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Abstract

Previous qualitative studies show that when the formal organization of a school and patterns of informal interaction are aligned, faculty and leaders in a school are better able to coordinate instructional change. This article combines social network analysis with interview data to analyze how well the formal and informal aspects of a school's social context are aligned. The focus is on two elementary schools engaged in initiatives aimed to use data to inform instructional decision making. The multimethod case study integrated findings from questionnaire and interview data. Data were collected over two years from case study schools. By fitting multilevel social selection models to longitudinal social network data collected from surveys, the authors estimated the relative influence of formal and informal processes on patterns of advice giving in each school. They used interview data to

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contextualize and corroborate findings. The social selection models they fit revealed distinct patterns in each school that helped explain why one school had been successful in developing a shared vision for change and a second school had been unsuccessful. The authors' research shows that efforts to promote formal collaboration can and do vary in their success in ways that are evident from social network analyses. These case studies imply directions for future analyses of the social context of teaching and schools.

Keywords

social selection model, institutional analysis, network analysis, instructional change, school reform

In this article we examine the alignment of formal mechanisms designed to promote teacher collaboration with the informal social structure in two schools engaged in significant reform efforts to improve instruction. Both schools sought to deploy formal and informal interactions to accomplish their aims. They differed in how formal aspects of the organization (e.g., grade-level teams, formal leaders, and cross-grade vertical teams) influenced actual patterns of giving advice about instructional matters. They also differed in ways in which more informal influences, such as collegial bonds among faculty members and norms of trust and collective responsibility, emerged over time. In addition to describing the relative influence of these factors in shaping teachers' advice networks, we consider how these schools' different types and levels of alignment of formal organization and informal social structure shaped the course of reforms. As other researchers who have explored the interplay of the formal organization of schools and informal processes of collaboration have done, we included in our analyses the qualitative descriptions of how teachers construct their school contexts (e.g., Westheimer, 1998).

Our research builds on past research findings that the formal and informal aspects of schools as organizations play important complementary roles in school improvement. For example, McLaughlin (1993) has argued that schools are at once "a formal organization" and a "social and psychological setting in which teachers construct a sense of practice, of professional efficacy, and of professional community" (p. 99). In a similar vein, Kruse, Louis, and Bryk (1995) argue that to create a professional community, both structural conditions and social and human resources are essential. When structural conditions enable teachers to connect to those resources, teachers are better able to address local problems of practice (Bidwell and Yasumoto, 1997), take risks intended to improve practice (Bryk and Schneider, 2002), and develop a shared commitment to organizational goals (Kruse, 2001).

Institutional and network theories of organizational change propose different ways to analyze the alignment of the formal social organization of schools and the informal social structure. Institutional theories focus researchers' attention on technical uncertainties in work and competing pressures on individuals and organizations that lead organizations to create a gap between the formal organization and the conduct of actual work. Researchers have used such theories to develop compelling accounts of why deep and lasting instructional change in American schools is difficult to achieve. But such accounts often fail to consider how local actors, through their interactions with others, frame institutional pressures and provide help to one another to support instructional change.

This article draws on alternative, network theories of organizations that suggest the need for greater attention on how access to resources and expertise is structured within a collegial advice network. Social network analyses allow researchers to study and model the relationship between the formal and informal aspects of schools in a way that attends to how organizations differ with respect to how interactions about instruction take place in ways that contribute to and detract from efforts to promote instructional change. One type of social network analysis in particular, social selection modeling (Frank and Fahrbach, 1999; Leenders, 1997; Robins, Elliott, and Pattison, 2001) allows researchers to estimate how important formal collaborative processes and organizational structures are relative to informal processes and attributes of individual teachers in shaping the pattern of interaction on instructional matters. In this research, we used longitudinal social network data collected from successive waves of questionnaires to develop and fit models of social selection in two schools, and we examined how patterns of interaction among faculty in each school changed as a function of formal and informal processes in each school. By comparing the model results with qualitative data from each school, we developed narratives that indicate the effect of formal mechanisms to promote collaboration can vary from school to school.

The Formal and Informal in Theories of Organizational Change

Recent theoretical and methodological advances in organizational studies point to the importance of examining change as a function of pathways or networks in which members of an organization exchange resources and expertise. Theoretical advances draw upon and extend institutional theories of organizational change by examining microfoundations of institutions grounded in social interactions (Powell and Colyvas, 2007). Methodological advances include the use of social network analysis to investigate how

individuals' ties to one another and characteristics of the organizational network to which individuals belong affect their attitudes, beliefs, and actions.

We begin by comparing and contrasting institutional and network theories of organizational change and describing how each has been applied to the study of instructional change in schools. This review establishes the relationship between the formal and informal aspects of organizational functioning and how those relationships impact significant change to individuals' attitudes, beliefs, and actions. Our core hypothesis is that alignment of the formal and informal aspects of schools as organizations is essential for developing a common vision for reform that can help bring about coordinated instructional change.

Institutional Theories

Institutional theories have played an important role in studies of organizational change since the late 1970s. A central motivation for these theories has been to develop accounts of how organizations respond to outside pressures to change (Nee, 1998). Neoinstitutionalist theory posits that "institutionalized rules" provide vocabularies for goals, procedures, and policies and ready-made interpretations of actions and events to organizations and individuals (Immergut, 1998; Meyer and Rowan, 1977). These rules define a field of possible action for organizations; they also define a set of organizational forms that are seen as "rational" or "reasonable" for organizations to adopt, which affect the survival of the organization in an institutional sector (DiMaggio and Powell, 1991; Ingram and Clay, 2000). Institutional theorists posit that these rules are not always explicit; rather such rules are part of the socially constructed reality of which members of an institutional sector are participants (Meyer and Rowan, 1977).

In many sectors, including education, the effectiveness of particular activities or practices cannot be assumed ahead of time; what constitutes "best practice" may not be known or the achievement of goals may not be measured easily. To achieve legitimacy in such an institutional environment, organizations often build gaps between their formal structures and actual work activities, leading to a "loose coupling" of the formal and informal organization (Meyer and Rowan, 1977; Weick, 1976). These constructed gaps also serve the function of helping actors manage the heterogeneity of purposes manifest in most institutional rules (Meyer and Rowan, 1977). Forms of loose coupling observed in the 1970s in the school settings that were the inspiration for the development of the idea include minimal observation or monitoring of the performance of work, making goals ambiguous

and hard to measure, and turning inspection and evaluation activities into “ceremonial” types of activities (Meyer and Rowan, 1977; Meyer, Scott, and Deal, 1981; Weick, 1976). Although these forms are less common in the context of today’s accountability systems with their rewards and sanctions for performance on standardized tests, most systems hold schools, not teachers, accountable for results, and the systems still leave individual decisions about instructional strategies for teachers to make, leaving individual teachers to coordinate activities and work out technical interdependencies of work informally (O’Day, 2002).

Network Theories

Analyses of organizations based on network theories develop accounts of the constraints and possibilities of organizational change that arise from local interactions. These theories pay particularly close attention to the importance of individuals’ developing, transferring, and transforming knowledge to solve and frame problems in their work (von Krogh, Ichijo, and Nonaka, 2000). In most professions and for most organizations, knowledge transfer is difficult, since most valuable knowledge is tacit, and actors often have trouble making such knowledge explicit in ways that are useful to others (Flyvbjerg, 2001). So called informal “advice networks” become important resources for individual and team problem solving and innovation because they can help individuals reframe problems, provide solutions to problems, and validate and legitimate interpretations of problems (Cross, Borgatti, and Parker, 2001). Typically, these networks map only imperfectly onto the formal organization; getting advice from trusted others with whom individuals already share sentiments or behavior is common (Friedman and Polodny, 1992). At the same time, network theorists often propose ways to redesign the formal organization to better support knowledge transfer through advice networks, such as providing time and resources for “go to” people in the organization to help others as part of a sanctioned, official role in the organization (Cross, Parker, and Borgatti, 2002).

