To extend this, the effect of the number of teachers (network size) on measures of normative culture was examined in this study. Lee and Smith (1996) found student SES to be higher in schools with higher collective responsibility; concordantly FRPM as a measure of student SES was included here. The indicator for pilot or charter status was included to explore whether teacher working in schools with differing autonomy hold differing perception of normative culture. A significant finding controlling for other factors would motivate future study of how site-based autonomy shapes teacher community and normative culture.

Predictors — Teacher-Level Attributes

Information on teacher background was collected included their *personal characteristics* such as gender, ethnicity, years at the school, years of teaching experience, certification level and highest degree. Teachers were also asked about their *positions in the school organization*, including the grade-level, subject-area and special programs (such as special education) assignments, and several items on the specific *leadership roles* held.

One feature of this study to note is that these predictors appear at different levels in the two different analyses. In the p2 analysis, these teacher attributes form "level 2" predictors (with teachers at level 2 and dyads cross-nested within individual teachers at level 1). In the HLM analysis, these teacher attributes form "level 1" predictors (with schools at level 2).

Predictors (p2 analysis; Level 1) — Dyadic Variables on Position in the Formal Organization

The teacher attribute data on teachers' positions within the school organization were used also used to construct the dyad-level covariates for the p2 network models. These dyadic covariates describe each *pair* of teachers within a school and are includes as predictors in the p2 analysis at level 1, the dyadic level.

Both the *count of grades taught in common* and *count of subjects taught in common* are attributes of teacher pairs, and are each included as dyadic-level covariate to estimate the effect of the number of overlap in these assignments on the likelihood of an advice relationship. Similarly, the *leader/non-leader pairs* dyadic-level covariate takes a value of 1 when one of the two teachers in the pair is a formal leader and the other is not. When the dyadic-level covariate *special ed/general ed pairs* describes when a pair of teachers that include one special education and one general education teacher.

Predictors (p2 analysis; Level 1) — Dyadic Variables on Personal Characteristics

The *difference in years at school* between a pair of teachers is a dyadic-level covariate to estimate the effect of this difference on the likelihood of an instructional support relationship between two teachers given their respective tenure at the school site. Similarly, the *difference in years of experience* is likewise included as a dyadic-covariate. The *male/female pairs* dyadic-level covariate and *same race* dyadic-level covariate similarly characterize pairs of teachers based on their individual personal characteristics.

This chapter described the methods used to examine the instructional support relationships and normative culture in 20 site-managed high schools. In what follows, Chapter 4, *Factors Predicting Instructional Support Relationships*, will present findings from the p2 network analysis. Chapter 5, *The Influence of Teacher Collaboration on Perceptions of Normative Culture*, will present findings from the hierarchical linear modeling (HLM) estimation of collective responsibility and relational trust. In closing, Chapter 6, *Conclusion*, will provide interpretation of these findings, implications for theory and practice, limitations and areas for further research.

Table 1

Collective Responsibility and Relational Trust Scale Items and Factor Loadings

Collective Responsibility Item (α = .88)	*Factor*
How many teachers in this school:	
1. Feel responsible when students fail?	0.4614
2. Feel responsible to help each other do their best.	0.7087
3. Help maintain discipline in the entire school, not just their classroom.	0.7430
4. Take responsibility for improving the school.	0.8318
5. Feel responsible for helping students develop self control.	0.7560
6. Set high standards for themselves.	0.8221
7. Feel responsible for ensuring that all students learn.	0.7618

Relational Trust Item (α = .96)	*Factor*
1. Teachers in this school typically support each other.	0.8983
2. Even in difficult situations, teachers in this school can depend on each other.	0.8807
3. Teachers in this school trust each other.	0.9079
4. Teachers in this school are open with each other.	0.8697
5. Teachers in this school have faith in the integrity of their colleagues.	0.9128
6. When teachers in this school tell you something you can believe it.	0.8688
7. Teachers in this school do their jobs well.	0.7280

CHAPTER IV

FACTORS PREDICTING INSTRUCTIONAL SUPPORT RELATIONSHIPS

Site-based management – a pivotal facet of magnet, charter, and labor-friendly pilot schools – promises to nurture strong teacher communities marked by steady collaboration and shared responsibility for student learning. Earlier work associates tighter cooperation and support among colleagues with achievement gains but little is known about the factors that contribute to more frequent collaboration within small high schools. Drawing on social network data, I examined what factors predicted instructional advice relationships between teachers in 20 charter and pilot high schools in a large urban district. Both position in the formal organization and teacher personal characteristics predicted instructional advice relationships. Teachers were more likely to seek advice to improve their teaching practice from colleagues who teach the same subject. However, teachers were less likely to seek advice from the more experienced teachers in the school. The likelihood of an instructional advice relationship was greater when teachers were of the same race. A deeper understanding of these patterns of instructional support has immediate implications for school leaders in autonomous settings as they formally organize teachers to support instructional improvement and select teachers into their schools.

This chapter presents the results of the *p2 network analysis*, in response to the first research questions:

1. What accounts for the choice of colleagues for instructional support in site-managed high schools?

a. To what extent are these relationships influenced by a teacher's formal positions or roles within the organization?

b. To what extent are these relationships driven by personal characteristics of the teachers?

Recap of Effects Included in Model

To address these questions, I used a p2 network model (Van Duijn et al., 2004) to determine the extent to which two types of factors predict teachers' instructional support relationships. First, factors pertaining to *position in the formal organization* included grade-levels taught, subject-area assignment, leadership roles held, and special education program participation. Also, *personal characteristics* of teachers that were analyzed included years teaching at one's school site, years of teaching experience, gender and race.

These factors occurred in the models on both the individual teacher-level (level 2) and the dyadic-level (level 1). The ability to examine level 1 effects pertaining to similarities and differences in several characteristics of the teachers pairs is a methodological advantage of the p2 approach. For the purposes of the discussion of these results however, effects are organized here not by level but by whether the effect reflects the influence of position in formal organization or personal characteristics; this allows a comparison between the relative influences of these two types of factors to be foregrounded over the methodological distinction.

Before presenting the findings from the model, here I recap the effects included in the model.

Personal Characteristics Covariates and Effects

Years at school is an individual teacher-level (level 2) provider covariate to control for the effect of a teacher's years teaching at the school site on their likelihood of providing advice. The (directed) *difference in years at school* between the seeker and provider of advice is included

as a dyadic-level (level 1) covariate to estimate the effect of this difference on the likelihood of an instructional support relationship between two teachers given their respective tenure at the school site. Similarly, *years of teaching experience* is included as a (level 2) provider covariate to test for whether teachers the more years of experience a teacher has the more likely they are to provide advice; the (directed) *difference in years of experience* is likewise included as a dyadic-covariate (level 1) to reflect the effect of difference in years of experience between the advice-seeker and provider on their likelihood of an instructional support relationship.

Female is an individual-level covariate to control for whether female teachers are any more likely to seek and provide advice than male teachers. The absolute difference of female is used to form the *male/female pairs* dyadic-level covariate to test whether instructional support relationships between male and female teachers are more or less likely than ties between teachers of the same gender (male-male or female-female). Finally, the *same race* dyadic-level covariate is included to estimate the effect of being of the same race on the likelihood of an instructional support relationship.

Position in Formal Organization Covariates and Effects

Subject-area and grade-level assignments are two central ways of organizing teacher collaboration at school sites and as such, the effects of these assignments within the formal organization are focal covariates for the analysis. Both the *count of grades taught in common* and *count of subjects taught in common* are attributes of teacher pairs, and are each included as dyadic-level covariate to estimate the effect of the number of overlap in these assignments on the likelihood of an advice relationship.

As an individual-level covariate, *holds leadership role* is included to determine whether teachers holding a leadership role are any more or less likely to seek and provide advice than non-leaders. The absolute difference of holds a leadership role is used to form the *leader/non-leader pairs* dyadic-level covariate to test whether relationships between leaders and non-leaders are relatively more likely than ties between two leaders or two non-leaders, regardless of their direction. Similarly, *special education teacher* is included as an individual-level covariate for advice seekers and providers, and its absolute difference as the dyadic-level covariate *special ed/general ed pairs*, for ties between special education and general education teachers.

<div align="center">

Results

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Tables 2 and 3 summarize the results of the p2 models that were fit, which sought to predict the factors associated with an instructional support relationship between two teachers. The models progressively added explanatory variables, beginning with a simple model that examined grade and subject overlap only, adding other positions in the formal organization, then adding personal characteristics. The following sections present the effects estimated in the full model, which includes all positions in formal organization variables and all personal characteristics variables (see Table 3, Full Model, in the rightmost column). Models adjust for all variables in the table, and all effects presented below are thus controlling for all other factors in the full model.

The "Characteristics of Advice-seeker" effects of individual teacher-level (level 2) measures in Table 2 refer to attributes of the teacher seeking advice that account for the patterns of collaboration reflected in the network. Similarly, the "Characteristics of Advice Provider" effects of individual teacher-level (level 2) measures refer to attributes of the teacher from whom

advice is sought that account for the observed patterns in the network. The "Characteristics of Teacher Pair" effects at the dyadic-level (level 1; pairs are cross-nested within the two individual teachers) refer to the extent that two teachers have an advice tie given similarity or difference in attributes.

Overall Trends

The negative value of the density parameter (-2.57) indicates that the probability of an advice relationship is low (less than 0.5) when all other factors are equal to zero; in other words, that the networks are relatively sparse. The reciprocity parameter is positive (2.64), indicating that the advice relationships tend to be reciprocated.

The variance of the seeker random effects (2.57) is larger than the variance of the provider effects (0.81) showing larger individual differences in asking advice than in being asked for advice. The negative covariance (-0.86) between the seeker and provider effects indicates that, on average, teachers that ask for advice more are being asked for advice less and vice versa.

Effects of Position in Formal Organization

In the full model, *count of subjects taught in common* as a dyadic effect was associated with having an instructional support relationship between teachers. The more subjects teachers taught in common, the more likely they were to provide or receive advice from one another, as suggested by a positive dyadic effect of count of subjects in common (1.82).[7] However, the *count of grades taught in common* did not have a significant effect on the likelihood of an instructional support relationship between two teachers.

