

**Going With the Flow:
Communication and Reform in High Schools**

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Changing Times: How High Schools and External Improvement Organizations Work Together

PROJECT OVERVIEW

Each year more high schools are identified as underperforming due to failure to make adequate yearly progress. To raise achievement, new performance expectations require teachers, schools, and districts to move beyond aligning curriculum, reallocating time, and other conventional approaches. In response, they are relying more and more on external school improvement organizations. Although U.S. schools since the early 1990s have increasingly turned to external sources of assistance for improving academic achievement, literacy, graduation rates, and other key problems, the challenge of making changes in schools, and high school in particular, is well documented (Siskin, 2003).

To better understand this challenge, CPRE researchers have prepared four papers that examine the efforts of five external reform organizations and their interactions with high schools. We focus on provider design strategies and challenges, the uses and perceived effects of the reforms in high schools, the mutual impacts of communication networks and reforms in schools, and the nature and school leadership in the implementation of reform efforts. This project is particularly important and innovative because it makes the reforms and their impacts on schools simultaneous objects of investigation. Findings will allow schools and providers alike to select and strategize more carefully in order to maximize the potential for deep use of improvement strategies.

The research presented in the four papers draws from interview, survey, and observation data collected during 2004 and 2005 at 15 high schools across the country and from staff at five external assistance providers. The external reform organizations—High Schools That Work, First Things First, Ramp-Up to Adolescent Literacy, the Penn Literacy Network, and SchoolNet—were selected as representative of the types of external assistance found in high schools during previous CPRE research (see Gross & Goertz, 2005). The providers include two whole school reform models, two literacy programs, and one strategy to increase data-driven instruction. The 15 schools in our sample were selected based on recommendations from the reform organizations. Each provider identified three schools with which they had collaborated for one to five years. Ten of the study schools (two from each of the five providers) were in their first or second year of implementation. Five “mature” sites had worked with their respective provider for more than three years. In this way, we were able to examine several phases of a given reform.

Schools at the earlier stages of implementation were visited twice (at the beginning and end of the 2004–2005 school year) while the mature sites were visited once. During each visit, interviews were conducted with teaching and administrative staff at the school and district level. Staff members with both central and peripheral involvement with the reform were targeted. In total, our findings are based on approximately 380 semi-structured interviews lasting about 30–60 minutes each. During our site visits, we also conducted guided observations in a sample of classrooms. Interviews were also conducted with staff members at each of the reform organizations. These interviews focused on general questions related to the reform as well as

specific issues related to the schools in our sample. Interviews with fourteen provider staff members were conducted and analyzed for this project.

In addition, a survey was conducted with all teaching staff at each of the 15 sites. Using social network analysis, the survey provided information on the communication networks that exist within schools. The survey also contained items that allowed us to measure the depth and breadth of the implementation of a particular reform in each of the 15 schools. Our survey findings are based on 1,057 returned surveys, with individual school response rates ranging from 60 to 90 percent.

The interim findings of this project have been compiled into four papers (a fifth paper on the role of the central office will be forthcoming) that each shed important light on the design, use, and mutual impacts of external reform efforts and American high schools. Taken together, the papers provide a multi-faceted approach to describing the complexities of making change in high schools.

Citations

Gross, B., & Goertz, M. E. (Eds.). (2005). *Holding high hopes: How high schools respond to state accountability policies* (CPRE Research Report No. RR-056). Philadelphia, PA: University of Pennsylvania, Consortium for Policy Research in Education.

Siskin, L. (1994). *Realms of knowledge: Academic departments in secondary schools*. London: Falmer.

The four papers currently based on the data from this project include:

Goertz, M. E., Goldwasser, M., Hovde, K., Mueller, J., & Riggan, M. (2006). *Getting past go: The use and perceived effects of external provider packages in high schools*. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Riggan, M., & Supovitz, J. A., & Hovde, K. (2006). *They come in all shapes and sizes: Leaders and high school reform efforts*. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Shiffman, C. D., Massell, D., Goldwasser, M., & Anderson, J. (2006). *Design as intended, design as enacted: External assistance providers and high school reform*. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Weinbaum, E. H., Supovitz, J. A., Gross, B., Cole, R. P., Weiss, M. J., & Ricalde, B. (2006). *Going with the flow: Communication and reform in high schools*. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

INTRODUCTION

Communication is the cornerstone of building professional community. It plays a vital role in supporting teachers when expectations for professional practice are changing. “Teachers are better able to sustain change when there are mechanisms in place at multiple levels of the system to support their efforts. This includes the presence of a supportive professional community of colleagues in the school that reinforces normative changes and provides continuing opportunities to learn” (Coburn, 2003, p. 6). One dimension of professional community can be measured by assessing the extent and distribution of communication in schools. In this paper, we shed light on communication patterns among staff in high schools. We illustrate existing communication patterns in schools engaged in various reform programs and assess the impacts of several variables, including the reform programs themselves, on social and professional networks in schools.

We situate this work in the research and literature around the concept of social capital, arguing that social capital is subject to construction and destruction caused by intentional and unintentional factors of school leadership, organization, structure, and reform. Furthermore, we believe that social capital, while not sufficient for the construction of professional communities, is a necessary part of, or precursor to, the development of such communities. We use social networks to study the communication component of social capital in schools in the three ways described below.

We have identified five external reform programs that seek to alter the practice and/or organization of teachers in 15 high schools. In each school, teachers completed a survey which, among other things, asked teachers to identify the co-workers to whom they turn for advice about a number of issues. These communication links create patterns. Through an analysis of these patterns, we illustrate the variation in the strength and structure of communication that exists at the school level. We then provide explanations for that variation based on our analysis of a number of school- and individual-level variables. In the final section, we present data to identify particularly influential individuals in schools and analyze their collective characteristics. Subsequent research will examine changes in the school communication over time and will consider the explanations for and implications of these changes. As a precursor to our description and analysis of the data, we review the literature that informed our study.

RESEARCH BACKGROUND

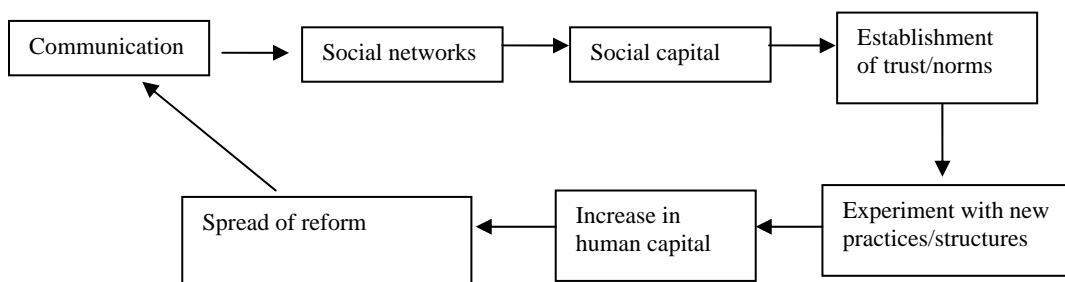
For many years, researchers and practitioners have bemoaned the isolation of teachers in their classrooms (Lortie, 2002). Isolation has been cited as a cause of stifled development of professional consensus, limited innovation, high burnout and turnover, and insufficient teacher learning (Rosenholtz, 1989; Dussault, Deaulelin, Royer & Loiselle, 1999; Eisner, 1992). “Separated by their isolated classrooms and tightly packed daily schedules, [teachers] seem resigned to the fact that they rarely work with colleagues on matters related to teaching and learning. This traditional structure and culture of teacher isolation stands in sharp contrast to the collective inquiry, reflective dialogue, and collaborative culture of the professional learning community” (DuFour, 1999, p. 61).

As a result, researchers have called for the creation of communities of practice with time allotted for communication among teachers and fora that allow for the open exchange of ideas.

McLaughlin and Talbert (2001) found that teacher communities can play an essential role in transmitting information and establishing organizational norms. Bryk and Schneider (2002) illustrate how effective social relationships among stakeholders in schools, which they call relational trust, can play a key role in school improvement. Relational trust is built through the number and variety of interactions and communication that take place in schools. Supovitz (2002) has shown that teachers involved in teams designed explicitly to encourage communication do in fact demonstrate significant positive differences in the way they feel about their school involvement, collaboration, and interaction with their peers.

All of this research points to the importance of communication in schools for the purposes of sharing information, establishing professional norms, building trust, and enabling the spread of reform (See Figure 1). Clearly, in this model, communication plays a key role in the scale-up and particularly the spread of reform, an issue of concern to the other papers in this set.

Figure 1.



The connections formed between individuals as they communicate to share and create knowledge for the aforementioned purposes are referred to as “social capital.” Many of the studies cited above could be said to speak to the need for and development of social capital in organizations. Social capital is an organically developed resource that exists within the relationships between individuals. It comes into existence when individuals attempt to use their connections with others to accomplish something that is of value to the initiating individual (Loury, 1977).

Social capital provides an important complement to two other types of capital that exist in organizations. Human capital – the skills and knowledge possessed by individuals – and physical capital – the equipment and resources available to be marshaled in pursuit of a particular goal – are the forms of capital most frequently discussed by economists in analyses of the ongoing work and potential of organizations. The human and physical forms of capital are more easily analyzed and quantified than social capital and, as a result, have received greater attention in research examining change in schools. For example, one can easily measure the number of staff members in an organization, their years of experience, attainment of particular academic degrees or mastery of certain skills (examples of human capital) and attempt to correlate it with changes in teacher practice or student performance. In a similar vein, it is relatively simple to assess the physical capital that exists in an organization by looking at the available equipment, funding, or the physical space in which an organization can operate. Social capital is more difficult to assess and quantify, but plays a role in an organization similar to these other two forms of capital. If social capital exists in sufficient quantity and with the appropriate

distribution, it “makes possible the achievement of certain ends that in its absence would not be possible” (Coleman, 1988, p. S98).