Coburn and Russell (2008) recently applied social network analysis to explore how two different districts used coaches to support individual teachers in making changes to their practice. The intended roles of an instructional coach can include serving as a point person to whom teachers can turn for advice or instructional resources (Camburn, Rowan, and Taylor, 2003) and helping teachers connect with peers who might benefit from joint work (King, 2002). In practice, coaches do not always enact their roles as intended, as Coburn and Russell discovered in their research. Even though coaches in

their study had been assigned to help teachers, teachers did not always nominate coaches as influential members of their advice networks. Teachers did report some interactions with coaches were helpful in producing significant changes to teachers' practices, but only when the interactions were characterized by greater depth and focus on instruction. The Coburn and Russell study illustrates one way that, by attending to dyadic effects of interactions, researchers can study the alignment of the formal and informal aspects of schools as organizations.

Network analysts studying other contexts, however, point out that network characteristics can affect organizational change beyond dyadic effects. Network characteristics refer to parts of networks (e.g., cliques or subgroups) or to properties of the network as a whole (Scott, 2000). Characteristics examined in past network studies include such features as cohesion (Burt, 1987), range of expertise accessible to members of the network (Reagans and McEvily, 2003), and density of ties (Maroulis and Gomez, 2008). The relevance of a particular characteristic depends on the context and the theoretical framework that motivates the network analyst: it is relatively easy to calculate a given parameter for a network using sophisticated analysis tools, but the relevance of the parameter necessarily depends on specification of how it is relevant to the problem at hand (Maroulis and Gomez, 2008).

With respect to organizational change and innovation, recent research incorporating network analysis suggest that three characteristics—group cohesion, the range of expertise available to groups within their broader advice networks, and the alignment of formal and informal social structures—are significant predictors of success in teams' development of innovative solutions to complex problems of practice. For example, when organizational scholars studied teams in research and development firms, they found that the cohesion of a work team's network, as well as the range of expertise upon which the team can draw, was related to the team's success in innovation (Reagans and McEvily, 2003). Reagans and McEvily argue that cohesion within teams, that is, the degree to which members share strong ties, is important because it increases trust and increases the chances that someone with expertise relevant to solving a problem will help another. They argue that network range is important, since the team's cohesion can work against the discovery of new solutions to emerging problems; teams who are able to access expertise from outside (even within their organizations) through their ties to others were, in their study, more successful.

In our own research on schools, we have found that dynamics within and across subgroups of teachers (network cliques) in a school can affect how effectively the school as a whole enacts reforms. In a comparative study of two schools engaged in literacy-focused whole-school reform designs that

emphasized teacher collaboration as a strategy for instructional improvement (Penuel, Riel, Krause, and Frank, 2009), we focused on differences in the network characteristics of the two schools as possible explanations for why one school's reform efforts had succeeded and the other had failed. In both schools, there was a strong overlap between the informal social structure of the school and patterns of advice sharing. But in the successful school, we found a cohesive advice network with subgroups aligned to the formal organization of the school into grade-level teams, strong buffering of the school by the principal from district pressures to adopt competing reforms, and a coach who played a central role within the advice network. In the school that had not succeeded in enacting significant reforms, we found a fractured social network where subgroups were defined by what network analysts sometimes call "homophily," or the tendency of individuals who share beliefs, attitudes, or identities to develop ties with one another (McPherson, Smith-Lovin, and Cook, 2001). The teachers in this school faced heterogeneous pressures from district and principal reform efforts, and had a literacy coach who was on the periphery of their advice network.

Taken together, these two study findings suggested to us the potential of using network analyses to explore how analyzing social interactions can help explain why some reforms take hold in schools and others do not. In particular, the two studies suggest that the internal structure of the organization, including the cohesion of subgroups and relationships among subgroups, are potentially important to analyze, since these are the source of interactions that can spur innovation. In addition, access to valued expertise within the network is important, since these are the sources of new ideas that must be present within interactions to bring about instructional change. Third, considering the relative value of designed or planned for interactions to spur change in the social structure of the organization strikes us as particularly important to analyze, since these provide clues as to how well aligned the formal and informal organization are to achieve a shared vision for schools, which is a critical function of leadership for instructional change (Fullan, 1993, 2002).

Modeling Social Selection in School Advice Networks

One way that network analysts have analyzed the relationship of formal and informal aspects of organizations has been the study of processes involved in "social selection." We use social selection to refer to the process individuals use to decide with whom they will interact (Frank and Fahrback, 1999; Leenders, 1997; Robins, Elliott, and Pattison, 2001). Even when leaders in an organization assign individuals into work teams or otherwise compel groups to interact, the gap that always exists between the designed and lived

organization leaves individuals some choice in whom they turn to for help or with whom they develop more enduring social ties (Lin and Carley, 1995). Social selection models analyze how actors structure their own social networks on the basis of characteristics of other actors in the network (Leenders, 1997). Modeling the selection process is a particularly powerful way to test the influence of organizational forms on patterns of interaction. The persistence of these externally introduced forms requires the cooperation of individuals to reproduce them in everyday interaction (Burawoy, 1979). The degree to which such forms “override” or complement the personal, less job-relevant characteristics that may influence whether individuals turn to another for help is something that can be explicitly tested in social selection models (see, e.g., Cross, Borgatti, and Parker, 2001).

Social selection models seek to explain the formation of new dyadic interactions, but they can also trace the effects of sharing social contexts with individuals, even in the absence of direct interaction. Social selection models focus on predicting the existence of particular relationships between actors from a range of characteristics, including individuals’ prior interactions with one another (Frank and Fahrback, 1999; Leenders, 1997; Robins et al., 2007). Analysts can examine network evolution, testing whether network characteristics such as being part of the same advice subgroup predicts the formation of a new social tie, independent of whether two individuals shared a tie in the past (Snijders, 2001). Furthermore, analysts can fit separate models for organizations with nonoverlapping networks to compare and contrast selection processes in different organizations (Frank, 1995). For these reasons, social selection models enable analysts to consider the relative influence of multiple informal and formal processes in an organization in a single study. Frank and Zhao (2005) illustrate how social selection models can be used to study how the expertise and resources needed to integrate technology into classroom instructions flowed in one school. The school they studied had a fragmented social structure and limited internal expertise and struggled to adopt new technology for classroom use with students. In the school they studied, a district initiative to introduce a new operating system rendered the school’s internal expert ineffective as a source of help for teachers. The school brought in an outside expert to help, but this expert had few existing ties and ended up focusing her efforts on members of a single subgroup. A member of a different subgroup served as a liaison to other subgroups in the school, thus spreading implementation in ways the designated expert could not. In that school, selection models revealed that talk related to technology was more likely to transcend informal ties than was talk related to other

curricular matters, confirming the pattern observed in case study interviews. At the same time, teachers with similar attitudes toward the value of technology were more likely to talk with one another, which points to a potential limit of diffusion through networks: To the extent that intentional efforts to promote collaboration are not sufficient to overcome the tendency of actors with similar attitudes to reinforce each other's beliefs, selection mechanisms can stem change efforts.

Many policymakers and scholars today are interested to know whether efforts to promote collaboration on a wide range of instructional matters are effective. Researchers have studied the characteristics of successful instructional coaches (e.g., Ertmer et al., 2005) and interdisciplinary teams (e.g., Pounder, 1999) to address questions about the efficacy of these efforts. In an important sense, effectiveness can only be measured in terms of impacts on teaching and learning, but policymakers and school leaders often need something that is an early, leading indicator that those efforts are paying off. Social selection modeling offers one possible metric, to the extent that giving advice related to particular reforms is the first step in a collaborative reform taking hold. To date, scholars have not used social network analysis or selection modeling in this way; if it is to be a powerful evaluative tool or way to study organizations, scholars need to investigate particular cases using multiple methods in order to explore what selection models can reveal about the effects of changes on the formal organization on the actual pattern of interaction among teachers in schools.

Formal and Informal Supports for School Reform

In this research, we fit models of social selection to explain the development of new ties between individuals in teachers' advice networks. Specifically, we address the following questions in our analyses:

- Do organizational forms introduced to support collaboration affect advice networks? How important are they, relative to the existing informal social structure of advice networks?
- Do forms of collaboration bring the formal and informal organization into alignment in ways that can support coordinated school change efforts?