There is no significant effect of either *holding a leadership role* or serving as a *special education teacher* on seeking or providing advice. The *leader/non-leader pairs* covariate however, has a negative effect (-0.15), indicating that the probability of an instructional support relationship between leaders and non-leaders is smaller than the probability of an instructional support relationship between non-leader/non-leader and leader/leader pairs. Instructional support relationships between *special education and general education pairs* are no more or less likely.

Effects of Personal Characteristics

The negative effect of difference in *years at school* (-0.10) indicates that a teacher asking for advice from a teacher with longer tenure in the school (corresponding to a negative difference of years at school between the advice seeker and provider) is more likely. However, the non-significance of the *years at school provider* effect suggests that there is no increased probability for providing advice as an effect of being at one's school site for longer irrespective of any relative difference in tenure. Surprisingly, more experienced teachers were less likely to be sought out for advice, as indicated by a negative provider effect of years teaching experience (-0.48). Also notably, a teacher was no more (or less) likely to have an instructional support relationship with teachers who had more experience relative to their own, as reflected by the non-significance of the *difference in years of experience* dyadic-effect.

Similarity of race and gender between two teachers are positively associated with an instructional support relationship. The *male/female pairs* covariate has a negative effect (-0.22),

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[7] Parameter estimates reported in parentheses are statistically significant. Odds ratios are not reported; calculations would be biased by assuming no network dependencies (i.e., that reciprocity, sender and receiver parameters are equal to zero).

indicating that the probability of an instructional support relationship between a male and female teacher is smaller than the probability of an instructional support relationship between two teachers of the same gender. However, male and female teachers do not differ strongly with respect to their overall likelihood of either sending or providing advice. Finally, the effect of *same race* is large and positive (2.43), indicating that the probability of an instructional support relationship increases when teachers are of the same race.

Summary and Implications

Teachers' access to the social support of their colleagues to improve their teaching practice is one component of school improvement. School leaders use formal positions- such as teaching assignment and leadership roles- to organize teacher collaboration. However, teachers in turn choose the colleagues they turn to for advice to improve their instruction, and these choices do not always reflect school leaders' efforts to shape teacher collaboration. In this sample, we see that both the *formal organization* and *personal characteristics* play a role in shaping teachers' advice networks.

Formal Organization: Subject (But Not Grade) Assignments and Leadership Roles Matter

The basic ways of organizing teachers within schools are by subject-area assignment and grade-level assignment. With regard to formal organizational position, subject-area assignment was associated with the presence of instructional support relationships. The more subject assignments teachers held in common, the more likely they were to provide or receive advice from one another. However, similar grade-level(s) assignments did not have a significant effect on the likelihood of an instructional support relationship between two teachers.

The finding that subject-area assignment shapes teachers' instructional support networks is on its face not surprising, particularly at the secondary level. In the context of the small autonomous high school, however, the finding warrants concern. First, separate analysis of the larger project data (Waite & Lee, 2014) revealed how school leaders in this study frequently relied on grade-level teaming in these smaller settings even given the high school setting. Furthermore, the majority of schools in the study have the same (n=8) or higher (n=6) frequency grade-level meetings as subject-area meetings,[8] suggesting grade-level as a way of organizing teacher collaboration that is prioritized. Yet teachers in the study, when allocated time with both grade-level and subject-area colleagues, seek out same-subject colleagues for advice on improving teaching practice. Secondary school leaders in autonomous settings would benefit from knowledge of this differential preference when allocating time resources. The "department" of a large, traditional high school easily shrinks down to a handful of teachers in schools with 20 or 25 teachers. In these settings, teachers have a limited number of same-subject colleagues to turn to for social support to improve their practice, which may hamper school improvement efforts.

Leadership role and special education assignments are the other positions in the formal organization explored in this study. There is no significant effect of either a teacher's holding a leadership role or serving as a special education teacher on their likelihood of seeking or providing advice. However, the probability of an instructional support relationship between leaders and non-leaders is smaller than the probability of an instructional support relationship

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[8] As reported on the questionnaire completed by study principals. Waite & Lee (2014) describes in further detail the methods and findings from this project component.

between non-leader/non-leader and leader/leader pairs. Instructional support relationships between special education and general education pairs are neither more nor less likely. Further analysis will reveal whether holding a specific leadership role is influential for providing and seeking instructional improvement advice. The greater likelihood of leader/leader pairs may suggest a pattern where a subgroup of teachers is more active in school improvement efforts. Their preference for supporting one another could limit more peripheral teachers' access to this social support for improving their practice.

Personal Characteristics: Gender, Race, Years at School and Years of Experience All Play a Part

Adding in personal characteristics of the teachers provides a richer picture of the patterns of teacher instructional support relationships in these small autonomous high schools. Demographically, similarity of race and gender between two teachers is positively associated with an instructional support relationship. The probability of an instructional support relationship between a *male/female pair* of teachers is smaller than the probability of an instructional support relationship between two teachers of the same gender. However, male and female teachers do not differ strongly with respect to sending and providing advice. Finally, the probability of an instructional support relationship increases when teachers are of the *same race*. The strong and significant effect of race on the formation of instructional support relationships, while consistent with homophily findings in the network literature, is of interest. On one hand, race of teacher has little direct bearing on quality of the support to improve their instruction that a teacher accesses through those relationships, for example, in how to best structure lesson units or strategies for checking for understanding. However, the content of the advice could be related to race and ethnicity if it pertains to how a teacher connects with students of a particular race dissimilar to your own. The effect of race is greater than all other factors --- organizational and personal – accounted for in the study.

Teacher tenure at their school and years of experience are associated with an instructional support relationship in different directions. Teachers do not seek out advice from teachers with more years of experience than they have, contrary to what is expected in a traditional setting (c.f. Lortie, 1975). Surprisingly, teachers are less likely overall to seek advice from the more experienced teachers in the school – regardless of how many years experience the teacher seeking advice has. On the other hand, a teacher is more likely to ask for advice from someone with longer tenure at the school in question.

Characteristics of the Relationship Contributed to Choice of Colleague Significantly

Of the factors considered here, features of the relationships mattered more than teachers' individual features, for both personal characteristics and position within the formal organization. Overall, five aspects of the relationship between teachers were significant. By including the dyadic level, with a sample of 400 teachers we learn a great deal about the nature of social support for their teaching practice. And, of the four significant variables included at both the individual and dyadic levels, in three instances the effect was found at the dyadic level. Teachers did not uniformly seek advice from a teacher with the profile one might expect: more experienced, those in leadership roles, and with more years at the school. Instead, the colleagues from whom teachers sought advice were dependent on the attributes of that teacher *relative* to their own attributes.

Notably, one characteristic does uniformly describe teachers providing instructional improvement advice: teachers are *less* likely to seek advice from the more experienced teachers in the school. This finding, which suggests veteran teachers are not viewed above others as sources of knowledge about teaching practice, is line with findings from at least one other study (Moolenaar, 2010). Qualitative work from a separate qualitative study related to this project revealed differences in pedagogical approaches that may account for this nontraditional pattern. Further systematic qualitative work is necessary to reveal the basis for this preference.

This chapter described findings from modeling factors pertaining to the formal organization and personal characteristics actors to estimate the likelihood of an instructional support relationship between two teachers. There were a few main findings.

I found that teachers did not uniformly seek advice from a teacher with the profile one might expect: more experienced, those in leadership roles, and with more years at the school. Instead, the colleagues from whom teachers sought advice were dependent on the attributes of that teacher relative to their own attributes. The pursuit of advice depended on the fit between individuals that form the association. Teachers were more likely to receive support to improve their instruction from colleagues who taught the same subject, had been at the school for longer, or were of the same race or same gender. Notably, teachers were less likely to seek advice from the more experienced teachers in the school.

In the next section, Chapter 5, *The Influence of Teacher Collaboration on Perceptions of Normative Culture*, I will present findings from the hierarchical linear modeling (HLM) estimation of collective responsibility and relational trust, two elements of the school's normative culture. I will show how the instructional support relationships described in this chapter are associated with perceptions of the normative culture. I will also show how personal characteristics and position within the formal organization, demonstrated in this chapter to contribute to the likelihood of instructional support ties, also condition teacher perceptions of normative culture.

Table 2

Parameter Estimates of the p2 Model of the Effect of Grade-level and Subject-area Teaching Assignment on the Probability of Having an Advice Relationship

| Variables | Intercept-only model | | | | Grade and subject only | | | |
	Parameter Estimate	SE	Quantiles 2.5	97.5	Parameter Estimate	SE	Quantiles 2.5	97.5
Overall effects								
Density	-2.6788	(0.1409)	-2.98	-2.58	-2.7034	(0.1242)	-2.92	-2.45
Reciprocity	2.6188	(0.1930)	2.24	2.74	2.6010	(0.1868)	2.25	2.99
Dyadic level covariates (level 1)								
Characteristics of the Teacher Pair:								
Count of grades taught in common	---	---	---	---	0.3403	(0.3614)	-0.36	1.00
Count of subjects taught in common	---	---	---	---	1.1105 ^	(0.6509)	-0.21	2.38
Random effects								
Seeker variance	2.4054	(0.2577)	1.95	2.57	2.3882	(0.2484)	1.94	2.91
Provider variance	0.7831	(0.1161)	0.58	0.86	0.7947	(0.1108)	0.60	1.03
Seeker-provider covariance	-0.8368	(0.1416)	-1.13	-0.74	-0.8117	(0.1408)	-1.11	-0.56
Model fit measures								
Deviance	4605.55				4590.51			
Bayesian information criterion (BIC)	13600.84				13609.54			
Newton-Raftery p4	-2311.98				-2304.46			
Log-likelihood	-2537.60	20.08			-2532.69	19.90		

Notes: N=11526 tie observations among 392 teachers

^p<.10 *p < 0.05 **p < 0.01

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Table 3

Parameter Estimates of the p2 Model of the Effect of Position Within Formal Organization and Personal Characteristics on the Probability of Having an Advice Relationship