Researchers and theorists point to a large number of benefits that are to be gained from the construction of social capital within organizations or social sectors. Coleman (1988) identifies at least four ways in which social capital is useful. First, it *establishes a system of obligations and expectations* that connects people in an organization to each other. If person A is able to do a favor for person B, person A then gains credit with person B. Person A may “call in” this credit at a later point in time. This system of credits and debts makes it very clear who is connected to whom. Even those people who tend to hold more debts than credits are strengthened by the very tangible evidence that they are part of a social network, as opposed to outside of it. Participants in the system benefit from their connections to others regardless of the position they hold. Such a system inevitably leads to some individuals possessing greater influence in an organization than others. These may be people to whom debts are owed or people who are seen as possessing desirable or helpful information. As we will see in our data, the presence of a social system of exchange (information being the commodity exchanged in this case) is evident through an identification of individuals who regularly receive requests for advice. Such connections strengthen the webs in which social capital inheres. We do not suggest that teachers are actually accounting who owes what to whom. Instead, it is the concept of reciprocation and the unspoken understanding that reciprocation can be expected that binds the social network.

Second, the strong connections developed in the process of exchange that is described above can be used to *define social norms* within a community. Norms define those practices that are acceptable within a community and those that are not. The establishment of norms is an essential part of the “spread” of reform described by Coburn (2003). In order to scale up a reform within or across schools, schools must provide mechanisms for the “spread of underlying beliefs, norms, and principles” (p. 7). Development of social capital is one such mechanism to support this dimension of spread of reform by allowing teachers to feel supported when experimenting with new practices. Norms may be helpful to limit negative behaviors or encourage professional growth.² There are, however, a host of contextual factors that influence the communication between individuals and thus play a role in establishing norms of communication as well as the norms of practice in the organization.

When norms of practice are in flux, or are the target of change by an outside force, as is the case in this research, the relationships between individuals in an organization can be a highly effective mode for transmitting new information. *Transmission or diffusion of new information* is the third benefit of social capital identified by Coleman. The web of relationships that exist in an organization may have been created for any number of purposes – to secure a favor, pursue a political agenda, or as a result of a natural friendship affinity – but will serve people well when they need to acquire information. Pre-existing ties with others in the organization provide opportunities for access that otherwise may take more time and effort than some individuals are willing and/or able to expend. As a result of such ties, certain actors may be able to access

² Networks can be conservative as well as innovative. Networks can inhibit change if members become too entrenched in their norms of their practice. A strong network can stop change or endorse it (OECD, 2003; McLaughlin & Talbert, 2001). We are conscious of this point and are choosing to discuss those networks in which there is a desire to change and/or sufficient pressure for change.

information or advice not available through other channels. The use of social networks to disseminate information is highly correlated with the fourth and final of Coleman's uses of social capital, which is to *build human capital*. Individual capability is increased, in part, through fruitful interactions with others. Through connections with others in an organization or community, individuals are able to enhance their own knowledge and skills in a particular area. This strengthens their own positions as well as the organization's social capital. The success of social capital depends in part on the expertise possessed by the individuals involved in the relationships in which social capital inheres. Human capital then is both necessary for, and is enhanced by, functioning social capital in an organization.

As mentioned above, social capital in an organization facilitates the flow of information and increases the likelihood that individuals will turn to one another for professional advice. This means that social networks – in contrast to traditional hierarchies, or formalized dissemination procedures – may be the most mobile and potentially reactive form or system within a large organization to deal with a changing environment. While individuals may learn new information or a new approach and theory in a traditional setting, networks are required for the psychological support system that reduces the isolation of innovators and innovative groups and makes their efforts more sustainable and more likely to spread through the organization (Agapitova, 2003). In addition, the theoretical and even practical information about new practices or objectives is rarely sufficient to encourage innovation. Individuals expected to innovate need to be connected to networks that can provide the types of tacit information that is almost exclusively gained through experience and experimentation. A teacher will be more likely to use and sustain a reform if s/he has colleagues to whom the teacher is connected through a communication network who use and discuss the reform. While formal professional training is clearly needed, at least one report has argued that access to tacit knowledge from peers and colleagues may be necessary in order to fully understand and employ the codified knowledge shared in more formalized settings (OECD, 2003). Brown and Duguid (1991) argue that networks of professionals essentially complete the body of knowledge needed to maintain practice. This is particularly true when the expected practice represents a departure from traditional practice.

This study paper investigates social capital and its role in high schools in a new way. In our research, social networks serve as evidence of a condition necessary (though not sufficient) for the construction social capital. Networks have been defined as “open structures, able to expand without limits, integrating new nodes as long as they share the same communication codes (for example values or performance goals)” (Castells, 1996, p. 470). For researchers in a number of arenas, these networks have been used to shed valuable light on how communication flows in an organization. Careful analysis of social networks in schools allows us to identify variables which may impact the development of social capital in organizations. We examine social networks in schools engaged in reform as the reform context elevates the importance of networks for the flow of information.

While educators have studied social capital in schools, and network analysts have studied communication, social network analysis in schools has limited history. However, this method holds much promise for understanding the mutual and overlapping impacts of school leadership, organization, reform, and communication.

In order to assess the impacts of schools, individuals, and reform strategies, and the implications they may have for reaping the benefits of social capital that Coleman describes, in this study we ask: What do communication networks look like among teachers and staffs in high schools? What organizational and individual characteristics impact communication patterns? Because we are studying high schools that are engaged with external change agents of various types, we pay special attention to how the reform strategies impact communication. Finally, we provide some insight, based on our network analyses, about the characteristics of influential individuals in school networks. Before presenting our data, we identify and describe those variables considered in our analysis.

Organizational strategies influence social capital

The concept of social capital assumes that individuals are neither totally independent actors, nor are they cogs in an organizational machine over which they have little power. Instead, the concept of social capital combines these two ideas and recognizes individuals' locations within a larger social context as well as their individual agency and self-interest.

Because social capital exists between individuals within organizations, its development can be facilitated or obstructed by the systems, structure, and routines of the organization itself. Organizational structures that provide people with opportunities to interact with each other have been shown to support the development of social capital (Coleman, 1990).

In high schools, research has documented that teachers have established norms of autonomy which frequently prevent them from being connected to networks that may be of use (McLaughlin & Talbert, 2001). Several high school reforms have attempted, through changes to the organization of schools (including those introduced by two of our reforms), to allow better connections between teachers and increase the amount of professional communication in high schools. In our research, two of the five reform programs being studied, First Things First and High Schools That Work, make explicit use of the organizational structure to catalyze new patterns of communication in their effort to improve teacher practice and student achievement. Two others, Penn Literacy Network and SchoolNet, attempt to make use of pre-existing communication patterns in high schools to spread their practices. The final reform, Ramp-Up, generally does not view spread of the reform as a primary goal and thus has relatively little use for the concept of social networks. Given this difference in the ways the reforms view social networks, we will focus our analysis heavily on the two reforms which attempt to make explicit use of social networks in their reform efforts (i.e. First Things First and High Schools That Work).

However, it has also been established that structural decisions alone do not result in instructional changes (Elmore, 1995), and we do not contend otherwise here. Instead, we seek to investigate the impacts that structure has on communication, arguing that it is the communication that will begin to change the knowledge, experiences, values, and norms that significantly impact changes in teacher practice. Structural changes such as common planning periods, interdisciplinary teacher teams, and rearrangement of classroom locations have been implemented in some schools to stimulate communication among staff members and build social capital. While in some cases these rearrangements have allowed individual teachers more frequent access to their peers, they have infrequently resulted in the development of new and lasting social networks that

form the basis of social capital. We are searching for evidence of those social networks and the factors that influence them.

Researchers have identified a number of factors that influence *where and how* social networks develop within organizations. This question of which school factors influence the distribution of social networks consumes the bulk of our attention in this paper.³

Chief among the factors that influence the development and distribution of social networks is a tendency toward homophily – associating with individuals with whom a person shares particular characteristics. It is likely unsurprising that analyses of social relations confirm that people socialize within their zones of comfort and familiarity. Though the probability of such homophilous relationships has changed somewhat over time, it continues to hold true in most cases. Though homophily is based on shared individual characteristics, certain factors that create homophily can be manipulated by school leaders. Independent choices about the people with whom teachers communicate may be guided to some extent by the structure of the organization in which they work. Groups of people may then be attracted to each other as a result of this “induced homophily” (McPherson & Smith-Lovin, 1987). We identify and consider the effects of four organizational variables that have the potential to cause induced homophily. Those variables are: shared membership in an academic department, shared membership in a small learning community or planning team, shared free or lunch periods, and close physical proximity of teachers’ primary classrooms. Each of these variables has a basis in previous research as well as having been a component of high school reform efforts.

Shared membership in departments or teams

In high schools, academic departments and other organizational configurations that encourage team-based decision-making have been shown to improve communication and collaboration (Supovitz, 2002). The academic department, perhaps the most common organizational feature of the American high school, has often been touted as the foundation for professional communication networks (Stodolsky & Grossman, 1995; Siskin, 1994).⁴ Interdisciplinary teams (e.g., small learning communities and planning teams) have also been used as a strategy to build more communication throughout the school, breaking down the teacher isolation that is often cited as a limiting factor in school reform.

Shared free periods

If teachers are to begin to communicate about issues of professional concern, there has to be time for that during the school day. A third strategy – in addition to establishing departments and

³ There is also a set of organizational features that have been shown to impact social networks that are somewhat less amenable to administrative control, but are worth mentioning for consideration for future studies about the impacts of organizational variables on professional communication in schools. In addition, they are variables that went unexamined in this study but should be kept in mind as possibilities that may help to explain the amount or extent of social networks in the schools. Unlike the variables that we identify and investigate, which provide explanations for the *distribution* of social networks in schools, organizational variables such as shared ideology, stability of staff, and interdependence of staff members on each other for advice and support influence *how much* communication is likely to be generated in an organization.