Our study takes a multimethod, case study approach to advancing knowledge about how schools can organize to develop a shared vision for how to improve teaching. Both case study schools introduced a number of forms to promote

teacher collaboration with the objective of implementing a schoolwide initiative to improve teaching and learning. By using evidence from models of social selection and interview data, we argue that the schools differed in how well aligned the formal and informal processes of collaboration are, with important consequences for each school's implementation of reforms. We analyzed three dimensions of alignment for each school: (1) the alignment of the informal social structure of the school with formal grade-level teaching assignments of teachers, (2) the alignment of formal roles of reform leaders with their expected role as sources of knowledge and expertise for teachers and as bridges between groups, and (3) the alignment of patterns of advice giving with deliberate efforts to create cross-grade vertical teams that cut across organizational groupings of teachers in the school.

Method

Sample School Characteristics

The sample for this study is a subsample of two schools that were part of a larger sample of schools participating in a survey study of teacher networks and reform implementation (Penuel, Frank, and Krause, 2006). Our larger sample was a purposive sample of schools from California. In constructing the overall sample, we sought to include schools that (1) were engaged in a reform initiative intended to have a schoolwide influence on teachers' practice and (2) had distributed leadership (Spillane, 2006) for initiatives across people and practices, evidenced by assignment of responsibility for reform to multiple actors in a school and by allocation of time for teachers to meet regularly to discuss their school's initiative.

The two schools in the subsample had in common a focus on using "data-driven decision making" as a key element of their reform strategies. Both regularly monitored instruction and outcomes and sought to make decisions about how to help students experiencing academic difficulties using data the school collected as a basis for those decisions. Other similarities were that both received Title I funds, served elementary-level students, and were minority-majority schools. Table 1 indicates the goals and key strategies used by the two schools in our sample—Dickerson Elementary School and La Plaza Technology Charter.

These schools were chosen because they were the only two schools focused on the same approaches to reform and monitored implementation within a subsample of 6 schools in the study for which we had collected qualitative data to complement the quantitative network data. The other schools in the subsample focused primarily on improving literacy or mathematics instruction, and only one other school regularly monitored

Table 1. Goals and Key Strategies of Reforms in the Case Study Schools

School	Goals	Key Strategies
Dickerson	Shared leadership with respect to instructional decision making	Consensus process for deciding on instructional strategies based on data (primarily English/language arts and mathematics) Frequent monitoring and assessment of students
La Plaza	Improving instructional decision making through better use of data	Analysis of alignment among national standards, state standards, and assessments (especially in English/language arts) Structured process for reviewing curricular resources Frequent monitoring and assessment of students

implementation of reforms. Implementation monitoring was an important criterion for inclusion in the sample for this study, since it has been theorized that implementation monitoring potentially strengthens the coupling between the informal and formal aspects of schools as organizations (see Meyer and Rowan, 1977).

Teacher Characteristics and Roles

Faculty in each of the two schools participated in the study by completing questionnaires described below at two points in time. A total of 16 of 17 faculty members completed surveys at Dickerson, and 29 of 34 faculty members completed surveys at La Plaza. These response rates are well above the threshold of 80% considered generally acceptable for social network analysis to minimize the effects of missing data (Costenbader and Valente, 2003). At Dickerson, the faculty was comprised of 3 kindergarten teachers, 2 first-grade teachers, 2 second-grade teachers, 2 third-grade teachers, 3 combined fourth-fifth grade classroom teachers, an art teacher, a Reading Recovery teacher, 2 special education teachers, and the principal. At La Plaza, the faculty was comprised of 4 kindergarten teachers, 5 first- or first-second-grade combined classroom teachers, 2 second-grade teachers, 2 second-third-grade combined teachers, 3 third-grade teachers, 3 fourth-grade teachers, 3 fifth-grade teachers, 2 sixth-grade teachers, 8 specialists, an art teacher, and the school’s director.

In addition, at each school we selected three to four school staff to interview. We asked the principal or a formal initiative leader whether we could interview these teachers to learn more about their perspective on their school’s initiative and on teacher collaboration at the school.

Table 2. Characteristics of School Staff Interviewed

Teacher	Role	Assignment	Years Teaching	Years at School	Ethnicity	Gender
Dickerson						
5401	Teacher ^a	1st	11	6	White	F
5406	Teacher	1st	20	12	White	F
5409	Principal		18	17	White	F
5414	Teacher	1st	10	5	White	F
La Plaza						
0804	Teacher	1st	8	8	White	M
0828	Teacher	4th-5th	8	4	White	F
0832	School leader	Media specialist	32	12	White	M

^aThis teacher was also an informal leader within the school.

The sample of teachers in the study was predominately White and comprised of veterans in their schools (see Table 2). All but one of the teachers was White. All but one had more than 5 years of teaching. The grade spans taught varied, but 4 were first-grade teachers.

Sources of Data

Below, we describe the sources of data used in the study and present a summary of the constructs measured in each data source at the end of this section in Table 3.

Interview protocols. We developed interview protocols for school leaders and for teachers in both years of our study. The protocols were distinct for school leaders but focused on the same constructs. For purposes of our study, school leaders included the principal, assistant principal, and instructional coaches. In 2003-2004, the school leader and teacher interview protocols included questions about the nature of the schoolwide initiative, the typical implementation process for new initiatives at the school, patterns of communication at the school, and perceptions about the school's social network. Interview protocols in 2004-2005 addressed collegial interactions in the school in general, teachers' perceptions of the schoolwide initiative and its successes and challenges, and the nature of interactions around the initiative.

Faculty questionnaire. Network data were collected at two points in time, once in fall 2004 and again in spring 2005. The same questionnaire was administered at both points in time; all faculty members with responsibilities for classroom teaching provided data we used to characterize two kinds of ties among faculty members at the schools at both points in time. We collected data on what we call "collegial" ties by asking teachers a set of

Table 3. Sources of Data

School Year	Interviews	Faculty Questionnaire	Principal Questionnaire
2003-2004	Nature of schoolwide initiative Typical implementation process for new initiatives Patterns of communication perceptions about the school's social network	Closest professional colleagues on work matters and frequency with which teachers interact with them Colleagues who have provided help with respect to the initiative and frequency help was provided	
2004-2005	General collegial interactions Teachers' perceptions of the schoolwide initiative Nature of interactions around the initiative	Closest professional colleagues on work matters and frequency with which teachers interact with them Colleagues who have provided help with respect to the initiative and frequency help was provided	Formal teams and leaders Membership of the teams

questions about their closest professional colleagues and members of their advice networks with respect to their school's reform. Teachers identified the individuals they considered to be their closest professional colleagues using a numbered roster with the names of all the staff members (including school leaders) in their school. For each colleague selected, the respondents indicated the frequency of interaction with options of daily, weekly, monthly, and once or twice a year. We asked a second question of all teachers to identify members of their advice network ("advice" ties). Teachers listed individuals who had provided them help with implementing their school's reform and the frequency with which they provided help (using the same frequency categories for the first network question).

To measure trust among teachers, we used a four-item scale from Bryk and Schneider (2002). The scale included questions about overall perceptions of trust, respect for colleagues, and comfort with discussing feelings, worries, and frustrations with other teachers. Reliability for this scale was $\alpha = .86$.

We also used a five-item measure of collective responsibility, adapted from Bryk and Schneider (2002). Our measure of collective responsibility asked teachers to report on whether they thought that staff members had a shared commitment to the goals of the school and to fostering student learning. This measure asked teachers to indicate the proportion of teachers in the school whom they believed felt a sense of responsibility for different aspects of school functioning. The scale had a reliability of $\alpha = .89$ in our study.

The faculty questionnaire also included two questions related to teachers' backgrounds that we used in models: gender and ethnicity

Principal questionnaire. A questionnaire administered to principals in fall 2004 was the primary source of data on the formal organizational structures for the school. In this questionnaire, principals indicated what formal teams and leaders existed at the school and listed the members of the teams, so that teachers who shared common meeting venues could be identified. For teams, they also indicated how frequently they met and how frequently their school's initiative was discussed at the meeting.

Data Analysis

Identifying cohesive subgroups. As an initial step in data analysis, we used data from our questionnaire to construct subgroup boundaries based on collegial ties between actors (Frank and Yasumoto, 1998). Specifically, we used the sociometric question asking teachers to list their closest professional colleagues as the basis for identifying cohesive subgroups. Identifying subgroups across the schools in our sample then required an algorithm that could objectively and successfully identify within-school subgroups from the sociometric question with a minimum of subjective input or interpretation from the researcher (e.g., specification of the number of subgroups, criteria defining subgroups). We used Frank's

(1995, 1996) network clustering algorithm for this purpose. Related to network models such as p^* and p_2 (Lazega and van Duijin, 1997; Wasserman and Pattison, 1996), Frank’s algorithm iteratively reassigns actors to subgroups to maximize the increase in odds that a relationship occurs between a pair of actors if they are in the same subgroup relative to the odds of a relationship occurring if they are in different subgroups.