Advice Network	All position in formal org only				Full model: all position in formal org + all personal characteristics				
	Parameter Estimate		SE	Quantiles 2.5	97.5	Parameter Estimate		SE	Quantiles 2.5	97.5
Overall effects										
Density	-2.6066		(0.1466)	-2.87	-2.50	-2.5657		(0.1255)	-2.82	-2.29
Reciprocity	2.5714		(0.1759)	2.22	2.70	2.6351		(0.1990)	2.24	3.00
Individual level covariates (level 2)										
Characteristics of Advice-seeker:										
Holds leadership role	-1.0871		(1.1361)	-3.11	1.24	-1.4166		(1.4724)	-3.93	1.49
Special education teacher	0.0146		(1.1808)	-2.26	2.26	-0.0605		(1.4240)	-2.32	3.31
Female	---		---	---	---	1.0323		(1.2143)	-1.48	3.13
Characteristics of Advice Provider:										
Holds leadership role	1.0257		(0.7406)	-0.41	2.52	1.0507		(1.1877)	-1.15	3.28
Special education teacher	0.6212		(0.7361)	-0.79	1.15	-0.195		(1.0370)	-2.25	1.77
Years at school	---		---	---	---	0.5511		(0.7693)	-0.79	2.31
Years of teaching experience	---		---	---	---	-0.4771	*	(0.2623)	-1.06	-0.03
Female	---		---	---	---	0.7659		(0.9000)	-0.79	2.62
Dyadic level covariates (level 1)										
Characteristics of the Teacher Pair:										
Count of grades taught in common	0.075		(0.4491)	-0.89	0.94	-0.1654		(0.6197)	-1.39	1.00
Count of subjects taught in common	1.2277	^	(0.6689)	-0.08	2.58	1.8156	*	(0.9371)	0.10	3.71
Leader/non-leader pairs	-0.1559	*	(0.0648)	-0.27	-0.01	-0.1479	*	(0.0712)	-0.30	-0.01
Special education/general ed pairs	-0.0286		(0.0781)	-0.18	0.12	-0.0487		(0.0772)	-0.21	0.09
Difference in yrs. at school	---		---	---	---	-0.0993	**	(0.0293)	-0.15	-0.04
Difference in yrs. teaching experience	---		---	---	---	0.0021		(0.0085)	-0.01	0.02
Male/female pairs	---		---	---	---	-0.2249	**	(0.0684)	-0.37	-0.10
Same ethnicity	---		---	---	---	2.4272	**	(0.6084)	1.22	3.69
Random effects										
Seeker variance	2.4281		(0.2689)	1.94	2.99	2.574		(0.2719)	2.08	3.16
Provider variance	0.7798		(0.1130)	0.58	1.02	0.8058		(0.1127)	0.60	1.05
Seeker-provider covariance	-0.8092		(0.1427)	-1.10	-0.54	-0.8625		(0.1479)	-1.17	-0.59
Model fit measures										
Deviance	4586.94					4539.02				
Bayesian information criterion (BIC)	13677.17					13724.18				
Newton-Raftery p4	-2302.67					-2278.71				
Log-likelihood	-2530.69		20.11			-2510.06		19.88		

Notes: N=11526 tie observations among 392 teachers

^p<.10 *p < 0.05 **p < 0.01

CHAPTER V

**INFLUENCE OF TEACHER COLLABORATION ON PERCEPTIONS OF
NORMATIVE CULTURE**

Policymakers and districts look to smaller size and site-based autonomy as strategies to foster strong teacher professional community and social cohesion in high schools. The hope is that these schools will develop a culture of trust and shared responsibility for student learning, an important support for school improvement (Bryk & Schneider, 2002; Bryk et al., 2010; Frank, 2009; Goddard et al., 2000). Evidence suggests teacher relationships are what matter for fostering positive normative culture (Bryk & Schneider, 2002; Louis et al., 1996; Coburn & Russell, 2008; Spillane & Kim, 2012). But what are the social mechanisms through which teachers perceive their colleagues as trustworthy and mutually responsible? This chapter describes the influence of one social factor, teacher collaboration, and in particular, the network of instructional improvement relationships, on teachers' perceptions of normative culture in their schools. I find that the teachers to whom most colleagues go for support held weaker perceptions of social cohesion. Furthermore, in schools with more centralized networks, i.e., where advice and support were unevenly distributed, teachers reported lower levels of collective responsibility but higher levels of trust. This examination contributes to our overall understanding of which social structures promote a normative culture of shared responsibility for student learning and trust among colleagues – the foundations of strong teacher professional community.

This chapter presents the results of the HLM analysis, in response to the second research question:

2) What is the relationship between teachers' instructional support relationships and their perception of normative culture (relational trust and collective responsibility)?

a. What shares of variance in trust and collective responsibility among teachers is attributable to within or between schools?

b. What characteristics of teachers' networks are associated with higher mean levels of trust and collective responsibility at the school level? (Level 2, $n = 20$)

c. What is the relationship between a teacher's position in their school's network and his or her perception of the normative culture at the school? (Level 1, $n = 392$)

The results of the models described in chapter 3, Methods, for estimating the influence of teacher collaboration on perceptions of normative culture are presented here.

Two normative culture outcomes, (a) relational trust; and (b) collective responsibility, were predicted through a series of models. The results for each progressive modeling step for relational trust and collective responsibility are presented together below. The level 1 models for each outcome estimate teacher perceptions of normative culture predicted by:

- Models 1 and 2: Unconditional model
- Models 3 and 4: Teacher background characteristics
- Models 5 and 6: Teacher collaborative activity variables (i.e., teacher network measures)
- Models 7, 8 and 9: Collaboration experience indices

The level 2 models for each outcome include the final level 1model variables (presented in Model 8 for collective responsibility and Model 9 for relational trust) and estimate teacher perceptions of normative predicted by:

- Models 10 and 11: School background characteristics

- Models 12 and 13: School-level network measures

Level 1 Models

First, I present the level 1 models, which include the (a) unconditional models; (b) teacher background characteristics; (c) models incorporating teacher collaboration activity; and (d) models incorporating teacher experience of collaboration.

Unconditional Model

The unconditional model results (Table 4, Model 1 and Table 5, Model 2) show that 13.2% of the variance in teachers' perceptions of relational trust and 9.1% of the variance in perception of collective responsibility occurs between schools, and the remaining 86.7% and 90.9% of the variance in trust and collective responsibility, respectively, occurs among teachers within schools. These estimates of the proportion of the variance in perceptions of normative culture are similar to the variance components for social science studies and indicate a hierarchical approach is reasonable in this case. This also highlights a large amount of within-school variance that needs to be accounted for.

Teacher Background Characteristics Models

The next model was used to control for teacher personal characteristics and position in the formal organization by adding teacher background variables. Conceptually, teacher roles and characteristics are generally established prior to teachers' engagement and formation of relationships with their colleagues during the school year and so the teacher background variables were entered into the model before entering the teacher collaboration variables (the results are summarized in Table 4, Model 3 and Table 5, Model 4). Advanced degree (effect size = -0.28, p < .003), years experience (effect size = -0.02, p < .039), and leadership role count (effect size = 0.11, p < .03) all had significant associations with relational trust, controlling for other positions held in the organization and personal characteristics. The greater the number of leadership roles held, the higher the teacher's perception of trust among colleagues in the school, whereas the greater the number of years experience, the lower the perception of trust. Teachers with a Master's or Doctorate degree also held lower perceptions of trust.

For collective responsibility, the teacher background model results were different in that neither advanced degree nor years experience had significant associations. However, subject area assignments, in particular, subject area count (effect size = 0.14, p < .022), social studies teaching assignment (effect size = -0.17, p < .027) and English teaching assignment (effect size < -0.24, p < .001) had significant associations with collective responsibility. Social studies teachers and English teachers held lower perceptions of collective responsibility among colleagues, whereas the more subject areas taught, the higher the perception of collective responsibility. Regarding leadership roles, although count of leadership roles had no significant association, instructional leader (effect size = 0.12, p < .043) had a significant positive association with perception of collective responsibility.

Models Incorporating Teacher Collaboration Activity

The next step was to examine the effects of teacher collaboration on teachers' perceptions of normative culture. These models included all teacher background variables from prior models. The results are summarized in Table 4, Models 5 and Table 5, Model 6. First, two level 1 measures of teacher collaboration activity, normalized in-degree and normalized out-degree,

were added to the model of teacher background variables. Normalized out-degree is a teacher-level network measure that reflects the number of colleagues from whom a teacher seeks advice. Normalized in-degree is a teacher-level network measure that reflects the number of colleagues to whom the teacher provides advice. These level 1 network measures indicate the teacher's collaborative activity within their school's advice network.

Neither network measure was significantly associated with relational trust. However, both in-degree (effect size = -0.70, p < .002) and out-degree (effect size = 0.56, p < .000) were significantly associated with collective responsibility. The more colleagues that reported seeking advice from a teacher, the lower that teachers' perception of the group's overall collective responsibility. In contrast, the more colleagues a teacher reported seeking advice from, the higher that teacher's perception of the group's collective responsibility. In other words, not only did teachers' perceptions vary with their collaborative activity, but their rating of the group depended on how they interacted: within the same school, teachers tapped to provide instructional support to many colleagues felt the overall responsibility of the group was lower whereas the more colleagues a teacher sought instructional support from, the higher they rated the group's sense of responsibility.

Models Incorporating Teachers' Experience of Collaboration

The next model was used to investigate the impact of teachers' experience of collaboration on their perceptions of the normative culture after controlling for teacher background and reported collaboration activity. The results are summarized in Table 4, Model 7 and Table 5, Model 8. These models retained all variables from the prior models. The rating of collaboration index is a teacher-level (level 1) measure of how positive the teacher's personally rated the collaboration experience. The collaboration expectation index, also a teacher-level measure, reflects the extent to which the teacher perceived an expectation to collaborate with colleagues in various domains. Both rating of collaboration (effect size = 0.53, p < .000) and collaboration expectation (effect size = 0.24, p < .006) were significantly associated with relational trust. Perceptions of trust were higher for teachers who perceived a higher expectation of collaboration and rated the collaboration higher. From the previous model, the significant associations between relational trust with advanced degree and leadership role count remained the same (with similar magnitude and same direction). Mixed and other race variable was no longer significantly associated with perception of trust, however Latino variable (effect size = -0.20, p < .028) and Asian variable (effect size = 0.27, p < .023) were significantly associated with trust.