⁴ Somewhat in contrast to this, our own earlier research has shown that departments in many high schools serve little professional function beyond the most basic of administrative tasks (Gross & Goertz, 2005).

interdisciplinary teams - that has been cited as potentially increasing the social capital in high schools is the creation of common planning times (Louis, Marks, & Kruse, 1996; Warren & Muth, 1995). Sometimes this time is carefully structured by school leaders while other times it is left open for teachers to use as they see fit. For this reason, we included the presence of a shared preparation or lunch period among the variables potentially creating a condition of induced homophily.

Shared physical location

Physical proximity has also been shown to foster the type of relationships that contribute to social networks. “Employees tend to develop informal relationships with others who work close to them” (Brass, 1985). And because “the more frequently persons interact with one another, stronger their sentiments of friendship for one another are apt to be” (Homans, 1950, p. 133), it is likely that individuals working in proximity with each other will become friends. Because people who are friends are likely to discuss professional issues (Frank, Zhao & Borman, 2004), it is likely that physical proximity in schools will lead to developing professional relationships.

Titular leaders

In addition to the four homophily variables described above that can be shared among staff, we also believe that the organization and designation of formal leadership in schools plays a role in the construction of communication networks and social capital. The official organization of schools endows certain individuals with leadership credentials through the use of titles and authority over human and physical resources. The hierarchical organization of most high schools (and most institutions of any sort) results in the designation of some people as resources for staff. Administrators (e.g., principals, assistant principals, school improvement facilitators and coordinators, coaches), subject department chairs, and individuals designated as resources by a reform program stand somewhat apart from the rest of the faculty as a result of their acquisition of an additional title and a slightly different set of responsibilities.

Our methods (described in detail in the Methods section) allow us to assess the impact of each of the school characteristics detailed above that are policy amenable. By controlling for each variable in a series of mathematical models, we identify those variables with particular influence. This early stage of the research will allow school policymakers to consider the impacts on teacher communication of various organizational strategies. Understanding how organizational characteristics impact teacher communication is a first step in building professional community and norms aligned with school reform efforts.

As mentioned at the outset, the concept of social capital recognizes not only the organizational surroundings which play a role in determining communication patterns, but also recognizes the attributes and agency of individuals themselves. Though we are heavily focused in this work on the impacts of school organization as it has been described above, we do want to consider the effects of individual characteristics on both organizational and individual social capital.

Individual factors influence social capital

As noted above, the concept of homophily plays a considerable role in influencing interpersonal communication in many settings. For example, research has shown that people of similar education levels, income levels, and occupational categories are significantly more likely to

socialize with each other than are people without these qualities in common (Garrison, 1979; Curtis, 1963). Above, we discussed *induced* homophily, those characteristics that can be assigned to individuals through manipulation of the organization. However, individuals and groups may also affiliate as a result of “*choice* homophily,” affiliation with “others who view the world in the same way” (Ridgeway & Smith-Lovin, 1999, p. 210).⁵

While the characteristics subject to induced homophily often foster communication networks around issues of professional and organizational concern, choice homophily will often lead to friendship. Friendship relations, also known as expressive connections, originate out of mutual support and are not necessarily related to professional concerns (Ibarra, 1993). Several researchers have argued that the expressive connections tend to be stronger, more durable, more trusting than relationships constructed for more professionally oriented, or instrumental, purposes (Uzzi, 1997; Ibarra, 1993). Expressive connections are also likely to influence choices made in the instrumental arena. Researchers have found that people are likely to turn to those with whom they have friendship relationships when seeking professional advice (Frank, Zhao, & Borman, 2004). Thus, it is important to understand friendship connections in an organization as a factor that may influence professional communication. In our work, expressive connections are manifest in the friendship networks among staff, while the more clearly goal-oriented instrumental networks, are manifest in the multiple professional networks for which we have data.

The factors of choice or induced homophily, as well as the other organizational factors discussed above, play a role in determining who each individual chooses to approach for advice about different areas of their professional and personal lives. The more requests for advice that a person receives (or “in-ties”), the more potentially influential that person may be within the organization. By examining the particular people who are influential in an organization, regardless of their position, we can characterize the traits associated with those who play influential roles within organizations. Some of this influence will likely be explained through the organizational and individual factors mentioned above (e.g., formal leadership titles, social connections, etc). However, in our analysis, we will look across schools to better understand patterns of influence and the characteristics of those influential individuals.

These findings are important because the “attractors” of communication ties strengthen social capital in the first of the four ways identified by Coleman (1988) by establishing a system of obligations or expectations about expertise. They possess information that others wish to access and, in so doing, create a network of ties that bind people one to another. The distinction about whether such attractors are individuals in formal leadership positions or whether they are individuals who have not been formally identified as resources is important for several reasons. One of the ways that organizations sometimes try to preserve social capital in the face of staff turnover is to inhere authority and expertise in a *position* rather than in a *person*. In this way, if an individual serving as a department chair leaves, others will continue to view that position (and

⁵ Qualities related to choice homophily are much harder to identify and are not subject to analysis in this study. Such qualities often help to explain why people become friends and may include attributes such as affect and demeanor as well as life experiences, political affiliations, and professional interests. Immutable characteristics such as race and gender have also been shown to play a role in choice homophily as well (Ridgeway & Smith-Lovin, 1999; Verbrugge, 1977).

the new person occupying it) as the seat of knowledge and authority and the organization's social capital will suffer less disruption. If this strategy is to succeed, formal leadership positions must be recognized as sources of information. However, if individuals without formal leadership positions are seen as important resources, we may be able to identify attributes of such people that would help schools to build the type of social capital discussed above. Thus, the presence of such influential individuals can strengthen both individual and organizational social capital.

Distribution of social networks

Coleman (1990, 1998) argues that the benefits of social capital are most likely to be realized when there is "closure," or close connections between all actors in the system. Coleman states that close relations between actors will build trust and trustworthiness in the system, will strengthen organizational norms and expectations, and will provide multiple paths for the transfer of information. Closure, Coleman argues, allows individuals in a system to build particular reputations upon which social capital depends and is developed. In a more open system, or one with separate sub-groups or "cliques," it is difficult for anyone to build a reputation and to create positive and productive relationships.

"The probability that 'whatever it is' will flow from person i to person j is directly proportional to the number of all-positive (friendship) paths connecting i and j and inversely proportional to the length of such paths" (Davis, 1969, p. 549). Bridges, links that create more and shorter paths between people, increase the probability that new practices will flow to all parts of the organization. Bridges which span cliques can play a vital role in maintaining the types of connections to leaders that are described above as being important in creating trust and norms in an organization and allowing it to respond more quickly and with more fidelity to the guidance of leaders (Granovetter, 1973).⁶ When we look at the distribution of ties in our data in a subsequent section, it will become clear that certain patterns may allow information to flow throughout a school while other patterns will make such an eventuality much more difficult.

Because this study is interested in organizational social capital as it exists in the service of development of human capital (as evidenced by compliance with external reforms), we are particularly concerned with those arrangements of social capital that are most likely to benefit the organization. This macro-organization analysis and assessment of social capital is a relatively new way to consider the role of social capital in organizational learning. Because we are looking at the ways in which new ideas move through a whole organization, rather than the particular characteristics of individuals who implement (or fail to implement) the reforms, this perspective is more appropriate for our study.

RESULTS

The survey instrument that was used to obtain data about the schoolwide networks included five network questions, three of which focus on instruction, one on friendship, and one on communication about the provider. The table below describes these five networks.

⁶ Where bridges extend the distance between person i and person j , they do not improve the network. The more extended the number of steps between the influential individual and those seeking advice, the greater the possibility for the message to be distorted or the influence of the individual to be distorted. This is particularly true in larger organizations with more extended connections (Bidwell, Frank, & Quiroz, 1997).

Table 1.

Network label	Explanation	Group
Friendship	Discuss family, home, and/or personal issues	Friendship
Classroom Management	Seek advice about classroom management strategies	Professional
Curriculum	Seek advice about course content coverage and pacing	
Low Performers	Seek advice about assisting low performing students	
Provider	Seek advice about using the strategies advocated by the reform program in use	Provider

For each network question, respondents were prompted to name the individual from whom they sought advice, the frequency with which advice was sought from this helper and the level of influence of advice from this person. There was space for respondents to list up to five names for each network.⁷

Our data show a great deal of variation in the social networks that exist in high schools. Both between and within schools there is variation in the density and strength of networks (i.e., the number and influence of communication ties among staff) as well as the distribution of the networks (i.e., the way in which the ties are arranged). Below, we provide some examples of the variation in density, strength, and distribution of networks. Following this illustration, we analyze the data using the variables identified in the previous section. These variables allow us to explain, in part, the variation that is described below.

VARIATION IN NETWORK DENSITY

Let us first look at variation in network density. The measure of density that we report below, the average number of out-ties per survey respondent, is easily comparable for teachers across schools.⁸ The number of individuals from whom each survey respondent reports seeking advice – what is referred to as out-ties - is a relatively straightforward measure and is reported in the table below. The values in the table equal the average number of out-ties per respondent for a particular school and network. In our survey, it was possible to identify a maximum of five out-ties per respondent.

⁷ Limiting the potential responses to five colleagues may seem limiting. However, few of our respondents provided even five names, suggesting that the limit did not constrain the potential information. Only 15% of respondents provided either four or five names.