Analysis of selection. Because we asked teachers to report both on enduring collegial ties and on help received related to their school’s reform initiative, we could analyze the degree of overlap between the two. Furthermore, because we asked both questions at two time points, we could analyze the degree to which informal ties and organizational forms predicted the formation of new interaction related to organizational reform. The dependent variable for these analyses was the formation of a new tie related to help with the school reform, and the models sought to explain the formation of new ties as a function of characteristics shared by the nominator (the person responding to the survey) and nominees (the person the respondent identified as providing them help) and characteristics of the nominees.

The method for modeling the relative contribution of teacher background characteristics, formal organizational processes, and informal processes to the formation of ties began with constructing a selection model from our data (Frank, 1998). To describe the formation of new informal ties, we estimated multilevel cross-nested models, with pairs of school actors nested within the nominators and nominees of ties. These models are similar to p_2 models used to capture dependencies in social network relations with random effects for nominators and nominees; we modeled these dependencies as functions of individual characteristics (Lazega and van Duijin, 1997). Formally, let $Help_{ii'}$ indicate whether actor i indicated receiving help from actor i' , for example, whether Bob as actor i indicated receiving help from Lisa as i' . Thus there is a unique observation for each potential pair of helping relations. Then $Help_{ii'}$ is modeled as a function of the tendency of actor i' (Lisa) to provide help regarding the school’s initiative ($\alpha_{i'}$) and the tendency of i (Bob) to receive help (β_i). The model at level 1, for the pair of actors i and i' , is: Level 1 (pair):

$$\log\left(\frac{P[Help_{ii'} = 1]}{1 - P[Help_{ii'} = 1]}\right) = \alpha_{i'} + \beta_i, \tag{1}$$

where we use logistic model because ($Help_{ii'}$) is dichotomous.

To capture different bases of structuring, we included dummy variables indicating whether school actors were close colleagues at Time 1 (informal), were members of the same subgroup (informal), whether they taught in the

same grade (formal), and participated in meetings regularly in which their school's initiative was discussed (opportunities created by the formal organization). We also control for similarity of backgrounds and similarity of implementation of the reform, a balance effect (Davis, 1967; Heider, 1958; Newcomb, 1961). Finally, the p_2 framework includes control for the extent to which actor i' provided help to I (reciprocity).

The final level 1 model was:

$$\log\left(\frac{P[\text{Help}_{ii'} = 1]}{1 - P[\text{Help}_{ii'} = 1]}\right) = \alpha_{i'} + \beta_i, \quad (2)$$

- + δ_1 (close colleagues at Time 1) $_{ii'}$.
- + δ_2 (same subgroup) $_{ii'}$.
- + δ_3 (same grade teaching assignment) $_{ii'}$.
- + δ_4 (total of all meeting types in common) $_{ii'}$.
- + δ_5 (same gender) $_{ii'}$.
- + δ_6 (same ethnicity) $_{ii'}$.
- + δ_7 (difference in implementation levels at Time 1) $_{ii'}$.
- + δ_8 (reciprocity: help $_{i'i}$).

The larger the values of δ_1 and δ_2 , the more we would infer that the network structure as defined by close collegial ties and subgroup memberships affects the patterns of advice sharing as measured by questions about help provided. Large values of δ_3 and δ_4 quantify how help is shaped by the formal organization as represented by grade level and meeting structures. The values of δ_5 and δ_6 , imply help tends to develop among people of the same gender and ethnicity and δ_7 indicates the extent to which the pursuit of the school's organizational goals—as represented by teachers' levels of implementation of their school reform initiative—influences help. δ_8 indicates the extent to which actors helped others who had helped them.

We modeled the tendencies of school actors to be nominated as providing and receiving help at a separate level:

Level 2a (*i*': provider of help)

$$\alpha_{i'} = \gamma_0^{(a)} + u_{oi'}. \tag{3}$$

Level 2b (*i*: receiver of help)

$$\beta_i = \gamma_0^{(b)} + v_{oi}. \tag{4}$$

Here, the random effects $u_{oi'}$ and v_{oi} account for dependencies associated with tendencies to provide or receive that affect all relations in which a given individual engages. We added to level 2a measures of two formal aspects of the school organization: grade and leadership role.

Level 2a (*i*': provider of help)

$$\alpha_{i'} = \gamma_0^{(a)} + \gamma_1^{(a)} \text{grade level}_{i'} + \gamma_2^{(a)} \text{leadership role}_{i'} + u_{oi'}. \tag{5}$$

Tables 5 and 7, presented in the results section, report parameters for both levels of the models. Level-1 variables (pair) appear at the top of those tables. Under the category “Provider” are estimates associated with providers of instructional help (level 2a). For all variables, we report the parameter value, standard error, and *T*-ratio. *T*-ratios of 2 or greater are called out as significant (for a discussion of the challenges associated with significance testing within social selection modeling, see Robins et al., 2007). We also report variances and covariances for the provider and receiver effects ($u_{oi'}$ and v_{oi}).

Recent advances in models for selection of new ties allow analysts to compare information across multiple settings. This extension is ideal for modeling how selection effects vary across schools. For example, we can now model whether schools that deliberately cultivate interaction across grade settings using formal meetings generate instances of the provision of help across grades. These interactions can convey a broad range of information, including deeply contextualized advice (Kennedy, 2005; Smylie 1989).

One limitation in the current analysis for comparing across settings is that the two schools in our sample differed with respect to the density of collegial ties at the outset of the study. At Dickerson, nearly all teachers nominated all of their fellow faculty members as close colleagues. Because of the restriction in range of data, we did not include being a close colleague at Time 1 in the model for that school. We captured some of the close collegial tie effect using subgroup membership (identified from the full pattern of collegial ties at Time 1, including some not in our final sample), since subgroups are identified using data about the frequency, as well as presence, of collegial ties.

Analysis of principal questionnaires. We used data from the principal questionnaires to identify the nature and frequency of different teacher team meetings. We summarized the purpose of each meeting using the principal's own response to the questionnaire as a primary guide. Where interview data provided additional context, we modified our summary of the principal's description of the formal opportunities teachers had to collaborate in each school.

Analysis of interviews. The use of interview data in this study was primarily as a supplement to the quantitative models. We did not engage in a systematic coding of interview data, except to identify specific forms of help teachers found beneficial. We analyzed data on forms of help to identify contexts where help may have been provided (especially whether or not help was part of formal meeting times) and from whom help may have come (especially whether coaches were the source). We then used the coded data to help interpret the selection models; however, our sample of interviews was not as broad as the questionnaire data available to us on teacher attitudes and patterns of help.

We focused on two aspects of the interview data in developing interpretations of the selection models. We focused in the analysis on comparing the particular visions of change held by people who were interviewed, paying particularly close attention to those designated as being formal or informal leaders by other teachers in interviews and from survey data. This particular aspect of the analysis helped us to identify the extent to which the meanings of the goals and strategies of the school reforms held by different school actors were shared or used language to indicate that the meanings were congruent with one another. In addition, we used interview data to identify qualitative interview examples that could serve as illustrations of the phenomena documented through the teacher questionnaires. For this purpose, we used the categories of constructs included in the models to guide our search for examples (e.g., we searched for data relating to meetings to interpret data on how common meetings may have affected social selection processes, if in that school common meetings significantly predicted the formation of new ties).

Findings

The case analyses below point to how these two schools differed in the ways grade-level teams, coaches, and vertical teams designed to promote collaboration across grades influenced actual patterns of interaction relative to more informal influences, such as collegial bonds among faculty members and norms of trust and collective responsibility that had emerged over time. Interview data indicated that at Dickerson, informal patterns of exchange drove processes of formalization of roles and leadership and formal organizational

structures supported conversations about instruction, indicating a cohesive school community with good alignment between informal and formal processes. By contrast, La Plaza provides a view of what happens when misalignment between the formal and informal structures leads to competing visions of reform, specifically where vestigial organizational forms provide a means of splintering a school community's commitment to specific goals.