Rating of collaboration was significantly positively associated with perception of collective responsibility (effect size = 0.24, p < .000), however perception of expectation for collaboration was not associated with collective responsibility. From the previous model, the significant associations between collective responsibility with collaboration activity variables and Latino and English teacher variables remained the same (with similar magnitude and same direction). Instructional leader was no longer significantly associated with collective responsibility after accounting for experience of collaboration variables.

Level 1 Interaction Effects

The next models explore whether there are interaction effects between the collaboration experience (level 1) and collaboration activity (level 1) variables. Interaction terms between both in-degree and out-degree with both collaboration expectation and collaboration rating for both

collective responsibility and relational trust (8 models total) were considered. Only the interaction between out-degree and collaboration rating was significantly associated with relational trust (effect size = 0.27, p < .024). (Table 4, Model 9.) This interaction is not entirely straightforward to interpret because the rating of collaboration experiences with colleagues occurs after the experience of the collaboration activity, however one way to consider the significant finding is that the higher perception of trust for teachers who rate the collaboration experience highly is amplified for each additional teacher that they seek advice from (their out-degree). With no additional significant associations from other interaction terms, this interaction term moves forward as part of level 1 for relational trust, with the model for collective responsibility containing none of the interaction terms.

Level 2 Models

Next, we move on from the final teacher-level (level 1) models of the previous section to begin to incorporate the school-level (level 2) variables. The multilevel models for relational trust and collective responsibility first control for school characteristics (network size, pilot school status, and free and reduced price meal eligibility percentage) and then incorporate school-level network measures.

Incorporating School Characteristics at Level 2

Table 6, Model 10 and Table 7, Model 11 summarize the results for the models after three school characteristics were added. First, free and reduced price meal eligibility percentage was significantly associated with relational trust (effect size = .01, p < .023) prior to entering the school-level network characteristics, which suggests that the higher the level of poverty, the higher the perception of trust was among teachers in the school on average, although the magnitude of this effect was small. Second, being a pilot vs. charter school was not significant associated with perceptions of the level of trust or collective responsibility of the school. Third, prior to adding school-level network measures, network size also was not significantly associated with perceptions of the level of trust or collective responsibility of the school.

At the teacher-level, the significant associations of the previous model remained with the exception of leadership role count, which was no longer significantly associated with teachers' perceptions of trust. However, being a design team member was significantly associated with perception of trust (effect size = 0.23, p < .043).

Final Model: Two-level Model Adding School-level Network Measures

Table 6, Model 12 summarizes results incorporating school-level network measures (level 2; N = 20) for relational trust. Controlling the other factors, school in-degree centralization was significantly associated with relational trust (effect size = 1.53, p < .019). In-degree centralization reflects the extent to which instructional advice-provision is concentrated around a few individuals. The more the school network resembled this distribution of valued expertise around few individuals, the higher teachers' perception of the group's trust. No other school-level network measures were significantly associated with relational trust. This association was estimated after controlling for individual teachers' own position within the network, which as recalled had no significant association with their perceptions of the group's trust.

The significant association between in-degree centralization and relational trust indicates teachers in schools where instructional support was provided more prominently by select individuals perceived their colleagues as a more trusting group than schools where instructional

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support was more evenly distributed. This effect is also controlling for the extent to which these relationships were reciprocated, and the overall density of the ties in the school. The magnitude of this effect is much greater than that of other variables with significant association.

Table 7, Model 13 summarizes results incorporating school-level network measures (level 2; N = 20) for collective responsibility. Out-degree centralization reflect the extent to which instructional advice-seeking in a group is more extensive by one or some colleagues than others. Out-degree centralization was significantly associated with collective responsibility (effect size = -0.65, p < .000). The more centralized, that is, the more unevenly distributed advice seeking was, the lower teachers' perception of the group's shared responsibility for student learning. This effect was observed after controlling for other school-level network variables, and after accounting for the significant but opposite associations between individual teacher advice-seeking and advice-providing and their individual perceptions of the group's responsibility.

After accounting for school-level network measures, network size was significantly associated with collective responsibility (effect size = .01, p < .018). The more teachers in the school, the higher the perception of collective responsibility was among teachers in the school on average, although the magnitude of this effect was small.

The density of the instructional support relationships was positively associated with teachers' perception of collective responsibility of teachers in the school overall at a close to the 0.5 significance level (effect size = 1.66, p < .059). The magnitude and significance level suggests further consideration of the possibility that negative effects on collective responsibility of uneven draws of support within the school may be offset by an overall higher level of collaborative activity for a teacher network of that size.

After adding the school-level network measures, the magnitude of the effect of free and reduced price meal eligibility decreased and the association was no longer significant. This is perhaps related to less than 10% of the variance being between schools. Although the number of school-level variables must be considered carefully in HLM with small number of level-2 units, its inclusion did not seem to affect the ability to detect the level 2 effects for the remaining variables and so FRPM was retained for the final models as a control.

Summary and Implications

Based on this analysis, schools with more centralized networks, i.e., where advice and support are unevenly distributed, have lower levels of collective responsibility but higher levels of trust. Furthermore, a teacher's participation in the instructional support network conditions their perception of the normative culture: The more colleagues a teacher provides advice to, the lower their perception of collective responsibility. The more colleagues a teacher seeks advice from, the higher their perception of collective responsibility. No relationship was found between the number of colleagues with whom a teacher has an advice tie and their perception of relational trust.

There are several interesting conclusions about the individual- and school-level predictors of normative culture in site-managed high schools from the HLM analysis. To address the first research question, while there is meaningful variation between schools on relational trust (13.2% of the variance) and collective responsibility (9.1% of the variance), the within-school variance in how teachers' perceive the overall normative culture of their schools is considerable. There is 86.7% of the variance found within-schools in relational trust and 90.9% for collective

responsibility. Although in the literature there is a compelling argument that teachers' perception of the normative culture— the expectations, benevolence, responsibility to school goals, and integrity of colleagues — operates as an organizational property, this finding complicates the image of schools having a uniform culture. Rather, internal variability in culture challenges the ability for normative culture to serve as an organizational property that contributes in a meaningfully to the organization's ability to achieve its goals. This raises questions particularly for the relationship in the literature between collective responsibility and school improvement. When would a shared sense of responsibility for student learning constitute a true social control? In examining variation in individual perceptions, I begin to explore the idea of consensus in perception as shared expectation or norm for social behavior.

The second research question asks what network characteristics — what patterns of interactions across teachers around instructional advice provision and seeking — are associated with higher levels of trust and responsibility. From the literature, I hypothesized that the more centralized the school network, the lower the school's collective responsibility. I found the extent to which instructional advice-seeking in a group is dominated by one or just a few colleagues than others was related to collective responsibility. The more unevenly distributed advice seeking was, the lower teachers' perception of the group's shared responsibility for student learning, in support of the hypothesis. In contrast, the extent to which instructional advice-provision was concentrated around one or few individuals had implications for the overall perception of trust in the school: the more the school network resembled this distribution of valued expertise around few individuals, the higher teachers' perception of the group's trust.

In the literature, trust is often described in terms of shared responsibility and an expectation for behavior, and yet the contrast in influence of centralities on the two measures of normative culture suggests they operate differently. Future questions are to explore how distinct are collective responsibility and relational trust as characteristics of the normative culture of the school? To what extent are the factors associated with each same? More attention to the differences in these constructs would build into our conception of the bases of elements of normative culture and its relational influences and could add nuance to our understanding of how they contribute to organizational outcomes.

The hypotheses for the other network characteristics were not well supported. Density, controlling for all other factors was not significantly associated with trust, offering no evidence for that hypothesis. However, there was evidence suggesting density of instructional support relationships may be related to shared responsibility for student learning, and could be explored in a larger sample since it was borderline significant. Also unexpectedly, reciprocity had no bearing on levels of trust in this sample. Taken together, network measures pertaining to the distribution of instructional support (and perhaps expertise) and the extent to which teachers engaged in instructional support relationships did not reveal as much about the levels of trust in these schools as it did about collective responsibility. Additional analysis using other network relationships, e.g., instead of instructional advice relationship, the close friend network (which may reflect affective rather than instrumental support), may reveal more information about the associations between trust and teacher relationships than the instructional advice network provided.

I hypothesized that design team members, the founding teachers of pilot and charter schools, held higher perceptions of collective responsibility than others in their schools due to their engagement with the founding and development of the schools. I did not find evidence of

this. Across both normative culture measures, leadership roles including design team were positively associated with normative culture outcomes in earlier models but not after accounting for other teacher and school characteristics. For future exploration a different definition of leadership role should be explored, for example, narrowing to only those holding department or grade level chair roles, which may have a more direct relationship to perception of normative culture. This may also be related to or reflected in the individual network measures that were significantly associated with perception of collective responsibility. For example, if as department chair a teacher has advice sought out from them by many colleagues, the impact on their perception of the shared responsibility in the school may be captured in the negative association between in-degree and collective responsibility.

Relatedly, the significant and opposite associations between collaboration activity and collective responsibility is noteworthy. First, by incorporating the direction of the flow of the social resource (advice), this analysis provides nuance to our understanding of what if any relationship there is between collaboration activity and perception of normative culture. It appears teachers who provide more of the instructional support view the responsibility in the group lower than average and those seeking advice from many colleagues view responsibility as higher. There are implications then for the distribution of help and who is taxed within the school for normative culture. Teachers from whom other colleagues seek advice frequently potentially develop an impression that they do more than their fair share of the work, and rate the overall responsibility of the group lower.

Subject-area departments differ in their group culture and expectations (McLaughlin and Talbert, 2001). The significant negative association between being an English teacher and a teacher's individual perception of the overall collective responsibility in the school prompts further investigation into the factors that influence differences in normative culture between departments. I find that the teachers that most colleagues go to for support hold perceptions of the collective that are lower, that is, they have a sense that others around them are not similarly invested. An interesting premise for further exploration is whether this dimension could also speak to burnout in small site-managed schools, where teachers increasingly work long hours to support school improvement, especially in small high schools, wearing many hats.

This chapter described findings from estimating the influence of teacher collaboration on perceptions of normative culture. There were a few main findings. First, meaningful variation exists among teachers within the same school in how they perceive normative culture. These perceptions are influenced by the distribution of social resources in the school, in that uneven distribution of advice and support was detrimental for the sense of shared responsibility for student learning but conducive to a high level of trust in the group. For individual teachers, their collaborative activity conditions the perceptions further: the teachers to whom most colleagues go for support held weaker perceptions of the group's overall shared responsibility.