⁸ While we could use the more formal measure of network density that looks at the percentages of potential ties that are actualized, that makes it difficult to compare between schools, because given a limited number of possible responses to any of the network questions, it tends to report lower density percentages for larger schools, where similar numbers of conversations may be happening in all schools.

Table 2.

Average Out-Ties Per Survey Respondent in Five Networks

School	N	Curric	ClassMgmt	LowPerf	Friend	Prov	School Avg.	3-school average by Provider
FTF1	113	2.24	2.76	2.35	3.28	1.12	2.35	2.05
FTF2	38	1.82	2.18	1.61	2.03	1.47	1.82	
FTF3	134	1.98	2.26	2.03	2.57	1.04	1.98	
HSTW1	65	2.29	2.65	2.08	3.46	1.45	2.38	2.19
HSTW2	75	2.28	2.80	2.17	3.75	1.31	2.46	
HSTW3	52	1.13	1.98	1.83	2.48	1.25	1.73	
PLN1	60	2.20	2.50	2.50	3.78	0.25	2.25	2.10
PLN2	47	1.87	1.77	2.26	3.23	0.38	1.90	
PLN3	84	1.81	2.55	2.27	3.06	1.07	2.15	
RU1	27	1.30	2.30	1.41	2.41	0.30	1.54	1.80
RU2	67	2.12	2.16	1.94	2.99	0.70	1.98	
RU3	34	1.79	2.09	1.56	3.38	0.62	1.89	
SN1	41	1.12	1.68	1.51	2.71	0.71	1.55	1.67
SN2	165	1.71	2.02	1.44	2.39	0.41	1.59	
SN3	54	1.89	1.80	2.04	3.20	0.35	1.86	
Network Avg.		1.84	2.23	1.93	2.98	0.83	1.96	

N=number of surveys completed

The table above can be read in the following way: In FTF1,⁹ during the 2004-2005 school year, teachers sought advice from an average of 2.24 people in their school regarding course content and pacing. Looking at the column labeled “school avg.,” it is clear that teachers in some schools (FTF1, HSTW1, HSTW2, PLN1) report having conversations, regardless of topic, with more people than in other schools (RU1, SN1, SN2). Though the range is relatively small (with not even one person separating the lowest and highest), teachers in some schools identified more people from whom they sought advice or to whom they spoke socially, than did teachers in other schools.

We should also point out that the whole school reforms (FTF and HSTW) generally have much higher scores in the provider network than do the other schools. These schools average twice as many people cited for discussion about the reform than do the schools using the other three reforms. It is also true that schools using FTF or HSTW generally report more discussion about curriculum and classroom management as well. We will discuss reasons for this increased communication in a subsequent section of this paper.

The bottom row of the table makes clear that on average (as well as in 14 out of the 15 schools) respondents identified the largest number of people with whom they have conversations in the friendship network. Teachers across our 15 school averaged almost three people with whom they regularly “hang out.” This indicates that teachers are more likely to talk with colleagues about social concerns than they are to solicit advice from them about professional issues. The

⁹ All school names are pseudonyms that follow the same pattern: The letters indicate the provider with which the school is working and the number indicates whether the school is in its first, second, or third-plus year of the partnership.

network in which teachers named the second most number of colleagues from whom they seek advice was the classroom management network.

The network in which teachers reported the fewest conversations with colleagues was the provider network. In 14 of the 15 schools, teachers talked to fewer people about the strategies of the particular reform program being used in the school than they did about anything else. While this may not be surprising for some of the reforms that seek only to involve a limited number of staff members, it is somewhat surprising in those schools using reform programs meant to involve all teachers. Looking at the schools grouped by reform program, it is clear that teachers in those schools using whole school reforms (FTF and HSTW) report more reform-oriented conversations than teachers in schools with more narrowly targeted reforms. SN is the exception to this pattern, as it is meant to be used by all teachers but has not managed to encourage significant numbers of conversations about its program.

VARIATION IN NETWORK STRENGTH

While the measure of network density discussed above provides a rough picture of the amount of conversation occurring in schools, the *number* of people to whom a teacher reached out only tells part of the story. In an effort to incorporate the frequency and influence of the conversations that teachers initiate, we created a formula to assess the “strength” of communication networks. In our model, the strength of a network is composed of the number of individuals from whom each survey respondent reports seeking advice, the frequency of the conversations that the respondent reports having with each other person, and the influence that these conversations have on the respondent’s practice in a particular area. Said differently, a strong network has many people soliciting advice from a large number of colleagues and they find the advice that they receive to have considerable influence on their practice. In practical terms, this is a measure of the amount of meaningful conversation taking place around a given topic. Table 3 below shows the range in network strength in our 15 study schools. The values in the table are a scaled measurement of the average number of influential conversations that survey respondents reported having in areas of curriculum, discipline, assisting low performing students, and the reform being used in the school.¹⁰ The scale that was used has a minimum value of zero and a maximum of 25. (A fuller explanation of the formula used to derive these values can be found in the methods section.)

Table 3.

Average Network Strength Per Survey Respondent							3-school average by Provider
School	N	Curric	ClassMgmt	LowPerf	Prov	School Avg	
FTF1	113	6.10	7.27	6.16	2.97	5.63	4.98
FTF2	38	4.39	6.07	3.93	4.52	4.73	
FTF3	134	5.05	5.53	5.17	2.55	4.58	
HSTW1	65	6.38	6.85	4.97	3.92	5.53	4.88
HSTW2	75	6.50	6.07	5.32	3.22	5.28	
HSTW3	52	2.93	4.51	4.24	3.71	3.85	
PLN1	60	5.70	5.49	6.05	0.59	4.46	

¹⁰ The friendship network is not included in this table because there is no measure of “influence” in our question about friendship ties.

PLN2	47	6.18	4.60	5.11	0.75	4.16	4.54
PLN3	84	5.11	6.76	5.49	2.69	5.01	
RU1	27	3.13	5.40	3.41	0.80	3.19	3.79
RU2	67	5.34	5.14	4.53	2.10	4.28	
RU3	34	4.71	5.24	3.97	1.67	3.90	
SN1	41	2.34	3.54	3.25	1.70	2.71	3.23
SN2	165	4.91	4.79	3.42	0.68	3.45	
SN3	54	5.17	3.79	4.61	0.55	3.53	
Network Avg		4.93	5.40	4.64	2.16		

From the table, we can see that the strength of networks ranges from a low of 0.55 in the provider network in SN3, where there is very little meaningful conversation being conducted around the reform model to a high of 7.27 in the case of the classroom management network in FTF1. In fact, in 12 out of the 15 schools, the classroom management network had the strongest ties. This makes clear that managing disruptive students is a very salient concern for teachers and one in which they frequently seek and use advice from colleagues.

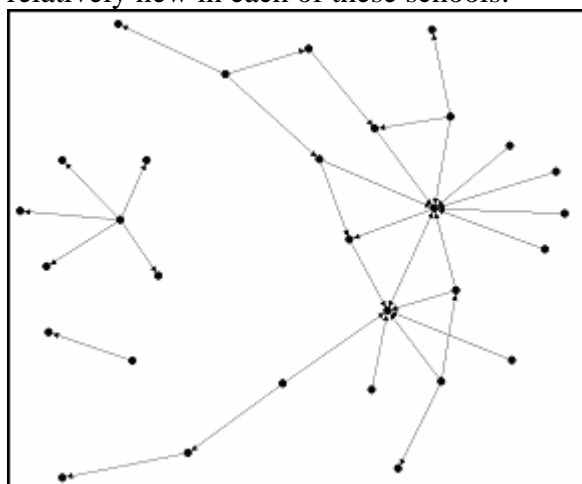
Even within a given school, network strength can vary widely. In PLN1, there is a great deal of conversation about classroom management, but very little conversation about the reform that has been introduced. Even setting the provider network aside (because there are different program design reasons for differences in communication around these reforms), variation among the networks in schools is evident. For example, as we saw with the number of conversations, communication in the classroom management network is frequently more robust than conversation in other networks. Interestingly, curriculum is the second strongest. This may appear to run counter to previous CPRE research (Gross & Goertz, 2005) that found little quality conversation about curriculum. However, it is important to remember that the numbers above are out of a possible maximum of 25. Thus, while it is informative to look at the relative strength of conversation around various areas of concern for teachers, none of these scores point to a tremendously strong communication network.

Comparing Tables 2 and 3, we can see that while people may identify relatively few people as resources for advice, (small number of out-ties reported in Table 2), those conversations that do occur can be frequent and influential. For example, while RU1 has the smallest average number of out-ties in the provider network, it has a *stronger* provider network than at least four other schools. This can be attributed to the fact that there are a limited number of individuals to turn to for advice about the provider, but those people are accessed with considerable frequency and have meaningful influence over the practices of the people who seek them out. As a result, the connections that do exist are stronger than the more numerous connections in some of the other schools. We can also see that the overall averages for each reform provider follow a somewhat different pattern when we look at strength versus out-ties. For example, FTF shows the strongest networks overall, though it did not show the highest average number of out-ties. This indicates that while there may be relatively few *sources* of advice in some of these schools, these people are quite influential for many teachers. This comparison makes clear the value of looking at these two different measures (i.e., average out-ties and network strength) as ways to assess communication among high school faculties.