Dickerson Elementary School: Formal Structures Emerge From Informal Ties

Dickerson Elementary School is a small school in an economically and ethnically diverse community with a long-standing commitment to teacher involvement in schoolwide decision making. The school's initiative, improving instructional decision making, is an example of a reform process that emerged from informal interactions but that was supported by constructive norms and formal opportunities for teachers to meet. A cohesive social network enabled teachers to use the formal organization to seek and get help from colleagues with differing attitudes toward the school's initiative.

Formal organization. At Dickerson, teachers had multiple formal opportunities to meet as members of teacher teams. The most frequent meeting opportunities were as part of grade-level teams and whole faculty meetings. The shared leadership committee, which led the initiative, met every two to three weeks. Less frequent opportunities involved cross-grade instructional improvement and staff development. Those meetings tended to take place less than once a month. In all the opportunities, the school's initiative was a focus at least part of the time, and for the shared leadership committee it was the sole topic.

An important characteristic of the teacher teams at Dickerson was that almost all had a fluid and open membership. Anyone who wanted to be part of the professional development committee, which two teachers identified as the most powerful in the school, could volunteer. Although newcomers were not specifically encouraged to join many teams, teachers stressed that they could and that when they did join, they were welcomed into those committees. Only the lesson study group had a restricted membership; high interest competed with the leaders' goal to keep the team small. Assignment to the team was random (based on teachers' social security numbers), and teachers who were interested but not selected had the chance to participate in lesson study in subsequent years. The fluidity of team membership (with the exception of lesson study) was an example of the internal consistency of the formal organizational structure at Dickerson, a way in which shared decision making permeated the school.

Another example of the internal consistency of the formal organizational structure at Dickerson was evident in the structured process several teams used for collaboration. All proposals made by specific teams and by the principal at Dickerson went before the full faculty for discussion whenever they affected the whole school. According to one teacher, there was a norm that “we . . . bring it back to the group. If you have that small conversation with someone that involves everybody on this staff, then that conversation needs to be had when everyone on the staff is present.” In addition, the lesson study group at Dickerson followed routines established for that practice. These routines included teachers designing a lesson together, implementing it in their classroom, and then discussing the lesson with other members of the lesson study group. These particular routines for discussing lessons provided a collegial atmosphere for deeper reflection on instructional matters than was afforded by larger meetings and than is typical for many schools whose reform efforts concern primarily shared decision making but not using collaboration to change the core of teaching (see Murphy and Beck, 1995).

Dickerson had no formal roles for the leaders of the shared decision-making initiative, but the principal had given them authority to lead the team charged with implementing it. Two teachers identified themselves as informal leaders of the initiative; the principal and other teachers confirmed their role as experts and drivers of the initiative to formalize a process of shared instructional decision making in the school. These two teachers had particular expertise in the topic because they had been enrolled in a master’s degree program in which school governance had been a focus, and they decided to specialize in this area. The principal had given these two teachers authority to change the name and function of the local site council to be a committee addressing shared decision making and then to lead this team. The only other formal position of leadership in the school was a head teacher position; this teacher had no formal role in the initiative other than to serve as a sounding board for teacher concerns in the school.

Informal social structure. The algorithm that assigned teachers to subgroups produced subgroups at Dickerson that were tightly aligned with grade-level structures (see Figure 1). Subgroup A was tight-knit (as indicated by the diameter of the circle), comprising 2 third-grade teachers and the principal. K-2 teachers made up subgroup B, which was less tight-knit than subgroup A. The fourth-grade and fifth-grade teachers and specialists were all in subgroup C.

Teachers’ own perceptions conform to this grade-level alignment of groups. One teacher commented that those in the K-2 group were close because they had a schedule that afforded frequent interaction, including at lunch. A primary-level teacher in these grade levels indicated that she rarely saw the upper-grade teachers because of their schedules.

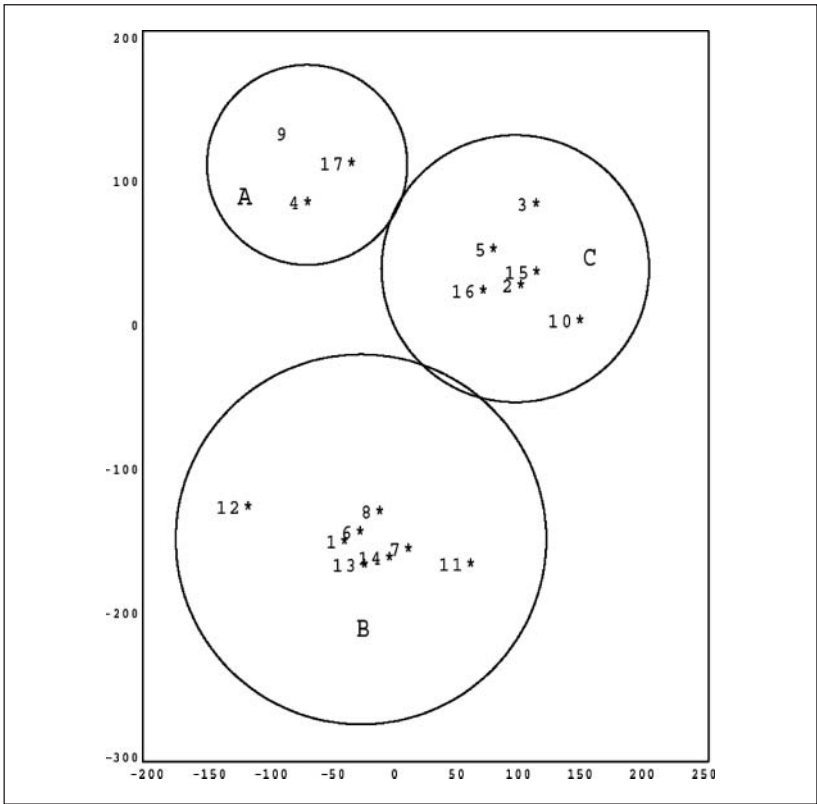


Figure 1. Sociogram for Dickerson.

Despite the fact that teachers perceived grade-level teams to differ in terms of closeness, their attitudes about the school community were fairly uniform (and positive) across subgroups (see Table 4). Average levels of collegiality were high, as were ratings of trust and collective responsibility. Thus, in terms of the norms that govern faculty interactions, the expectation at Dickerson was widespread that faculty members would treat one another with respect and would share a strong sense of responsibility for student achievement.

Within the school's social networks, the informal leaders of the initiative did play a significant role in bridging across groups. As Figure 2 shows, faculty member 14 in the center of subgroup B had many interactions related to shared decision making not only with members of her own subgroup but also with members of subgroups A and C. Faculty member 14 was one of the two

Table 4. Mean Ratings of School Community at Dickerson

Meeting Opportunity	Subgroup A	Subgroup B	Subgroup C	School Overall	
	(n = 2)	(n = 8)	(n = 6)	M	SD
Collegiality	3.50	3.77	3.42	3.61	0.44
Teacher-teacher trust	3.25	3.22	3.22	3.22	0.47
Collective responsibility	3.10	3.53	3.53	3.22	0.47

All ratings are on a 4-point scale, with 4 being the highest rating.

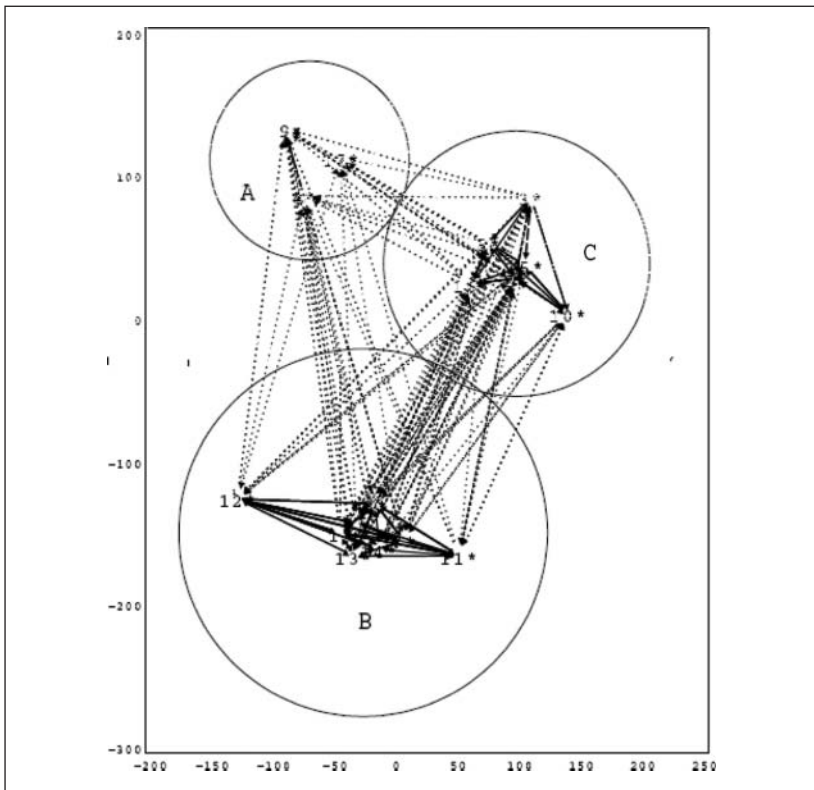


Figure 2. Sociogram for Dickerson showing frequent initiative-related interactions.