Personal characteristics and position within the formal organization, which in Chapter 4, *Factors Predicting Instructional Support Relationships,* were demonstrated to drive these instructional support ties, also conditioned perceptions. Race, degrees, leadership roles, and subject assignment shaped how teachers perceive trust and collective responsibility among teachers.

In the next and final section, Chapter 6, *Conclusion*, I will reflect on the study overall. I will present interpretation across the main p2 analysis and HLM findings, implications for theory and practice, and limitations and areas for further research.

Table 4

Relational Trust Level 1 Models

Variable	Model 1 b/se	p	Model 3 b/se	p	Model 5 b/se	p	Model 7 b/se	p	Model 9 b/se	p
trust_fs										
D_female			0.047	.613	0.059	.526	0.083	.284	0.076	.323
			(0.09)		(0.09)		(0.08)		(0.08)	
D_Latino			-0.119	.272	-0.124	.255	-0.199*	.028	-0.200*	.026
			(0.11)		(0.11)		(0.09)		(0.09)	
D_Black			0.367	.059	0.362	.063	0.139	.393	0.160	.323
			(0.19)		(0.19)		(0.16)		(0.16)	
D_Asian			0.068	.635	0.072	.613	0.272*	.023	0.267*	.024
			(0.14)		(0.14)		(0.12)		(0.12)	
D_Mix_etc			0.408	.054	0.419*	.049	0.174	.328	0.130	.464
			(0.21)		(0.21)		(0.18)		(0.18)	
D_Master_doc			-0.282**	.003	-0.282**	.003	-0.261***	.001	-0.260***	.001
			(0.09)		(0.09)		(0.08)		(0.08)	
D_cert_full			0.061	.69	0.061	.689	0.228	.074	0.251*	.048
			(0.15)		(0.15)		(0.13)		(0.13)	
D_total_yrs			-0.017*	.039	-0.017*	.042	-0.011	.113	-0.011	.111
			(0.01)		(0.01)		(0.01)		(0.01)	
D_curr_yrs			-0.029	.331	-0.026	.376	-0.030	.229	-0.028	.247
			(0.03)		(0.03)		(0.02)		(0.02)	
D_Gtotal			-0.079	.07	-0.077	.078	-0.026	.476	-0.030	.404
			(0.04)		(0.04)		(0.04)		(0.04)	
D_Stotal			0.091	.431	0.077	.509	-0.073	.454	-0.080	.409
			(0.12)		(0.12)		(0.10)		(0.10)	
D_math			-0.057	.654	-0.065	.609	-0.085	.418	-0.100	.34
			(0.13)		(0.13)		(0.11)		(0.10)	
D_science			-0.028	.838	-0.010	.944	0.042	.709	0.052	.644
			(0.14)		(0.14)		(0.11)		(0.11)	
D_social			-0.283	.052	-0.261	.074	-0.108	.375	-0.113	.351
			(0.15)		(0.15)		(0.12)		(0.12)	
D_english			-0.184	.176	-0.181	.189	-0.125	.274	-0.140	.221
			(0.14)		(0.14)		(0.11)		(0.11)	
D_special2			0.054	.613	0.056	.602	0.102	.252	0.104	.237
			(0.11)		(0.11)		(0.09)		(0.09)	
D_designteam2			0.170	.213	0.170	.211	0.202	.073	0.228*	.043
			(0.14)		(0.14)		(0.11)		(0.11)	
D_instleader2			0.216	.064	0.220	.06	0.109	.264	0.085	.38

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	(1)		(2)		(3)		(4)		(5)	
			(0.12)		(0.12)		(0.10)		(0.10)	
D_LeadCount			0.111*	.03	0.117*	.026	0.087*	.045	0.082	.058
			(0.05)		(0.05)		(0.04)		(0.04)	
D_nOutdeg					0.270	.272	0.187	.358	0.199	.326
					(0.25)		(0.20)		(0.20)	
D_nIndeg					-0.328	.461	-0.100	.787	-0.021	.954
					(0.44)		(0.37)		(0.37)	
D_climate_FS							0.236**	.006	0.233**	.006
							(0.09)		(0.09)	
D_collexp_FS							0.526***	0	0.513***	0
							(0.07)		(0.07)	
c.D_collexp_FS #c.D_nOutdeg									0.607*	.024
									(0.27)	
_cons	0.381***	0	0.371***	0	0.371***	0	0.372***	0	0.369***	0
	(0.09)		(0.09)		(0.09)		(0.09)		(0.09)	
lns1_1_1										
_cons	-1.112***	0	-1.101***	0	-1.096***	0	-1.004***	0	-1.008***	0
	(0.22)		(0.22)		(0.22)		(0.19)		(0.19)	
lnsig_e										
_cons	-0.171***	0	-0.230***	0	-0.233***	0	-0.419***	0	-0.426***	0
	(0.04)		(0.04)		(0.04)		(0.04)		(0.04)	
bic	916.625		988.572		998.541		888.873		889.645	
N	350.000		350.000		350.000		350.000		350.000	

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

Table 5

Collective Responsibility Level 1 Models

Variable	Model 2 b/se	p	Model 4 b/se	p	Model 6 b/se	p	Model 8 b/se	p
resp_fs								
D_female			-0.034	.488	-0.008	.86	-0.004	.934
			(0.05)		(0.05)		(0.04)	
D_Latino			-0.101	.076	-0.111*	.043	-0.124*	.016
			(0.06)		(0.05)		(0.05)	
D_Black			0.100	.323	0.091	.353	0.023	.808
			(0.10)		(0.10)		(0.09)	
D_Asian			-0.065	.385	-0.056	.432	0.004	.951
			(0.07)		(0.07)		(0.07)	
D_Mix_etc			0.121	.274	0.145	.174	0.072	.473
			(0.11)		(0.11)		(0.10)	
D_Master_doc			-0.069	.166	-0.068	.153	-0.065	.144
			(0.05)		(0.05)		(0.04)	
D_cert_full			-0.087	.278	-0.087	.253	-0.036	.623
			(0.08)		(0.08)		(0.07)	
D_total_yrs			-0.004	.344	-0.004	.389	-0.002	.59
			(0.00)		(0.00)		(0.00)	
D_curr_yrs			-0.016	.307	-0.010	.484	-0.011	.43
			(0.02)		(0.01)		(0.01)	
D_Gtotal			-0.035	.128	-0.030	.167	-0.017	.405
			(0.02)		(0.02)		(0.02)	
D_Stotal			0.139*	.022	0.109	.063	0.077	.162
			(0.06)		(0.06)		(0.06)	
D_math			-0.088	.183	-0.105	.102	-0.115	.055
			(0.07)		(0.06)		(0.06)	
D_science			-0.132	.064	-0.094	.173	-0.086	.181
			(0.07)		(0.07)		(0.06)	
D_social			-0.169*	.027	-0.122	.096	-0.089	.198
			(0.08)		(0.07)		(0.07)	
D_english			-0.243***	.001	-0.236***	.001	-0.224***	.001
			(0.07)		(0.07)		(0.07)	
D_special2			0.030	.584	0.036	.503	0.043	.39
			(0.06)		(0.05)		(0.05)	
D_designteam2			0.102	.152	0.103	.132	0.113	.079

			(0.07)		(0.07)		(0.06)	
D_instleader2			0.124*	.043	0.132*	.025	0.096	.085
			(0.06)		(0.06)		(0.06)	
D_LeadCount			-0.006	.837	0.007	.782	0.001	.957
			(0.03)		(0.03)		(0.02)	
D_nOutdeg					0.559***	0	0.546***	0
					(0.12)		(0.12)	
D_nIndeg					-0.698**	.002	-0.615**	.003
					(0.22)		(0.21)	
D_climate_FS							-0.072	.141
							(0.05)	
D_collexp_FS							0.235***	0
							(0.04)	
_cons	0.130***	.001	0.130***	.001	0.128**	.001	0.130**	.001
	(0.04)		(0.04)		(0.04)		(0.04)	
lns1_1_1								
_cons	-1.983***	0	-1.978***	0	-1.936***	0	-1.899***	0
	(0.25)		(0.24)		(0.23)		(0.21)	
lnsig_e								
_cons	-0.830***	0	-0.874***	0	-0.919***	0	-0.982***	0
	(0.04)		(0.04)		(0.04)		(0.04)	
bic	449.439		530.984		513.794		483.941	
N	350.000		350.000		350.000		350.000	

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

Table 6

Relational Trust Level 2 Models

Variable	Model 10		Model 12	
	b/se	*p*	*b/se*	*p*
trust_fs				
D_female	0.078	.313	0.075	.329
	(0.08)		(0.08)	
D_Latino	-0.198*	.028	-0.196*	.029
	(0.09)		(0.09)	
D_Black	0.162	.318	0.160	.323
	(0.16)		(0.16)	
D_Asian	0.268*	.023	0.274*	.021
	(0.12)		(0.12)	
D_Mix_etc	0.130	.462	0.131	.459
	(0.18)		(0.18)	
D_Master_doc	-0.260***	.001	-0.259***	.001
	(0.08)		(0.08)	
D_cert_full	0.253*	.046	0.241	.058
	(0.13)		(0.13)	
D_total_yrs	-0.011	.116	-0.011	.114
	(0.01)		(0.01)	
D_curr_yrs	-0.029	.242	-0.029	.239
	(0.02)		(0.02)	
D_Gtotal	-0.032	.383	-0.030	.402
	(0.04)		(0.04)	
D_Stotal	-0.080	.405	-0.078	.418
	(0.10)		(0.10)	
D_math	-0.098	.35	-0.099	.344
	(0.10)		(0.10)	
D_science	0.051	.649	0.045	.688
	(0.11)		(0.11)	
D_social	-0.114	.348	-0.119	.328
	(0.12)		(0.12)	
D_english	-0.141	.216	-0.140	.220
	(0.11)		(0.11)	
D_special2	0.104	.237	0.107	.224
	(0.09)		(0.09)	
D_designteam2	0.229*	.042	0.228*	.043
	(0.11)		(0.11)	
D_instleader2	0.086	.375	0.085	.381
	(0.10)		(0.10)	