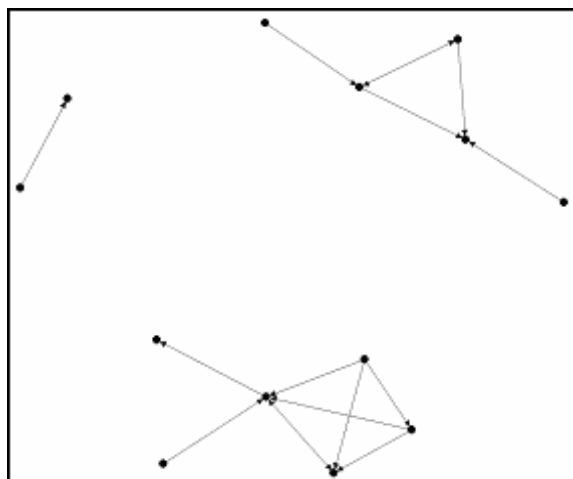
VARIATION IN NETWORK DISTRIBUTION

While the tables above demonstrate considerable variation in the density and strength of communication networks in schools, graphical representation of the networks provides insight into both the number of ties in various networks as well as the ways in which the networks are distributed throughout the schools. We present evidence of this variation first looking at variation in terms of the network density and then looking at networks with similar densities but with very different distributions of ties. In the sociograms¹¹ below, each dot represents an individual. The arrows between them represent requests for advice that emanated from one person and were addressed to the people on the receiving end of the arrows.

Looking at two schools of similar size (below), we can see that communication around a particular domain, such as implementing a new reform program, can be relatively robust in one school (SN1) and very weak in another (PLN1). The images below illustrate how different this network looks in two different schools. These are both using reforms that try to take advantage of existing networks rather than creating new structures to encourage communication. Though neither of these schools scored very highly in terms of the strength of their provider networks (when compared with some of the whole school reforms), the images make very clear the difference in the number of people involved in conversation about the reform efforts, still relatively new in each of these schools.



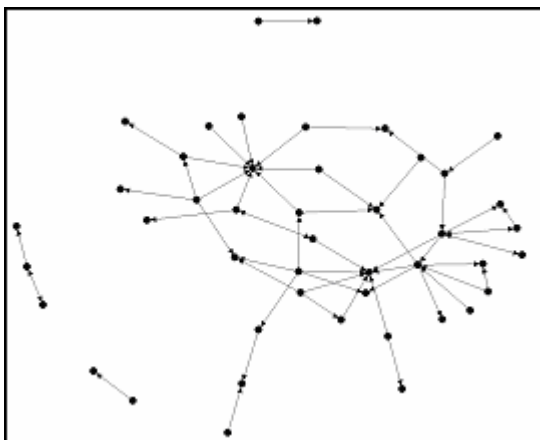
SN1 Provider Network



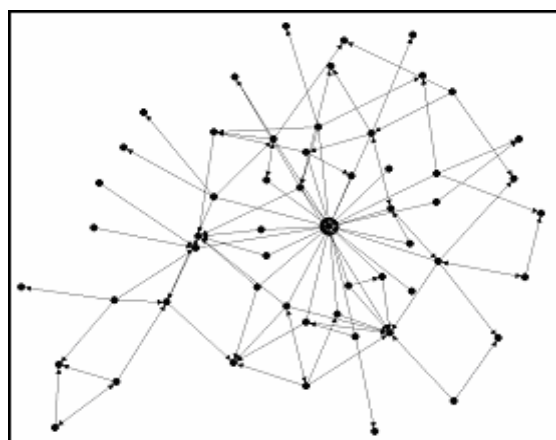
PLN1 Provider Network

Even within a single school, communication around different issues may vary widely in terms of the number of communication ties that exist. For example, in HSTW3, there is ample communication about classroom management, but very little communication around course content and pacing. (It is worth noting that there are no subject matter departments at this school, undoubtedly limiting the amount of curricular discussion that is taking place.) The two images below illustrate the within school variation between networks in terms of the numbers of ties.

¹¹ A graphical representation of the relationships or communication ties between individuals.



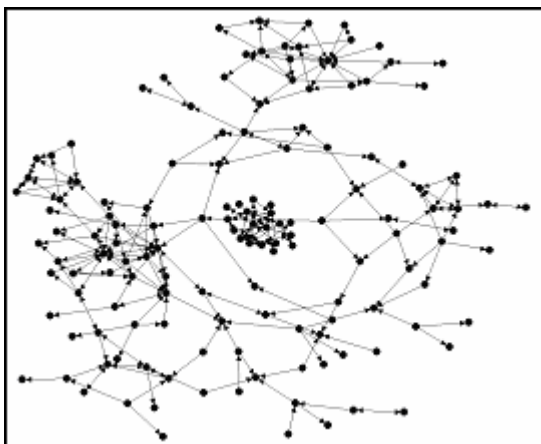
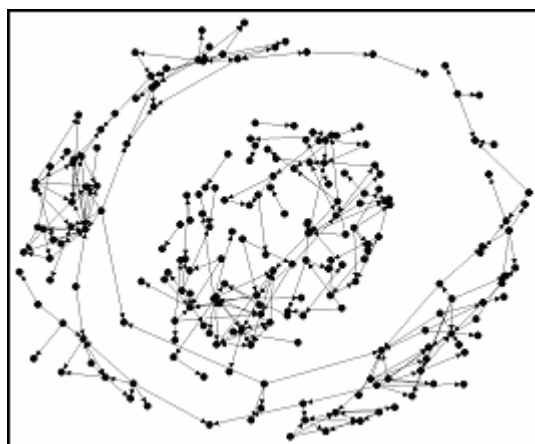
HSTW3 Curriculum network



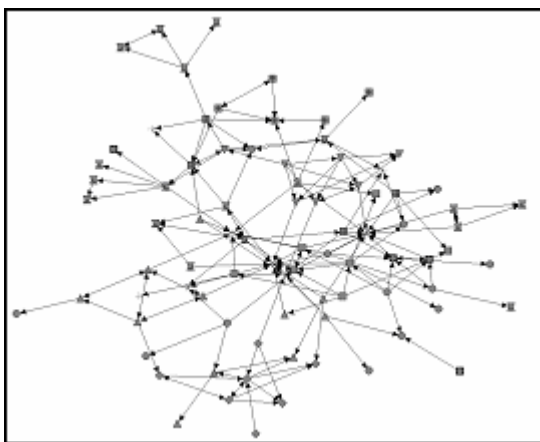
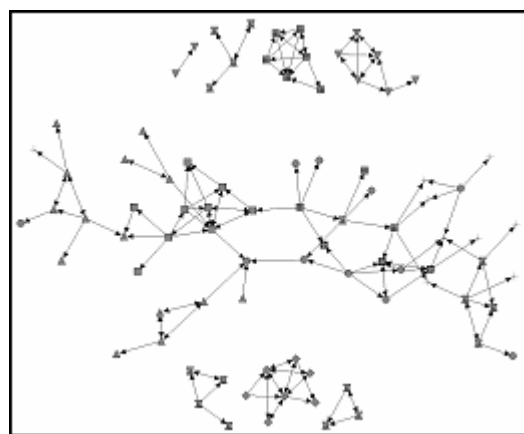
HSTW3 Classroom management network

Also evident from the picture is the different patterns in communication. The casual viewer can see that the classroom management network, while having more communication paths, is also much more centralized around a few individuals. This raises the issue of how ties are distributed among school staffs. Beginning here and for much of the remainder of this paper, it is the distribution of communication ties on which we focus our attention.

As with the *density* of networks, the patterns of *distribution* of ties can also vary within and between schools. The patterns of who talks to whom may be very different due to a wide variety of factors. For example, in two different schools, there is a very similar level (in terms of number of out ties or network strength) of conversation around course content and pacing (FTF3 and SN2). This similarity is reflected in the tables above that indicate average out-ties and network strength. These two schools could be said to have similarly “strong” curriculum networks and the numeric representations could lead one to believe that these two schools have similar curriculum networks. However, an examination of the sociograms for the two schools (below) illustrates two very different distributions. In one school (FTF3), curriculum conversation is spread throughout the school while in the other (SN2), we can see two discrete subgroups, one clustered within the other, with almost no connections between them. The similar number of ties is distributed in a unique pattern in SN2 due to the design of the physical environment and placement of teachers. In this school, the physical separation of grade levels has led to a near total absence of communication between the two groups. This difference illustrates varying distribution patterns in the social networks and illustrates the necessity of examining not only quantitative data but graphical data as well. This is just one example of how two schools, rich in communication in a particular domain (curriculum, in this case) may be structured in very different ways. It also provides very tangible evidence of how one of the homophily variables, shared physical location, can impact communication.

**FTF3 Curriculum network****SN2 Curriculum network**

Even within the same school, similar overall tie strength may be distributed quite differently. For example, in HSTW1, the networks for classroom management and the one for course content and pacing (labeled “curriculum”) look quite different in spite of the similar numbers of ties.¹² The classroom management network is spread throughout HSTW1 in no apparent pattern, though there are a few individuals who clearly receive many requests for advice. (We will talk more about the characteristics of the people who appear to be popular resources in this particular network in a subsequent section.) The ties that exist connect all staff members through more or less direct routes. In contrast, the curriculum network is departmentally based. As the sociogram clearly illustrates, in the curriculum network several departments are entirely disconnected from people in other departments. While this may not be particularly surprising given the departmental nature of curriculum in high schools, it certainly undercuts any interdisciplinary planning or coordination, one of the ideals of the whole school reform with which this particular school is involved. As this network has no ability to span departments, it limits the potential uses for this network in spreading other information or practices school wide.

**HSTW1 Discipline network****HSTW1 Curriculum network**

¹² In the images below, different shapes of the nodes (each representing one individual) represent different departmental affiliation.

Clearly, the varying density and distribution of networks has a meaningful impact on communication in the school. Networks with few ties provide little hope that a set of norms or expectations can be spread through a school. There is little potential for human capital to be built beyond those few individuals who possess it. In networks like the HSTW1 curriculum network pictured above where departments have strong networks among them but no bridges to connect them, it will be possible for departments to develop strong, if differing, norms and expectations. In these cases, there will be little hope of generating school-wide norms or of leveraging knowledge and skills that may reside in one department but not others.