Frequent interactions are defined as those occurring weekly or daily.

Table 5. Selection Model for Dickerson

Parameters	Parameter	Std. Error	T-ratio
μ - Pair (level 1)	-6.37	3.33	
Same subgroup δ_2	4.01	1.67	2.40
Same grade δ_3	6.11	2.32	2.63
Total of all common meeting types δ_4	0.01	0.53	0.02
Same gender δ_5	1.44	1.72	0.84
Same ethnicity δ_6	1.62	1.03	1.57
Similarity in Time 1 primary implementation initiative δ_7	-0.06	0.16	-0.38
ρ - Reciprocity	7.60	3.76	
σ^2 A - Provider variance (level 2a)	15.71	14.36	
Grade $\gamma_1^{(\alpha)}$	-0.05	0.36	-0.14
Leadership role $\gamma_2^{(\alpha)}$	1.46	1.97	0.74
σ^2 B - Receiver variance (level 2b)	293.04	161.84	
σ_{AB} - Provider-receiver covariance	-58.38	39.74	

teachers in charge of the shared leadership initiative and the one we interviewed as part of our study. As we would have predicted from interviews that named her as the informal leader of the initiative, the sociogram indicates that she was a key source of information and help regarding the initiative across different subgroups and acted as an informal bridge within the school.

Alignment of the formal and informal. The selection model (see Table 5) for Dickerson indicated that new ties involving initiative-related help were predicted strongly by teachers being in the same subgroup and teaching in the same grade level. Overall, this pattern of results suggests that informal and formal aspects of the organization are both sources of help provided for conducting a core task of teaching. At the same time, the designation of leaders to the initiative was not related to a significant shift in patterns of interaction, a point we discuss in interpreting the selection modeling in light of the interview data.

The finding that grade level was an important predictor of new ties may be partly explained by the function that team meetings played in supporting interactions among teachers at the same grade level. The principal noted that these meetings were ones in which teachers were expected to look closely at student data to plan instruction and identify new strategies for teaching students. For teachers, who tend to value expertise from people who share more of their social context of teaching (see Kennedy, 2005; Smylie, 1989), the grade-level team may offer the most useful source of information regarding instructional decision making, since teachers in the same grade must teach

the same standards and tend to share the same instructional materials. By contrast, the influence of cross-grade team meetings, which are represented by the total meeting variable in the selection models, may not be significant because discussions in these meetings are less salient to the day-to-day instructional decision making of teachers.

We did not see a pattern in which initiative ties become focused on interactions with the formal leaders of the initiative, in part because teachers already recognized the leaders of the initiative as resources at the outset of the study. Teacher 14, for example, was nominated by all of her peers at Time 1 as a close colleague and by all but 4 peers at Time 2. Interview data help to make sense of this pattern as well, since interviewees tended to emphasize that informal norms and patterns of interaction tended to drive the development of formal structures for supporting shared decision making and influenced collegial interaction. Shared leadership had been part of the informal way of doing business at the school; the principal herself had risen from the ranks of faculty. There had always been an informal "head teacher" with special duties to lead the faculty, even before shared leadership became a formal initiative. The initiative was born out of two faculty members' own graduate student experience; they had been studying shared decision-making leadership and wanted to apply the concepts to their own school. The principal supported their developing a leadership committee from the existing School Site Council and engaging the faculty in broader study of shared leadership. One faculty member commented, "It's just always been the way that we did things, and so just when I first came to Dickerson, there was a culture of that. And you were expected to step up and do your part."

La Plaza Technology Charter: Misalignment Among Organizational Forms

La Plaza Technology Charter School is a K-6 school in a community that serves a high proportion of English language learners. It was formed in the 1990s with an emphasis on innovative uses of educational technology. The school's population became more diverse in the years after the school's founding, and test scores dropped as the student body grew to include more low-income students and more English language learners. In response to accountability pressures, the principal shifted the school's direction and focused faculty members on looking at data together to identify areas where instruction needed to improve. The organizational forms that reflected the charter school's original mission, including a technology planning team and coach, worked at odds with the principal's new direction. During the period we studied the school, its faculty members were divided over the nature of assessments that are important to use, and the school was struggling to find a common vision on how to improve teaching and learning.

Formal organization. At La Plaza, teachers had multiple formal opportunities to meet, two of which focused most intensively on the school's efforts to engage in data-driven decision making. The most frequently occurring opportunity for teachers to meet was as an entire faculty; staff meetings took place once a week. Every two to three weeks, teachers in the same grade level engaged in "Review Time," a structured process that typically involved teachers in reviewing assessment data and in planning and reviewing lessons. Other meetings took place once a month or less. The greatest concentration of discussion on the school's initiative was in Review Time, where teachers made an effort to review data from unit tests, midyear benchmark assessments, and end-of-year achievement tests.

Teachers at La Plaza commented that meetings with other faculty members at their grade level were often either cancelled or their purpose undermined. For example, two teachers said grade-level meetings rarely happened every two to three weeks as intended; when they were held, teachers often skipped the meetings and went home. Another teacher commented that Review Time is not as effective as it could be because "so much of that time is pilfered for other things . . . that didn't really relate to how we were going to plan together as a team." Another commented that the increased pressure on the school from the district has meant that "a lot of our Review Time now is spent doing things for her [the principal] to prove to them whatever they need proven to them, so we don't get as much of that time to sit down and look at student work."

The most powerful organizational form left over from La Plaza's first years was the technology team and its coach. This coach still held a position of formal leadership within the school, but his leadership and team were no longer central to the principal's initiative. When we visited the school, he was pursuing a parallel initiative with teachers that had a different vision for data-driven decision making. His vision was based on *Understanding by Design* (Wiggins and McTighe, 1998), an approach to designing instruction that is driven by the overarching goal of teaching for deep understanding and assessed using authentic performance tasks. He saw a conflict between his own vision and process and that of the principal's, in that he considered student work a better measure of learning than standardized tests. Thus, at the level of the formal organization of the school, an inconsistency existed between the principal's vision and that of a major leader in the school; that inconsistency was reflected in the different settings for collaboration each established to pursue her or his vision.