D_LeadCount	0.083	.055	0.083	.056
	(0.04)		(0.04)	
D_nOutdeg	0.197	.331	0.191	.345
	(0.20)		(0.20)	
D_nIndeg	-0.012	.974	-0.008	.983
	(0.37)		(0.37)	
D_climate_FS	0.232**	.006	0.226**	.008
	(0.09)		(0.09)	
D_collexp_FS	0.513***	0	0.518***	0
	(0.07)		(0.07)	
c.D_collexp_FS#c.D_nOutdeg	0.603*	.024	0.568*	.034
	(0.27)		(0.27)	
netsize	0.005	.647	0.001	.942
	(0.01)		(0.01)	
pilot	-0.170	.305	-0.118	.471
	(0.17)		(0.16)	
FRPM	0.010*	.023	0.005	.161
	(0.00)		(0.00)	
Density			-1.101	.591
			(2.05)	
InCentral			1.529*	.019
			(0.65)	
OutCentral			-0.507	.217
			(0.41)	
DyadReciprocity			0.997	.294
			(0.95)	
_cons	-0.463	.319	-0.182	.742
	(0.46)		(0.55)	
lns1_1_1				
_cons	-1.155***	0	-1.455***	0
	(0.20)		(0.24)	
lnsig_e				
_cons	-0.426***	0	-0.426***	0
	(0.04)		(0.04)	
bic	902.453		917.325	
N	350.000		350.000	

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

Table 7

Collective Responsibility Level 2 Models

Variable	Model 11		Model 13	
	b/se	p	b/se	p
resp_fs				
D_female	-0.003	.938	-0.002	.96
	(0.04)		(0.04)	
D_Latino	-0.124*	.016	-0.121*	.019
	(0.05)		(0.05)	
D_Black	0.023	.804	0.022	.812
	(0.09)		(0.09)	
D_Asian	0.005	.945	0.007	.914
	(0.07)		(0.07)	
D_Mix_etc	0.073	.471	0.068	.499
	(0.10)		(0.10)	
D_Master_doc	-0.065	.143	-0.066	.14
	(0.04)		(0.04)	
D_cert_full	-0.036	.624	-0.038	.598
	(0.07)		(0.07)	
D_total_yrs	-0.002	.6	-0.002	.622
	(0.00)		(0.00)	
D_curr_yrs	-0.011	.426	-0.012	.404
	(0.01)		(0.01)	
D_Gtotal	-0.018	.39	-0.017	.421
	(0.02)		(0.02)	
D_Stotal	0.076	.167	0.075	.173
	(0.06)		(0.06)	
D_math	-0.114	.057	-0.113	.06
	(0.06)		(0.06)	
D_science	-0.086	.181	-0.087	.176
	(0.06)		(0.06)	
D_social	-0.089	.199	-0.091	.19
	(0.07)		(0.07)	
D_english	-0.224***	.001	-0.221***	.001
	(0.07)		(0.07)	
D_special2	0.043	.397	0.044	.384
	(0.05)		(0.05)	

D_designteam2	0.113	.078	0.116	.07
	(0.06)		(0.06)	
D_instleader2	0.095	.085	0.095	.086
	(0.06)		(0.06)	
D_LeadCount	0.001	.955	0.002	.938
	(0.02)		(0.02)	
D_nOutdeg	0.545***	0	0.547***	0
	(0.12)		(0.12)	
D_nIndeg	-0.611**	.004	-0.605**	.004
	(0.21)		(0.21)	
D_climate_FS	-0.072	.142	-0.079	.104
	(0.05)		(0.05)	
D_collexp_FS	0.235***	0	0.239***	0
	(0.04)		(0.04)	
netsize	0.004	.458	0.013*	.018
	(0.01)		(0.01)	
pilot	-0.044	.578	0.048	.484
	(0.08)		(0.07)	
FRPM	0.003	.211	-0.000	.992
	(0.00)		(0.00)	
Density			1.658	.059
			(0.88)	
InCentral			0.137	.625
			(0.28)	
OutCentral			-0.648***	0
			(0.17)	
DyadReciprocity			-0.291	.466
			(0.40)	
_cons	-0.144	.516	-0.123	.599
	(0.22)		(0.23)	
lns1_1_1				
_cons	-1.960***	0	-2.567***	0
	(0.22)		(0.40)	
lnsig_e				
_cons	-0.982***	0	-0.980***	0
	(0.04)		(0.04)	
bic	499.759		511.171	
N	350.000		350.000	

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

CHAPTER VI

CONCLUSION

As argued in chapter 1, while other school improvement strategies that leverage teacher relationships such as distributed leadership and professional learning communities are carefully detailed and normatively pressed, there is weak evidence of mechanisms connecting site-level autonomy to stronger, more cohesive teacher communities. Based on the review of the literature, chapter two argued that social network analysis addresses limitations of earlier lenses for the study of teacher professional community. Subsequently, chapter 3 described the methods used in the study.

Chapter 4, *Factors Predicting Instructional Support Relationships*, presents findings from the p2 network modeling to address research question 1. Chapter 5, *The Influence of Teacher Collaboration on Perceptions of Normative Culture*, presents findings for research question 2 from the hierarchical linear modeling (HLM) estimation of collective responsibility and relational trust.

This final chapter aims to interpret the findings and provide implications for policy, practice, and theory. In the discussion that follows, I first summarize the research questions and main findings. I then describe contributions to theory and practice for building cohesive schools. Finally, I describe limitations to the study and areas of further research.

Summary

A sense of chemistry between organization members is a notable and at times palpable feature of high-performing urban schools. In schools with this cohesive culture, teachers expect that others similarly contribute to the school's goals. An important interest is what settings foster a tight group of teachers who share responsibility for student learning, who do not close their classroom door and work independently.

Many policymakers think small schools hold the answer to achieving a strong, cohesive culture. Reformers and districts go further, and promote charter schools and other site-managed schools, where principals have the autonomy, both to hire teachers who will support the coordinated effort, and to shape the school day and job roles in creative ways to support teacher collaboration to improve their instruction. These schools hold a lot of promise as sites of cohesive school community. But as we know, not all schools that have site-based autonomy get there. So we ask what accounts for variability in the social cohesion of small site-managed schools?

First, the study examined what accounts for the choice of colleagues for instructional support in site-managed high schools. To what extent are these relationships influenced by a teacher's formal positions or roles within the organization? To what extent are these relationships driven by personal characteristics of the teachers? I found that teachers did not uniformly seek advice from a teacher with the profile one might expect: more experienced, those in leadership roles, and with more years at the school.

Instead, the colleagues from whom teachers sought advice were dependent on the attributes of that teacher relative to their own attributes. The pursuit of advice depended on the fit between individuals that form the association. Teachers were more likely to receive support to improve their instruction from colleagues who taught the same subject, had been at the school for longer than they had, or were of the same race or same gender. Notably, teachers were less likely to seek advice from the more experienced teachers in the school.

Second, I examined the relationship between teachers' instructional support and advice relationships and their perceptions of the school's normative culture. What shares of variance in trust and collective responsibility among teachers is attributable to within or between schools? What characteristics of teachers' networks are associated with higher mean levels of trust and collective responsibility at the school level? What is the relationship between a teacher's position in their school's network and his or her perception of the normative culture at the school?

I found that schools with more centralized networks, i.e., where advice and support were unevenly distributed, had lower mean levels of collective responsibility. In contrast, the more centralized valued instructional expertise was around a few individuals, the higher teachers' perceptions were of the group's trust. Furthermore, a teacher's participation in the instructional support network conditioned their perception of the normative culture: teachers who provide more of the instructional support viewed the responsibility in the group lower than average and those seeking advice from many colleagues view responsibility as higher.

Contributions to Theory and Practice – Building Cohesive Schools

Teachers' choice of colleagues to whom they turn for support to improve their teaching practice reflects leaders' efforts to shape collaboration but also teachers' preferences based on personal characteristics. The distribution of these social resources across teachers in the school influences perceptions of normative culture. These findings offer a new contribution to the empirical literature on teacher professional community and have implications for theory, policy and practice.

Contributions to the Literature and Theory

This study contributes new information regarding teacher professional community and collaboration inside small site-managed high schools. We know little empirically about teacher roles and collaboration in site-managed schools (Fuller, Dauter, & Waite, in press). The findings describe organizational and personal factors that contribute to the formation of relationships between teachers focused on improving one's teaching practice in a sample of 20 site-managed high schools. It reveals how these relationships contribute to teachers' perceptions of normative culture.

This study contributes to our understanding of two types of "linkages" that may operate in site-run, small schools: (a) how features under considerable flexibility in site-managed schools — teacher personal characteristics and formal positions and roles within the organization — contribute to teacher collaboration; and (b) how these features and the collaboration among teachers contribute to positive normative culture, a valued organizational resource. This work is important at a time when districts are increasingly opting for greater site-level autonomy as a reform strategy to improve schools. Although popular support for the portfolio approach is substantial, guiding research on its implementation is limited (Huerta & Zuckerman, 2009; Marsh et al., 2013). Attending to these linkages is an early step to the understanding when and under what conditions autonomy may deliver its intended benefits.

The most comprehensive evidence of the effects of decentralized reforms comes from the experiment with democratic localism in Chicago in the early 90s. Bryk and colleagues (2010) demonstrate that under decentralization, schools that leverage certain organizational features were more successful at improving student learning. While their findings are a significant advance in our understanding of what organizational elements distinguish improving schools

from those that fail to do so, this work extends this to explain how variable network structures may host and sustain one such support, and how an individual teachers' position in a school network may drive his or her perception of the normative culture. By mapping the variation in distribution of social resources across teacher networks, this study draws upon longstanding theories of social capital (Coleman, 1990) to attend to internal variability in organizational culture that is commonly ignored.

The study revealed that meaningful variation exists among teachers within the same school in how they perceive normative culture. Nearly 90% of the variance in normative culture occurred among teachers within schools. These perceptions were influenced by the distribution of social resources in the school. Uneven distribution of advice and support was detrimental for the sense of shared responsibility for student learning but conducive to a high level of trust in the group.