Networks or schools with a few primary influential leaders have a communication pattern that is very dependent on a few individuals (e.g., the HSTW3 classroom management network above). Some proportion of the faculty in these cases will be closely connected to these influential leaders and will thus be quite likely to employ practices espoused by those individuals. However, as the distance between the influential individual and other teachers grows, there is a decreasing likelihood that the message or guidance will be heard. In the example referenced above, some teachers are as much as five steps away from the primary receiver of in-ties in that image. These teachers at such a distance depend on a large number of bridges to receive the guidance of the primary influential individual. The absence of any one of these bridges could lead to teacher isolation.

Networks like the FTF3 curriculum network, pictured above, with a large number of fairly well dispersed ties are more likely to develop coherent and aligned norms and practices. However, even in cases like these, there are a few essential bridges without whom the school would have discrete and unconnected cliques.

ANALYTICAL METHODS

In order to examine the reasons for the type of variation in network density, strength, and distribution that we document above, we have relied on social network analysis. Social network analysis “is a recent set of methods for the systematic study of social structures” (Degenne & Forse, 1999, p. 1). This method, rather than a standard regression or more traditional variable analysis, is needed to measure social capital because of the “relational” nature of network data (Scott, 1991). Relational data implies that there is something about the relationships between the individuals that is the primary concern, rather than the individuals themselves. Social capital, as stated above, is not about the characteristics of individuals themselves though this can certainly impact the development of social capital.

In order to capture social network data, a survey was administered to all teaching staff (non-teachers were not included) in a school at a school-wide faculty meeting. Follow-up surveys were sent to all teachers that did not complete a survey and lists were sent to administrators seeking their help in order to garner high response rates. The table below provides response rates for each school.

Table 4.

School	Number of Respondents	Number of Teachers	Response Rate
FTF1	113	138	81.9%
FTF2	38	60	63.3%
FTF3	134	151	88.7%
HSTW1	65	89	73.0%
HSTW2	75	95	78.9%
HSTW3	52	67	77.60%
PLN1	60	101	59.4%
PLN2	47	55	85.5%
PLN3	84	100	84.0%
RU1	27	32	84.4%
RU2	67	98	68.4%
RU3	34	57	59.6%
SN1	41	55	74.5%
SN2	166	280	59.3%
SN3	54	90	60.0%

For each network question, respondents were prompted to name the individuals from whom they sought advice, the frequency with which advice was sought from this helper and the level of influence of advice from this person. There was space for respondents to list up to five names for each network. The responses to the frequency stem “... how often have you sought guidance from this person?” were on a 4 point scale (recoded to represent an approximate number of days in a school year: “Daily or almost daily” = 150, “Once or twice a week” = 40, “Once or twice a month” = 20, “A few times a year” = 2). The responses to the influence stem of “How influential is the advice...” were also on a 4 point scale (operationalized to represent the proportion of influential conversations with respect to the respondent’s practice: “Highly Influential” = 100%, “Influential” = 70%, “Slightly Influential” = 40%, “Not influential” = 10%). Due to the fact that the survey respondents were able to associate a frequency and a level of influence with the request for help, strength of the relationship was built into the survey, and thus, the ties between individuals could be transformed to contain a measure of strength, and not just a binary indicator of whether or not there was communication between a pair.

To utilize all of the survey data, we combined the frequency and influence measures by multiplying the respective recoded scores, and then taking the natural log of the result (Frank, Zhao, & Borman, 2004). A constant was added to the product before the logarithm in order to produce positive results. The logarithm was performed to reduce the positive skew of the frequency-influence product. The final weighted tie-strength metric took on 16 unique values, all in the [1,5] range. Non-communication was assigned a weight of 0.

These measures allowed us to ascertain an average value for the organizational strength of each network as well as the individual strength or influence of each actor in the organization. Each individual in the network was associated with an “influence” score, by summing the weighted in-ties to that individual. As a result, each individual’s influence score for each network is a function of the responses of everyone else in the school, and is thus a proxy for peer-endorsement of influence.

In order to assess the influence of each variable on the communication that we described using the process above, we analyzed the social network data. Social network data is a collection of the ties between the n nodes/actors in an organization. For the purposes of our analyses, the values of the relational tie emanating from actors i and received by actor j will be the variable y_{ij} , where $y_{ij} = 1$ if actor i writes actor j 's name, and $y_{ij} = 0$ otherwise. Our survey instrument allows for valued relations, but for the sake of simplicity, we chose to treat all ties as binary in the first stage of our analysis. The collection of all possible y_{ij} pairs for all n actors in the organization is called a sociomatrix (Wasserman & Faust, 1994). In our data, this sociomatrix is not symmetric, as actor i 's indication of a request for help of actor j does not necessarily imply that j requests help from i . A reciprocal relationship is never assumed; only indicated where both parties state that they request advice from the other.

To establish the social context of a school, the network response variable y_{ij} becomes the outcome of interest, under all possible sender-receiver combinations. We are interested in identifying which organizational variables are associated with the presence ($y_{ij} = 1$) or absence ($y_{ij} = 0$) of communication for the school. As such, attribute data were collected about the actors in the network. Actor attribute data including department and small learning community (SLC) membership, titular authority (department chair, SLC chair, administrator), free period and classroom location were collected in order to create a series of individual and dyad level predictors for y_{ij} . As such, vectors of sender and receiver attributes (a_i and b_j respectively) could be created, as well as vectors of common sender-receiver paired attributes (x_{ij}). For the purposes of our analysis, we were only interested in the homophily (x_{ij}), and the receiver (b_j) attributes, as described above.

The following dyad homophily variables (and their definitions) were used in the analysis:

SameDept _{ij} = 1 if i and j are in the same department, 0 otherwise.

SameSLC _{ij} = 1 if i and j are in the same small learning community (or focus team, if applicable), 0 otherwise.

SharedFree _{ij} = 1 if i and j share a free prep or lunch period, 0 otherwise.

Adjacent _{ij} = 1 if i and j have neighboring rooms (within immediate walking distance), 0 otherwise.

Friendship _{ij} = 1 if i nominates j in the “friendship” network, 0 otherwise.

As described previously, in addition to the homophily variables, we were also interested in seeing if teachers had a tendency to talk to formal (titular) leaders in the organization. As such, the following receiver attribute variables were included in the analysis:

DeptChair _{j} = 1 if j is a department chair, 0 otherwise.

SLCChair _{j} = 1 if j is a small learning community chair, 0 otherwise.

Admin _{j} = 1 if j is a school administrator (Principal, Vice Principal, etc.), 0 otherwise.

In ordinary regression, the equation $E(y_{ij}) = \beta_1'x_{ij} + \beta_2'b_j$ would be employed, where β_1 is a vector of regression coefficients for the dyad variables, and β_2 is a vector of regression coefficients for the receiver attributes. Every y_{ij} ($i \neq j$) in the sociomatrix is used as an observation in this regression. For our binary (0,1) outcome, logistic regression would appear to be the most appropriate, where the expectation of the response is related to the regression

variable through the relation $f(E[y_{ij}]) = \beta'_1 x_{ij} + \beta'_2 b_j$ where $f(p) = \ln \frac{p}{1-p}$. Unfortunately, the assumption of independence of the observations is violated in most network datasets, and thus, we were compelled to use the p_2 model (Van Duijn, et al. 2004).

With the p_2 model, the dependence between the relations to and from the same actor is accounted for, and as such, we can proceed with the general idea of logistic regression as before. One of the virtues of the p_2 model is that it attaches a random effect to the expansiveness and attractiveness for each actor in the network. The dependencies involving the same sender or receiver of ties are accounted for, as well as the potential dependency issue of reciprocity. For the purposes of this paper, we will not investigate these random effects, only the fixed covariates listed above.

To identify individuals whose influence was “statistically significant,” we compared the actual distribution of influence against the distribution which we would expect to see by chance alone. This was accomplished by randomly assigning each individual’s weighted out-ties¹³ to other individuals in the network. Once all of the weighted ties had been re-assigned, the influence measure for each individual was recalculated for the new random data. Both influence distributions (actual and random) were sorted, and each individual’s actual score in the original dataset could be compared with the influence score of the individual of the same rank in the random dataset. Ten-thousand random iterations were performed, and individuals were considered “statistically significant influentials” if their influence score was higher than their random ranked counterpart at least 99% of the time. As such, we are able to create a sampling distribution of influence scores that would arise by random chance given the set of survey responses, and therefore can identify those individuals whose influence is statistically significantly greater than random chance while holding constant the number, frequency, and influence of conversations in the network.

EXPLAINING THE VARIATION IN NETWORKS

Using the methods described in the previous section, we are able to identify explanations for the variation in communication patterns that we observed in schools. Though recent education policy has assumed that small school size is associated with increased communication and collaboration among teachers, we did not find that in our sample. The differences in the distribution of ties between individuals, as well as the overall strength of networks, are not related to school size. This points to a difference in communication at the schools that is being influenced by other contextual variables. The research cited in our literature review provided us with a number of independent variables to examine when considering factors that influence communication among teachers within high schools. We examined five general categories for the impacts they have on communication: 1) physical location, 2) leadership position, 3) shared department or team membership, 4) shared periods for lunch or preparatory time, and 5) friendship connections. Each category has been cited in previous empirical or theoretical research as being important in building the types of teacher communities believed to foster teacher learning.

¹³ The number of out-ties is the number of individuals that a survey respondent names as being approached for advice in a particular network. Weighted out-ties incorporate the frequency with which each person is approached as well as the level of influence that the person’s reportedly has on the person completing the survey.