Informal social structure. Compared with Dickerson, La Plaza was a less cohesive school community. Although the subgroups were themselves tightly knit, as evidenced by the small radius of the circles in the sociogram (Figure 3), La Plaza had more distinct subgroups than did Dickerson. Furthermore, a group

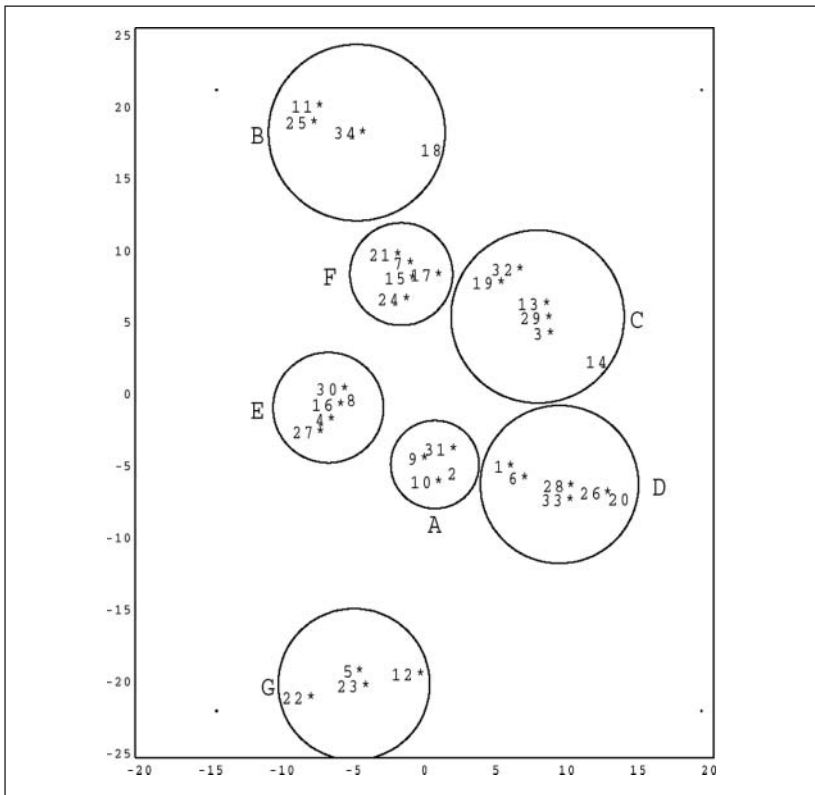


Figure 3. Sociogram for La Plaza.

comprising primarily the school's formal leaders and specialists was at the center of the social network (subgroup A), rather than the faculty members.

Another indicator that La Plaza's network is less cohesive than Dickerson's is that the teachers in each of the lower elementary grades had their own subgroups. First grade (subgroup E), second grade (F), and kindergarten (G) all formed their own subgroups. By contrast, at Dickerson, teachers from these grades tended to be part of one large and cohesive subgroup. Subgroup B comprised third-grade teachers. Only in the upper grades did the subgroups include teachers from multiple grade levels. Subgroup C includes fifth- and sixth-grade teachers, plus the main leader of the earlier technology initiative. Subgroup D comprised a group of fourth- and fifth-grade teachers.

In interviews, teachers talked about seeking out their own grade-level teachers first when looking for help, a choice that reflects the picture of the school community reflected in the sociogram. One teacher told us he sought help from colleagues outside his grade level only as a “last resort.” Primarily, talk about the new data-driven decision-making initiative was concentrated within grade-level teams, according to teachers, specifically when they met during Review Time.

Even though teachers perceived grade-level teams to differ in terms of closeness, their attitudes about the school community were fairly uniform (and positive) across these different subgroups (see Table 6). Average levels of collegiality were high, as were ratings of trust and collective responsibility. Notably, scores of community were somewhat lower in group C, in which the technology leader was a central member. These differences, however, were not statistically significant. Thus, in terms of the norms that govern faculty interactions, there was an overall commitment to collegiality and sense of shared responsibility.

Within the school’s social network, the principal played the primary role in helping teachers. As Figure 4 shows, the principal (2) in subgroup A had many interactions related to data-driven decision making; most of those interactions, moreover, involved people receiving help from her from other subgroups. Most of the other members of this subgroup were specialists but were not particularly critical sources of help to others for the initiative. Significantly, the leader of the earlier technology initiative, faculty member 32, remained an important resource for other teachers in the school. He was a resource both to the fifth- and sixth-grade teachers in his own subgroup and to teachers in subgroups B, E, and F. He was less helpful than the principal to the fourth- and fifth-grade teachers in subgroup D or to the kindergarten teachers in subgroup G.

Alignment of the formal and informal at La Plaza. The selection model (see Table 7) for La Plaza indicated that initiative-related help was predicted strongly by both informal factors: close colleagues and membership in the same subgroup. This indicates both a dyadic effect as well as an effect of the broader social context. There were also effects of teaching in the same grade and attending common meetings, effects associated with the formal organization. Finally, new help also emerged between teachers of different gender. Taken together, these factors suggest that targeted resources flow along the lines defined by a stable informal social structure as well as by the formal organization.

Table 6. Mean Ratings of School Community at La Plaza

	Subgroup							School Overall	
	A (n = 3)	B (n = 3)	C (n = 5)	D (n = 5)	E (n = 4)	F (n = 5)	G (n = 4)	M	SD
Meeting Opportunity	3.78	3.56	3.24	3.40	3.35	3.43	3.42	3.43	0.38
Collegiality	3.56	3.42	2.95	3.20	3.25	3.20	3.13	3.21	0.40
Teacher-teacher trust	3.07	3.50	3.12	2.75	3.15	3.12	3.66	3.17	0.44
Collective responsibility									

All ratings are on a 4-point scale, with 4 being the highest rating.

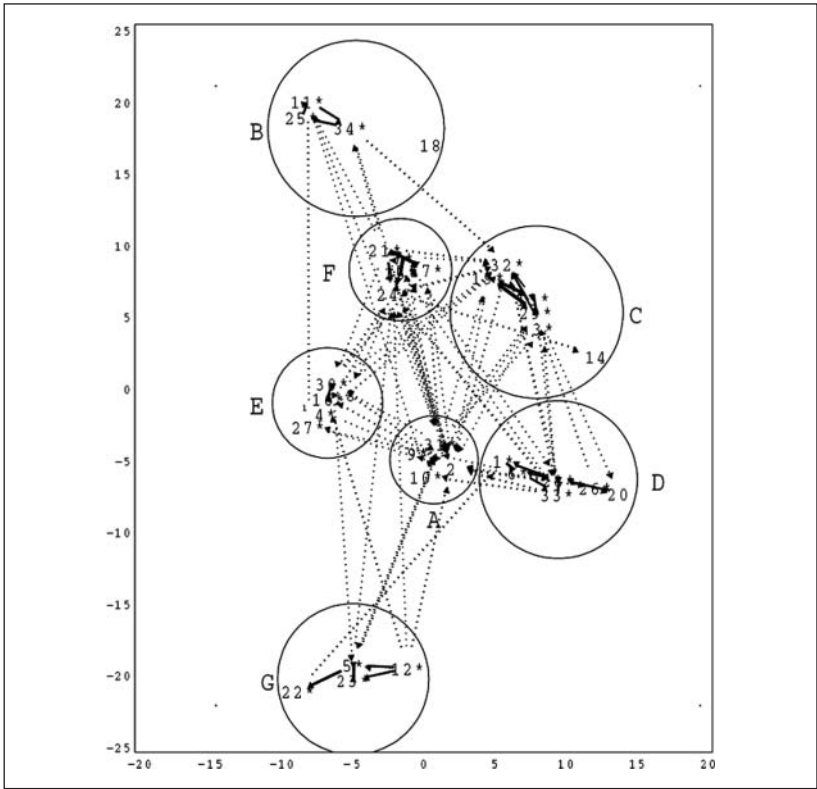


Figure 4. Sociogram for La Plaza showing frequent initiative-related interactions. Frequent interactions are defined as those occurring weekly or daily.

Interview data confirm the stability and importance of informal collegial ties in the school. One teacher, for example, described the influence his immediate colleagues had on his practice this way:

We have been working together for so long that we kind of have a general idea of what we want our school year to look like, and then it's just a matter of how, it's a matter of looking back or looking, looking back to the previous year, looking forward to the next year, and kind of coming up with what do we want to do?

Table 7. Selection Model for La Plaza

Parameters	Parameter	Std. Error	T-ratio
μ - Pair (level 1)	-3.71	0.53	
Close colleagues Time 1 δ_1	0.76	0.37	2.05
Same subgroup δ_2	2.25	0.36	6.25
Same grade δ_3	1.23	0.32	3.84
Total of all common meeting types δ_4	0.48	0.16	3.00
Same gender δ_5	-0.87	0.33	-2.64
Same ethnicity δ_6	-0.00	0.31	-0.01
Similarity in Time 1 primary implementation initiative δ_7	0.02	0.03	0.67
ρ - Reciprocity	2.62	0.48	
σ^2 A - Provider variance (level 2a)	2.51	0.83	
Grade $\gamma_1^{(\alpha)}$	-0.10	0.08	-1.25
Leadership role $\gamma_2^{(\alpha)}$	-0.56	0.86	-0.65
σ^2 B - Receiver variance (level 2b)	13.86	4.48	
σ^2 AB - Provider-receiver covariance	-4.29	1.70	

Another teacher cited the influence of his grade-level colleagues as the most significant on his practice: "We're all really good friends, so we interact a lot." When asked why he would help other teachers in the school when they asked for assistance, he said, "because we just really care about each other." All three teachers interviewed said that it was more important to share ideas about practice with one's closest colleagues than more broadly among the faculty; one cited friendship as an important reason why sharing expertise with a particular group of colleagues was important.