For individual teachers, their collaborative activity conditioned the perceptions further: those teachers most often approached for support by colleagues held weaker perceptions of the group's overall shared responsibility, whereas teachers seeking advice from many colleagues held higher perceptions. Personal characteristics and position within the formal organization, which drive these instructional support ties, also conditioned perceptions. Race, degrees held, leadership roles, and subject assignment shaped how teachers perceived trust and collective responsibility among teachers in their school.

The study also contributes to the growing body of social network studies in education that have examined teacher collaboration in other districts, countries, or at the elementary level. This network analysis represents a view of teacher community at an analytical scale between that of previous case studies of professional communities in a smaller number of schools and of the more general trends in teacher practices reported from large data sets (e.g., Schools and Staffing Survey).

This approach also advances the study of teacher collaboration to incorporate the "dyad" as a focus, honing in on an essential building block of cohesive social organizations. It is here where the p2 modeling technique in particular provides an advantage over other network approaches commonly used in education research. It provides more nuance than inferences about the universal tendencies of all teachers with some characteristic. Rather than focusing on individual attributes, this approach demonstrates how characteristics of each pair of teachers based on similarity or difference in positions in the organization (including leadership roles held and teaching assignments), as well as similarity or difference in their personal characteristics (such as years at the school and gender) contribute to the likelihood of a relationship.

Implications for Policy and Practice

As districts adopt portfolio models and create smaller high schools with additional site-based control, it is important for several reasons that policy makers consider how and why teachers seek out specific colleagues to support their practice. Consistent with the subject-specialist professional identity of secondary educators, teachers in this study are more likely to seek out advice to improve their teaching practice from colleagues who teach the same subject. This finding is then a problematic pattern for smaller high schools where few – if any – other teachers share the same subject. And as discussed in Chapter 4, despite efforts to organize teachers by grade-level, this feature of the school organization had no bearing on who teachers turn to for support to improve their practice. In the small high school setting where teachers have

a limited number of same-subject colleagues to turn to for social support to improve their practice this pattern may hamper school improvement efforts.

The findings on patterns of instructional support hold implications for school leaders in autonomous settings and charter management organizations as they formally organize teachers to support instructional improvement and for those with control over hiring. Unique to this setting, charter, pilot and other autonomous schools more directly control hiring practices than their traditional counterparts. School leaders of site-managed schools have influence over the composition of teachers in their school. Teachers were less likely to seek advice from the more experienced teachers in the school, which suggests veteran teachers in charter and pilot schools were not viewed as sources of knowledge about teaching practice. The probability of an instructional support tie increased when teachers were of the same race. The personal characteristics of the teachers that principals hire have a direct bearing then on the patterns of instructional support in these schools.

Limitations and Areas for Future Research

An outstanding question is to what extent do these patterns reflect teachers in all types of high schools, not just site-managed ones? The study as designed is not intended to make a comparison between site-managed pilot and charter schools and traditional public school counterparts. The study accounts for observed variability in normative culture and its antecedents between teachers and across schools. One limitation of the study is that the associations cannot be attributed to the structural design of the schools. To truly know whether small, site-managed schools do in fact deliver the organizational benefits policymakers assume, studies comparing the normative culture and factors that contribute to collaborative relationships in traditional and site-managed schools would be necessary.

It is also unclear to what extent the findings hold across other grade levels. Many features of school organization are different at the elementary and secondary levels (McLaughlin and Talbot, 2001). This study follows the convention of focusing the study of school organization to a particular grade level. In doing so, the inferences do not extend to elementary settings. Prior network studies of this type examine teacher advice relationships at the elementary level (e.g., Spillane et al., 2012). This study provides a complementary high school examination.

While inferences about the study represent patterns of teacher instructional support relationships in charter high schools in one large urban district, the purposive sampling of the pilot schools in the study limits the generalizability of the results. The sample schools represent a stratified random sample of all charter high schools authorized by LAUSD and a sample of 10 of the 14 pilot schools that served grades 9-12 in the district, chosen to increase geographic variability (in both cases of those schools open for at least a year in 2011-12). Similar research on other site-managed schools including newer generations of LAUSD pilot schools and in those in other urban districts is necessary to confidently extend inferences beyond this setting.

The study design struck a balance to look at between-school and between-teacher variation and antecedent drivers. This resulted in a trade-off between understand individual-level variation within schools and sampling more schools to learn about school-level drivers of teacher collaboration and normative culture. The latter would be of greater direct value to policymakers and school reformers. Future work would include a larger sample of schools.

Finally, causality and directionality in the case of network effects is an issue of debate given the reciprocal relationship between social interactions and perceptions. The inferences from this study cannot be interpreted causally. I and other scholars argue that social interactions are an "inevitable precondition" for the formation of teacher community; teacher interactions precede development of perceptions of trust and norms among colleagues (Moolenaar et al., 2010; see also Borgatti & Foster, 2003 for further discussion of causal direction in network research). Under this orientation, perceptions of normative culture function as the "outcome" predicted by social interactions. For example, teachers frequently approached by colleagues for advice may develop an impression that they do more than their fair share of the work and rate the overall responsibility of the group lower. A different interpretation is plausible. Instead, it may be a belief that teachers at one's school are jointly are responsible that prompts a teacher to reach out to more colleagues. Other research strategies such as longitudinal network analysis are necessary for a definitive inference about whether collaboration activity reflects or informs a teacher's perception of the culture.

This study extends our understanding of how schools respond when policymakers remove key features of regulatory systems to encourage innovative forms of organization. As districts increasingly rely on portfolio models and other decentralizing reforms, identifying the benefits of the emerging organizational structures become more pressing. In particular, the study contributes to our overall understanding of which social structures promote a normative culture of shared responsibility for student learning and trust among colleagues – the foundations of strong teacher professional community.

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APPENDICES

Table A1

Student and Teacher Characteristics in 10 Charter and 10 Pilot High Schools in 2011-2012

Student and Teacher Characteristics in 10 Charter and 10 Pilot High Schools in 2011-2012												
	Pilot				Charter				Combined			
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
Student Demographics												
Enrollment	578	258	362	1,030	447	346	99	1,152	509	306	99	1,152
White	3%	2%	1%	8%	4%	10%	0%	30%	4%	7%	0%	30%
African American	4%	6%	0%	19%	23%	37%	0%	95%	14%	28%	0%	95%
Latino	82%	12%	55%	96%	49%	38%	2%	97%	64%	33%	2%	97%
Teacher Demographics												
# of Teachers	21	4	14	30	19	10	9	43	20	8	9	43
Female	54%	10%	42%	71%	60%	12%	44%	79%	57%	11%	42%	79%
White	38%	13%	17%	58%	51%	11%	36%	69%	45%	14%	17%	69%
African American	4%	4%	0%	11%	9%	10%	0%	29%	7%	8%	0%	29%
Latino	39%	9%	16%	53%	23%	10%	7%	36%	31%	12%	7%	53%
Years at school	3	1	2	4	3	1	1	5	3	1	1	5
Years of teaching experience	10	2	7	14	6	3	2	12	8	3	2	14
Special education teacher	5%	4%	0%	11%	4%	5%	0%	15%	4%	5%	0%	15%
Holds leadership role	52%	12%	36%	76%	49%	15%	31%	78%	51%	14%	31%	78%

Description of Variables for HLM Analysis

DV

1)trust_fs: factor score for scale items on teachers' individual perceptions of collective trust in colleagues

2) resp_fs: factor score for scale items on teachers' individual perceptions of collective responsibility among colleagues

Level 1 - Teacher-level Covariates

*D_ reflects variables are group-mean centered

Teacher background variables

D_female: Female dummy

D_Latino: Latino dummy

D_Black: Black dummy

D_Asian: Asian dummy

D_Mix_etc: Mixed/other dummy

D_Master_doc: Holds a Master's or Doctorate dummy (base = Bachelor's)

D_cert_full: full certification dummy (base = no or alternative certification)

D_total_yrs: Total years teaching experience

D_curr_yrs: Years at current school

D_Gtotal: Number of grade-levels taught

D_Stotal: Number of subjects taught

D_math: Math teacher dummy

D_science: Science teacher dummy

D_social: Social studies teacher dummy

D_english: English teacher dummy

D_special2: Special education teacher dummy

Leadership roles

D_designteam2: Design team: was teacher part of the original design team for the school

D_instrleader2: Instructional leader: was teacher part of the Instructional Leadership Team (ILT)

D_LeadCount: Count of leadership roles help

Teacher-level network measures

D_nOutdeg: normalized out degree: the number of others the teachers goes to for advice (divided by N of teachers in school)

D_nIndeg: normalized in degree: the number of others who reported going to the teacher for advice (divided by N of teachers in school)

Collaboration indexes

D_collexp_FS: Rating of collaboration experience — factor score for 2 items on individual teacher's experience of collaboration [s. agree/s. disagree scale]:

1) My colleagues and I share information effectively at this school.

2) I work with other teachers to improve my instruction.

D_climate_FS: Expectation for collaboration — factor score for 3 items on teacher's perception of the expectation of collaboration at the school [s. agree/s. disagree scale]

1) Teachers are expected to work together to identify students that need extra help.

2) Teachers are expected to share teaching strategies that have been successful in their classrooms with each other.

3) Teachers are expected to work together to develop their lesson plans.

Level 2 - School-level Covariates

School background variables

netsize: the number of teachers in the school (i.e., size of social network)

pilot: dummy for pilot school (base: charter school)

FRPM: proportion of students who are eligible for free and reduced meals

School-level network measures

Density: ratio of existing ties to total possible ties for network of size n

InCentral: In-degree centralization is a measure of the extent to which the network resembles a perfectly centralized network of incoming ties i.e., a star with all teachers seeking advice from one central node.

OutCentral: Out-degree centralization is a measure of the extent to which the network resembles a perfectly centralized network of outgoing ties i.e., a star with one central node seeking advice from all other teachers.