Looking across these variables in the 15 study schools reveals some interesting patterns. In the sections below, we will identify and discuss the salient variables and their effects on three network groups: friendship, professional, and provider. The friendship network includes communication among colleagues who “hang out” and discuss family, home, and/or personal issues. The three professional networks include communication among school staff about three core issues related to professional practice: classroom management, selecting and planning course content and coverage, and strategies to assist low performing students. The third and final network, referred to as the “provider” network, maps the communication between teachers and the people they turn to for advice in using the particular school reform model with which they have partnered. After looking at these three network groups, we then look across all of the networks that we have analyzed in order to identify the broader effects of the school reform models and other organizational variables on school communication.

The results in the following sections are presented in terms of the odds that a teacher will turn to a certain type of colleague for feedback in a particular domain. The values reported in the following sections, and provided in complete detail in the Appendix, give the predicted odds that the average teacher in the school will access a departmental colleague, someone who shares a common planning period, a colleague who is situated close by, a colleague in the same small learning community, a friend, or an administrator holding all other variables constant at zero. That is, the predicted odds of accessing a departmental colleague are the odds of accessing a departmental colleague who is also *not* any of the other types of colleague (SLC colleague, nearby colleague, colleague with common planning time, etc.). While it is fairly common in schools for departmental colleagues to also be in close physical proximity, it is not a simple matter of adding the odds for the two characteristics together. What is important about the odds values as reported is that they reflect the relative difference in the importance of each colleague type or variable in a school. The table below is provided to remind the reader of the meaning of each variable.

Table 5.

Variable label	Explanation
recAdmin	Increased odds that someone will be asked for advice in a given network that can be attributed to the fact that the individual is an administrator
recDeptC	Increased odds that someone will be asked for advice in a given network that can be attributed to the fact that the individual is a department chair
recSLCC	Increased odds that someone will be asked for advice in a given network that can be attributed to the fact that the individual occupies a position identified by the reform program as possessing authority or information beyond that of most teachers (e.g., chair of a Small Learning Community or Focus Team, been exposed to additional training, etc.)
sameDept	Increased odds that two people will communicate in a given network that can be attributed to the fact that the two people are in the same department
sameSLC	Increased odds that two people will communicate in a given network that can be attributed to the fact that the two people are in the same non-subject based unit (e.g., same Small Learning Community or Focus team)
friendrelation	Increased odds that two people will communicate in a given network that can

	be attributed to the fact that the individual was named as a friend of person seeking advice
adjacent	Increased odds that two people will communicate in a given network that can be attributed to the fact that the two individuals have primary classrooms located within four rooms of each other
sharedFree	Increased odds that two people will communicate in a given network that can be attributed to the fact that the two individuals share lunch or preparation periods during the school day

Friendship Network

We begin assessing the effects of the explanatory variables on communication in the network that is the most robust in almost all of our schools, the friendship network. When looking at the friendship network across our 15 schools, it is readily apparent that there are two factors that increase the likelihood of social communication taking place among colleagues: close proximity in classroom location and shared membership in the same department or small learning community. When controlling for all other variables, the odds that two people in classrooms in close physical proximity talk about social issues is between two and 35 times greater than the odds of people not in physical proximity talking about social issues. Being in the same department or SLC is the second independent variable that plays a strong role in predicting social communication. The odds of engaging in social communication with someone in your same department or SLC are between 3 and 27 times greater than engaging in that type of communication with someone who is not in your department or SLC. Of all of the variables examined, these two – physical proximity and shared department/SLC – are the only ones that play a significant role in increasing the likelihood of friendship communication. These results are logical and imply that teachers are significantly more likely to engage in friendship or personal conversation with the peers with whom they work most closely in terms of both physical arrangement and content of work.

However, it is equally interesting to note what variables *do not* play a role in increasing the likelihood of friendship communication. While it appears that people become friendly with those with whom they work most closely, they do not engage in the same type of friendship communication with schoolwide administrators or even their department chairs. While there is clearly some communication between teachers and these people in positions of authority (below we will talk about the networks where this communication is evident), the position of authority does not make a person any more likely to be named as a friend. This indicates that while working closely with someone leads to a friendship relationship, when that close work is done in a superior-subordinate relationship it does not lead to the same personal connections that are likely to develop when the professional work occurs between peers.

Also not important in the development of friendship relationships was the free time that teachers share in schools. When controlling for other variables, having a shared free period (or two) did not significantly increase the likelihood that individuals would talk about social concerns. In fact, sharing a free period with other teachers was not consistently an influential variable in any network. These data undermine the idea that by giving teachers common periods for unstructured planning or lunch, communication will be engendered. The time itself, without

some other shared trait or institutional structure, is unlikely to lead to any communication beyond that which might occur randomly.

Professional Networks

The friendship network is not only the most robust in terms of the average number of ties per respondent among our five networks, it is also a very influential independent variable in predicting communication patterns around issues of professional concern. Perhaps the most striking result from our data analysis is the fact that the odds of communication around issues of professional concern are most strongly and consistently enhanced by friendship connections. The odds of communicating with a fellow teacher about professional issues, when that person is identified as someone with whom the teacher also discusses personal issues, are increased anywhere between six and 158 times. The social connection between teachers is a significant predictor¹⁴ of professional communication in every school in all three of the professional networks (classroom management, curriculum, and low performing students). This finding confirms earlier research that found in other contexts that people are most likely to turn to friends for professional advice (Frank, Zhao, & Borman, 2004). Friendship connection is the only independent variable that is a significant influence in all networks in all schools. This finding indicates that teachers are consistently more likely to turn to people with whom they talk about personal issues when seeking advice about classroom management, course content and pacing, and assisting low performing students. Fostering friendship connections among staff then, is one way to increase the likelihood of conversation about professional issues. Influencing choice homophily is very difficult to accomplish through structural change.

The only other independent variable which is nearly as strong and consistent a predictor of professional communication is common departmental/SLC affiliation. While this shared affiliation is statistically significant across all three professional networks, it is most strong in the network related to course content and pacing. It is logical, and probably not surprising, that people are between 3 and 400 times more likely to talk to people in their same department when seeking advice about their course content and pacing. The impact of shared department/SLC is also highly significant in the other two professional networks (classroom management and low performers). However, the increased odds of communication are less consistently high when seeking advice about classroom management or assisting low performing students than they are when seeking advice about course content and pacing. Aside from the social connection that teachers share, the shared departmental/SLC connection is second in influence in raising the odds for communication in the three professional networks.¹⁵ This induced homophily is more subject to administrative control through organizational structures and is an important variable to consider in fostering communication.

In addition to their departmental/SLC peers, teachers also are more likely to seek advice from their own department/SLC chairs than they are to seek advice from people who are not chairs. Again, this is most evident when teachers are looking for advice about course content and pacing, is slightly less apparent when seeking advice about classroom management, and becomes

¹⁴ In this case, the parameter estimates are both statistically and qualitatively significant.

¹⁵ In FTF2 and FTF3, where the SLC structure had been in place for at least two years the impact of SLC trumped that of the department in the classroom management and low performers networks. Department retained primacy in curriculum discussions.

a very minor influence when seeking advice about assisting low performing students. It is clear from our evidence that teachers disproportionately seek advice from department chairs when controlling for other variables shared between the teacher and the source of advice.

Schoolwide administration is also an influential source of professional advice for teachers when looking broadly across our schools. This is particularly true when teachers have questions related to classroom management. In 13 of our 15 schools, the odds that teachers will turn to school administrators for such advice are statistically significant and are between 10 and 1,200 times higher than the odds of asking someone who is not an administrator for advice. This very strong influence reinforces the popular perception that school administrators are heavily involved in discipline issues. The strong impact that being an administrator has on increasing the odds of being a target for those seeking advice tapers off slightly for questions of course content and pacing and decreases slightly more for questions related to assisting low performing students. However, in general, and as will be discussed in the section below on the influence of individuals in networks, the position and authority bestowed on school administration does increase the odds of being seen by teachers as resources in the school. This may suggest that the strategy of investing authority in formal positions such as department chairs or school-wide administration is in fact one way to build or preserve social capital in an organization.

The final variable worthy of discussion in terms of its influence on the professional networks in schools is the proximity of teachers' classrooms. Though the impact of proximity is neither as high nor as consistent on the professional networks as it is on the friendship network, its positive effect is evident in all three professional networks. The frequent response that teachers shared in interview data that they are likely to talk with their classroom neighbors before and after school or during the few minutes between classes is borne out in our network data. When controlling for all other variables, physical proximity increases the odds of communication between two teachers about professional issues anywhere between 1.65 and 14 times in comparison to the odds of communicating with someone who is not in a neighboring classroom (operationalized as a maximum of four rooms away). Though the influence of physical proximity was not statistically significant in every school in every network (four schools had at least one professional network in which proximity was not shown to be a significant predictor), it remains a small but significant influence on a range of professional communication in most schools. Again, though the influence of location on communication is small, it is the sort of induced homophily measure that is easily subject to administrative control.