Meetings were a significant factor in shaping initiative-related help, but interview data suggest that meetings were also a site of conflict at La Plaza, particularly between the faculty and the principal. Two teachers and the principal herself recalled incidents in which she had stormed out of staff meetings, upset at what she perceived to be faculty members' resistance to her efforts to get them to look honestly at what the data were showing about students' difficulties. One teacher put it differently:

There have been times where things have gotten really heated and the principal has left, stormed off. And those discussions where she has left, have been about our school philosophy versus our need to do what the district is asking us to do, as far as accountability.

Everyone interviewed acknowledged the conflict had been going on for some time, but the faculty asserted the worst of the conflict between the principal and teacher had passed.

Understanding the conflict requires a historical examination of leadership of La Plaza. La Plaza began as a charter school defined by shared governance structures and by extensive formal and informal teacher leadership. The reference to the “school philosophy” reflects that belief in teacher autonomy with respect to governance. Meanwhile, the declining test scores resulted in increased pressure from the district to improve, especially in reading and language arts, and the principal was the focal point for the external pressure. The principal acknowledged to us a tension between her felt need to act as a strong leader in response to external pressure and the school’s past acceptance of teacher autonomy. She also believed that the staff members were suspicious of her motives. As she put it, “Staff members pretty much thought it was my agenda only and that I was just trying to save my job.”

Significantly, even though the principal was an important resource for teachers in data-driven decision making, the technology coach was also a significant resource. In interviews, three teachers mentioned a third teacher, a sixth-grade teacher, as having relevant expertise in data analysis and as supporting the principal’s vision, but the social network data did not confirm her role as a significant figure in the initiative. Instead, the sociograms and selection models indicated a trend toward polarization, with the power in each pole supported by the authority given to specific leadership positions in the school. In interviews, one teacher conceded that when it came to data-driven decision making, “We all take the lead,” but “our leader is getting stronger.” He added that shared decision making was still something “worth fighting for.”

Discussion

The case study analyses for the two schools document distinct ways that formal and informal processes can influence the implementation of schoolwide reforms. In both schools, some aspects of the formal organization and informal social structure were aligned, in that formally designed leaders were key “go to” people in the school for advice about their school’s reform. The case of Dickerson suggests that formal structures to support teacher collaboration can emerge naturally from individual interests of faculty members and from a normative culture that supports collegial interaction about instruction, which in turn can produce consistent forms of practice (e.g., shared decision making) across a variety of settings. At the same time, the case of La Plaza illustrates how leaders in different formal positions of authority can work toward competing visions of how to improve schools rather than to consistent implementation of reforms.

The case of Dickerson illustrates the potential power of what might be called a “network-based” form of leadership, in which a key function of leadership is to provide formal recognition and authority to informal leaders. The idea that leaders can draw on the informal network of an organization to promote organizational change and development is one that has gained currency within business and management circles in recent years (e.g., Krackhardt and Hanson, 1993) and it is consistent with practices of distributed leadership in schools (Spillane, 2006). At the same time, our findings suggest one way that formal leaders such as principals can identify potential leaders of reform initiatives. Identifying appropriate teacher-leaders who are both trusted and have relevant expertise is something many schools and districts need assistance to accomplish successfully (Coburn and Russell, 2008).

The case of La Plaza illustrates how differing visions of sources of advice for teachers in a school network can prevent the emergence of a shared vision for improving the school. In that school, many teachers did provide help to one another, and the formal leaders in the school were also significant sources of help. At the same time, the two main sources identified by teachers as important sources of help did not share a vision about what was meant by “data-driven decision making.” In their earlier work demonstrating the importance of network range for innovation in research and development teams, Reagans and McEvily (2003) had focused on the value of teams’ being able to access a wide range of expertise. But even though in some senses the teams at La Plaza had access to a broader range of expertise than those at the smaller, more unified Dickerson Elementary School, that range suggested competing strategies for advancing the organization. In that context, range worked against, rather than toward, coordinated instructional change.

As has been documented in institutional analyses of schools, the formal organizational structures do not fully explain the pattern of interactions that occurred in these two schools with respect to instruction. In other words, the “designed” and “lived” organizations remained distinct enough to warrant consideration of the relative contribution of each. In that respect, our findings are consistent with other recent studies of schools that show the continued importance of informal interaction and social structure in shaping implementation of school reforms (Bidwell and Yasumoto, 1997; Coburn and Russell, 2008; Frank and Zhao, 2005; Stein and Coburn, 2008). Our methodological approach provides us a way to quantify that distinction, though, and to analyze how the relationship between the informal and formal changes over time, including as a function of intentional efforts to promote collaborative change in schools. In this respect, the social selection models make a unique

contribution to our understanding of schools' social context by revealing the extent to which patterns of expertise sharing related to problems of practice were influenced by different formal and informal processes.

From our perspective, it is unlikely that the gap between the formal and informal social structure of schools can ever be eliminated; rather, as our findings show, it is more productive to analyze the conditions under which these two aspects of the social organization of schools can be aligned to produce commitment to a shared vision for change. This focus on conditions of productive alignment has not to date been a focus of research on teacher collaboration and professional community, which drove these particular schools' own reform efforts and our broader research project. Beyond the acknowledgement of researchers of teacher professional community that informal and formal processes are both important in helping teachers work together for instructional change (e.g., Kruse, Louis, and Bryk, 1995), these case analyses show that successful teacher collaboration can be driven either by informal or formal processes. Formal processes can catalyze instructional change, but so, too, can informal norms that foster sharing of expertise and discussion of problems of practice. Conversely, formal positions such as that of an instructional coach, which distribute leadership across multiple actors in a school, can actually work against the goals of change, especially when those actors do not coordinate their activities or share a common vision for reform.

Conclusions

The case studies are also a reminder that a school's social context can be only partly influenced by formal initiatives to promote teacher collaboration. In both schools, sharing a collegial tie or informal subgroup membership with another teacher was a strong influence on who interacted with whom regarding their school's initiative. Even if these ties were formed as part of an earlier initiative or planned effort to promote teacher collaboration, any new initiative in a school begins with a preexisting informal social structure, which is likely to influence—to varying degrees, depending on the school—current and future initiatives. This reality is a sobering reminder that the social context of schools cannot be completely reengineered, no matter how thoughtful the reform process is in a school.

These case studies suggest some directions for future analyses of the social context of teaching and schools. In particular, they illustrate the power of using social network analysis to model the dynamics of teacher collaboration to the degree to which such processes can be and are influenced by

formal mechanisms, such as team meetings, protocols for collaboration, and instructional coaching. At the same time, these methods are most useful, we believe, when coupled with qualitative data that helps interpret the model findings. For example, we needed the interview data to develop the finding that the sources of valued expertise within La Plaza diverged with respect to their visions. The social selection modeling pointed to a phenomenon that distinguished it from Dickerson, in that patterns of advice seeking seemed to be more organized by total meetings that teachers had in common. But focusing as we did in interview data from the principal and technology leader at La Plaza allowed us to see more clearly that these faculty meetings were perceived by many to be so contentious and thus may have contributed to the school faculty's lack of agreement about visions for how to implement change.

The differences between the schools suggest the need for additional case studies and for studies with different kinds of samples to determine whether still more patterns of alignment exist between the formal and informal aspects of schools and also to estimate how prevalent particular patterns of alignment are. Research might also be undertaken to explore strategies leaders use to address situations like that of La Plaza, to reconcile competing visions for change in ways that respect alternative points of view and are responsive to demands for change from outside the school (e.g., from the district). Ultimately, research is needed that explicitly tests the efficacy of different approaches to promoting teacher collaboration within school contexts that differ in the way these schools (and perhaps others) do with respect to the alignment of their preexisting organizational forms and informal social structure. Such research has the potential to illuminate just how the formal organization can support and augment the informal social structure of a school in ways that yield coordinated, coherent instructional change. Our study, we believe, provides a language (of networks) and method to help organize such work.

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