Closure: reflects the triadic clusters that exist out of the possible triads for network of size n

DyadReciprocity: The ratio of the number of pairs with a reciprocated tie relative to the number of pairs with any tie

Table B1

Descriptive Statistics for HLM Variables

Variable	Mean	Std. Dev.	Min	Max
trust_fs	0.39	0.90	-3.01	1.46
resp_fs	0.14	0.46	-1.72	0.81
D_female	0.01	0.48	-0.79	0.58
D_Latino	-0.01	0.45	-0.53	0.93
D_Black	0.00	0.23	-0.29	0.96
D_Asian	0.00	0.33	-0.33	0.94
D_Mix_etc	0.00	0.21	-0.14	0.96
D_Master_doc	-0.01	0.47	-0.86	0.63
D_cert_full	0.02	0.30	-0.98	0.32
D_total_yrs	-0.15	5.58	-11.07	22.40
D_curr_yrs	0.00	1.73	-3.56	11.71
D_Gtotal	-0.07	1.20	-2.88	3.19
D_Stotal	0.01	0.59	-1.67	3.73
D_math	0.00	0.43	-0.35	0.88
D_science	0.01	0.39	-0.31	0.92
D_social	0.01	0.40	-0.67	0.93
D_english	0.00	0.45	-0.78	0.86
D_special2	-0.01	0.42	-0.48	0.93
D_designteam	-0.01	0.36	-0.50	0.98
D_instleader	0.01	0.42	-0.57	0.96
D_LeadCount	0.00	1.04	-1.38	5.95
D_nOutdeg	0.00	0.18	-0.30	0.80
D_nIndeg	0.00	0.11	-0.35	0.43
D_climate_FS	0.00	0.54	-2.19	0.99
D_collexp_FS	0.00	0.69	-2.40	1.24
netsize	24.20	8.96	9.00	46.00
pilot	0.49	0.50	0.00	1.00
Black_prop	0.06	0.07	0.00	0.29
Density	0.18	0.06	0.10	0.35
InCentral	0.25	0.11	0.07	0.61
OutCentral	0.52	0.18	0.19	0.83
DyadReciprocity	0.24	0.09	0.11	0.42

APPENDIX C

Further Detail on Measure Construction

Measures constructed from teacher survey items were operationalized as follows:

Personal Characteristics of Teachers

-Race, Ethnicity and Gender-

Female dummy

Male/female pair indicator: This dyadic indicator takes a value of 1 if the two teachers were different genders, 0 if they were the same gender.

Latino dummy

Black dummy

Asian dummy

Mixed/other race dummy

Same race: Teachers were asked to indicate their race by selecting one or more of the following: American Indian/Alaskan, Asian/Pacific Islander, Black/African American, Latino/Hispanic, White/non-Hispanic, decline to answer, and other. This dyadic indicator takes a value of 1 if the two teachers indicated the same race category, and a value of 0 otherwise.[9]

-Credentials/Prior Experience-

Years at School: Teachers indicated how many years they taught at their school, including the current school year as one full year.

Years teaching experience: Teachers indicated how many years of teaching experience they had, including the current school year as one full year.

Difference in years of at school: This value represents the difference in years at school between the two teachers, such that if teacher i has been at the school for 1 year and teacher j has for 3 years, then the value for the dyad is -2.[10]

Difference in years of teaching experience: This value represents the difference in years of teaching experience between the two teachers, such that if teacher i has 2 years of experience and teacher j has 5 years, then the value is -3.

Holds a Master's or Doctorate dummy (base = Bachelor's)

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[9] The same race dyadic indicator takes a value of 1 if the two teachers indicated the same single race category, 0 for pairs with one or both teachers selecting other, decline to answer, or multiple race categories. Not counting multiracial teachers as a same race match with teachers with overlapping single or multiple race selections likely results in a conservative estimate for the effect of having the same race, as these teacher pairs do not contribute to the same race effect. Nineteen of the 392 sample teachers selected more than one race category (in seven different combinations).

[10] Directed differences rather than absolute differences are used to determine the effect of the difference in years teaching at the school between the advice-seeking teacher i and the teacher targeted to provide advice, j. The directed difference allows us to see whether teachers are more likely to seek advice from someone with more or fewer years at the school relative to their own time at the school.

Full certification dummy (base = no or alternative certification)

Teachers' Positions in the Formal Organization

- Teaching Assignment-

Math teacher dummy

Science teacher dummy

Social studies teacher dummy

English teacher dummy

Number of subjects taught

Count of subjects taught in common: This dyadic measure is the count of the subject areas that the two teachers both teach in common. Teachers were asked to indicate what they were assigned to teach in any of the following subject areas: math, science, social studies, English/language arts, elementary, and other. Other was coded as PE, language (Spanish), or art when applicable.

Number of grade-levels taught[11]

Count of grade-levels taught in common: This dyadic measure is the count of the number of grade levels that the two teachers teach in common. This measures takes a value of 0 if no grades taught in common (for example, if teacher A teaches ninth grade and teacher B teaches tenth and eleventh grade) and a value for each grade that both teach (for example, if teacher C teaches ninth and tenth and teacher D teaches ninth, tenth, and eleventh, then the value is 2).

Special education teacher: Teachers who indicated they taught in their school's special education program were coded as 1 for this variable.

Special education/general education pair: This dyadic indicator takes a value of 0 if the two teachers both have a value of 1 for special education teacher *or* both have a value of 0 for special education teacher (i.e., are both general education teachers) and a value of 1 otherwise (when one teacher is a special education teacher and the other teacher does not teach in the special education program).

- Leadership roles-

Holds any leadership role: Teachers were asked to indicate whether they held any of the following leadership roles on the survey: instructional coach, program coordinator, mentor teacher, committee chair, department or grade level chair, guidance counselor, administrative (e.g., principal, assistant principal, dean), or other leadership role. A yes to any role was recoded as 1 for this variable else 0.

Count of leadership roles:

Leader/non-leader pair: This dyadic indicator takes a value of 0 if the two teachers both have a value of 1 for holds any leadership role *or* both have a value of 0 for holds leadership role, and a value of 1 otherwise (when one teacher holds a leadership role and the other does not).

---

[11] Grade level dummies were included in preliminary models but we not significant and also there was potential collinearity/variation structure was the same as many teachers teach many of the grades.

Design team: was teacher part of the original design team for the school

Instructional Leader: was teacher part of the Instructional Leadership Team (ILT)

Network Measures

- Teacher network measures of Collaboration Activity-

Normalized out degree: the number of others the teachers goes to for advice (divided by N of teachers in school)

Normalized in degree: the number of others who reported going to the teacher for advice (divided by N of teachers in school)

- School-level network measures-

Density: ratio of existing ties to total possible ties for network of size n. Density is calculated as the proportion of the existing relationships to the maximum number of relationships possible in the network

InCentral: In-degree centralization is a measure of the extent to which the network resembles a perfectly centralized network of incoming ties i.e., a star with all teachers seeking advice from one central node.

OutCentral: Out-degree centralization is a measure of the extent to which the network resembles a perfectly centralized network of outgoing ties i.e., a star with one central node seeking advice from all other teachers.

Closure: reflects the triadic clusters that exist out of the possible triads for network of size n

Dyad Reciprocity: ratio of the number of pairs with a reciprocated tie relative to the number of pairs with any tie.

Collaboration indexes

Rating of Collaboration Experience: factor score for 2 items on indiv. teacher's experience of collaboration [s. agree/s. disagree scale]:

1) My colleagues and I share information effectively at this school.

2) I work with other teachers to improve my instruction.

Expectations for collaboration: factor score for 3 items on teacher's perception of the expectation of collaboration at the school [s. agree/s. disagree scale]

1) Teachers are expected to work together to identify students that need extra help.

2) Teachers are expected to share teaching strategies that have been successful in their classrooms with each other.

3) Teachers are expected to work together to develop their lesson plans.

Measures of the Normative Culture

Trust: factor score for scale items on teachers' individual perceptions of collective trust in colleagues

1) Teachers in this school typically support each other.

2) Even in difficult situations, teachers in this school can depend on each other.

3) Teachers in this school trust each other.

4) Teachers in this school are open with each other.

5) Teachers in this school have faith in the integrity of their colleagues.

6) When teachers in this school tell you something you can believe it.

7) Teachers in this school do their jobs well.

Collective responsibility: factor score for scale items on teachers' individual perceptions of collective responsibility among colleagues

How many teachers in this school:

1) Feel responsible when students fail?

2) Feel responsible to help each other do their best.

3) Help maintain discipline in the entire school, not just their classroom.

4) Take responsibility for improving the school.

5) Feel responsible for helping students develop self control.

6) Set high standards for themselves.

7) Feel responsible for ensuring that all students learn.

School Characteristics

Network size: the number of teachers in the school (i.e., size of social network)

Pilot: dummy for pilot school (base: charter school)

FRPM: proportion of students who are eligible for free and reduced meals

Results from Exploratory Factor Analysis for Collaboration Experience Indices

Two collaboration experience indices were created by exploratory factor analysis of the following survey items:

Rating of the collaboration experience
1. My colleagues and I share information effectively at this school.
2. I work with other teachers to improve my instruction.

Perceived expectation of collaboration
1. Teachers are expected to work together to identify students that need extra help.
2. Teachers are expected to share teaching strategies that have been successful in their classrooms with each other.
3. Teachers are expected to work together to develop their lesson plans.

The analysis was an EFA conducted in MPlus using an ML estimator with geomin rotation:

```
ChiSqM_Value TLI    AIC BIC                 RMSEA_Estimate
    201.039      0.81      7333.859  7404.128 0.221
    1.054        1.00      7141.874  7230.882 0.008
```

The discrepancy measures compare the observed with our theoretically proposed Σ.
- TLI: adequate fit [0.90, 1.00] (Bentler, 1990; Hu & Bentler, 1999)
- RMSEA: close fit [0.00, 0.05], reasonable fit [0.05, 0.08] (Browne & Cudeck, 1992)
- The TLI, RMSEA, and the AIC all have explicit penalties for model complexity.

Goodness-of-fit strongly suggests two factor model. Choosing two factor model can be validated.

```
GEOMIN ROTATED LOADINGS
1 2

_____ _____
CLIMATE1 0.815 0.028
CLIMATE2 0.971 -0.102
CLIMATE3 0.685 0.064
COLLEXP1 0.036 0.815
COLLEXP2 -0.009 0.838

Est./S.E. GEOMIN ROTATED LOADINGS
1 2

_____ _____
CLIMATE1 11.483 0.353
CLIMATE2 19.656 -1.685
CLIMATE3 8.895 0.706
COLLEXP1 0.157 3.410
COLLEXP2 -1.066 13.688
```