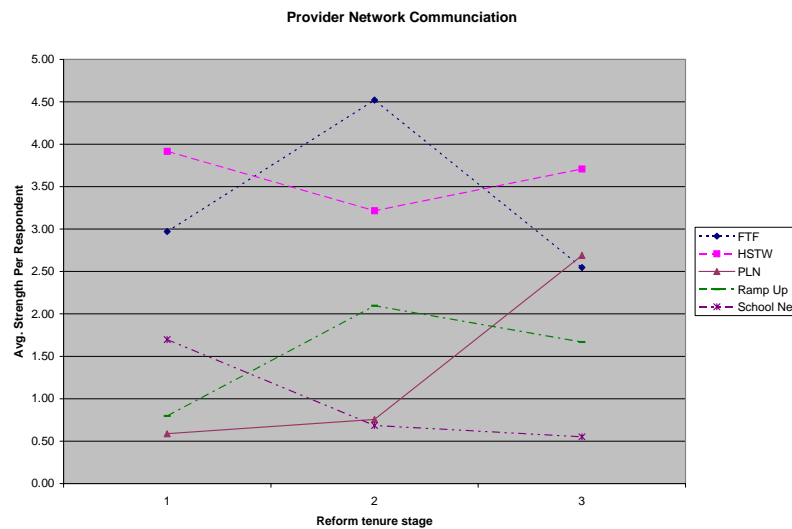
Provider Network

The final network to be examined in our data is the provider network; the network that describes communication between teachers and those individuals to whom they turn for advice about the particular school reform program with which their schools have developed a partnership. We need to note again at this point that the provider network was the most sparse of the five networks examined (three professional, one friendship, one provider). As we saw in Tables 2 and 3, measuring design and strength of networks, the provider network, in almost all cases, had the fewest ties between individuals of any of the networks in a given school. This fact made it difficult in some cases for the analytical model to settle on a conclusive and statistically significant parameter estimate indicating the influence caused by any given variable. Thus, the

coefficients indicating the increased odds of communication vary widely and are more reliably interpreted as orders of magnitude rather than the particular value that has been assigned.

It is also worth pointing out that the strength of the provider networks did not follow any pattern with regard to the tenure of the particular reform program in the school. Our sampling strategy intentionally captured schools with differing amounts of experience with their reform partners. In general, the effect of the length of the partnership was small and variable. The graph below illustrates the absence of any pattern among the five providers regarding the strength of the networks that were developed. It shows the strength of the provider network for schools at different stages of work with each of the five reform models. It is evident that the level of meaningful conversation reported around the reform varied widely but did not correlate with the amount of experience staff had with the reform.

Figure 2.



That said, the patterns of influential independent variables in the provider network followed closely, though not exclusively, those patterns in the other professional networks. Again, among the independent variables, the friendship relationship between teachers had the most consistently large and significant impact on the odds of communication. The physical proximity of teachers continues to play a statistically significant though not tremendously large role in increasing the odds of communication between teachers in comparison with those teachers who are not in neighboring classrooms.

Interestingly, a new independent variable becomes significant in the provider network that was not consistently significant in any of the other networks: the likelihood that teachers request advice from individuals in the school who have been identified as leaders of the reform effort. Identified as SLC chair in our analysis and data tables, these people were either coordinators of SLCs or focus teams or teachers who had been identified as resources and had received additional training in the provider strategies. This finding would indicate that in most cases (9 out of 13) where the provider and school had together identified teachers to lead the effort of

facilitating instructional reform, these individuals did indeed receive a disproportionate number of requests for advice about the use of the reform program.

Being in the same department plays a significant role in increasing the odds of communication among teachers in the provider network (though its magnitude is not as large as the influence of being an individual selected to lead the reform). The positive influence of shared department membership in the provider network is comparable to the effect on the networks around classroom management or assisting low performing students. Department chairs also become less influential in the provider network than they are shown to be in the professional networks. It would appear that teachers make a conscious decision to approach department chairs for advice in areas that they see as part of their traditional practice, but choose to turn to others for advice about use of the particular reform program. When considering communication related to the reforms, these findings in combination – a decrease in influence of department chairs and a reduction in importance of shared departmental membership - point to a decreased dependence on the department affiliation of teachers when new organizing structures (SLCs, focus teams) and leaders are created by the reform models. These new leaders appear to become teachers' primary sources of advice about the reforms.

Overall, the impact that being a school administrator has on the likelihood of receiving requests for advice also diminishes in the provider network in comparison to the professional networks. It only remains significant even to a small degree in five of the 15 schools. All five of these are schools that are implementing whole school reform programs. And while we will look in the following section at the effect of particular reform programs on communication patterns, it is worth noting that the influence of being a school administrator in schools that are not doing whole school reform is entirely insignificant with regard to questions about the reform program. Administrators in most of our schools did not receive any more requests for advice about the reform program than did other staff members who hold no formal positions of authority. The whole school reform programs each have an identified leader of the effort who is frequently an administrator; in these cases the individual is similar to the individuals identified as “SLC chair” in the variable discussed above. In places where the designated reform leader is *not* an administrator, the administrator is not seen as a resource for advice on the reform program. This explains at least part of the difference in the influence of school administrators and points to discriminating judgment on the part of teachers in seeking advice.

LOOKING ACROSS NETWORKS

Impact of the Reform Model on School Communication

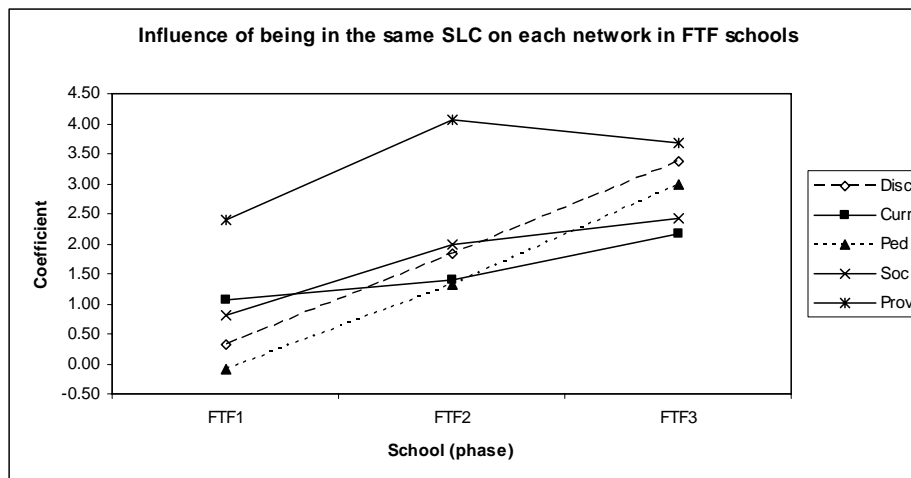
Based on our discussion of the provider networks in the section just above, it is evident that outside reforms can impact communication within high schools. Our data show that high schools are not the “Teflon boxes” they have been reputed to be, impervious to change with unchanging norms of communication and isolation. It is clear that the networks in these schools have been influenced by provider designs, at least when conversation is about the reform program. While the generally thin nature of the provider networks speaks to the limited influence that the designs have had thus far, the large number of significant influences being made by organizational changes that the reforms have introduced to schools makes it clear that new paths of communication can be forged. It should not be forgotten that two-thirds of our

sample was in the first or second year of work with an outside provider and thus one could expect somewhat limited impact. However, even with this in mind, we see that in all six of the schools where FTF or HSTW introduced a new organizational strategy (SLCs or focus teams), that unit of organization had a significant impact. Similarly, in most schools where a set of reform leaders were identified (i.e., SLC chairs, focus team leaders, individuals with additional training in PLN or SN) as resources for reform, these resource people became large receivers of requests for advice about that reform. The fact that the provider networks look different from other professional networks implies that teachers are building new social networks to support this function. Below, we have a brief discussion of how each of the five particular reforms in this research impact school communication in ways related to the particular strategies of the reform program. We begin with a discussion of the reforms with the most explicit strategies for the construction of new connections among staff. We continue with those reforms that are more reliant on pre-existing school organization and communication patterns.

First Things First

It becomes clear from looking at the network data, that the structural changes introduced by FTF have begun to have an effect. For example, the grouping of teachers into SLCs has clearly impacted communication. In FTF1, a school that had just begun to be organized by SLCs at the time of our survey, the SLC is only a significant predictor of communication in the provider network. This makes logical sense given that teachers are turning to the others in their SLCs for discussion about the reform that put them in those groupings. The traditional arrangement of teachers in this school, by subject matter department, remains a significant influence in every network, indicating that teachers are still more comfortable with those groupings. Teachers have not begun to rely on people in their SLCs for discussion in other areas. In FTF2, where the SLC had been established for two years at the time of our survey, shared SLC affiliation now appears to be a significant predictor of communication in every realm and the departmental affiliation is only materially significant in the network that deals with course content and pacing. The SLC has supplanted the department as the primary focus of communication in this school with the exception of curriculum discussion where it is most natural that teachers would turn to the group that shares content expertise rather than limiting their conversation to the people in their SLC. A similar pattern holds at FTF3 where the SLC is more often the primary influence on communication but the departmental affiliation maintains influence in the realm of curriculum.

The graph below illustrates the generally increasing importance of SLCs in FTF schools across networks as the reform is in the school for longer periods of time. It is evident from the fact that the coefficient associated with being in the same SLC increases for almost all networks in all schools. The one exception to this, somewhat ironically, is a small decrease in the importance of shared SLC membership in the provider network at FTF3. One potential explanation for this is the fact that FTF3 has so fully integrated provider strategies into ongoing practice that teachers there had some difficulty identifying those practices that were unique to FTF. Further qualitative research will help us to better explain this finding.

Figure 3.

High Schools That Work

A similar, if weaker, pattern can be seen in the HSTW schools. There, the primary organizational change, the creation of focus teams, can stand in for the SLCs in FTF. In HSTW1, in its first year of focus team organization, we see that these teams are only influential in discussion about HSTW. In HSTW2, having had such teams for a couple of years, the influence of this organizational change on communication is spread across networks so that it has significant influence on curriculum and low performers discussions in addition to the provider network. We can also see the influence that being a focus team chair has on communication in this school. Teachers are clearly more likely to ask a focus team chair for guidance than they are to ask other colleagues – or even administrators in most cases. Clearly, leadership around a number of issues has been devolved to the focus team chairs. In HSTW3, the school that has had HSTW for the longest period of time, we again see very little influence of the focus teams because they had just been reorganized prior to our survey. Focus teams are now large, have only modest participation, and have new chairpeople in some cases. For these reasons, the patterns in HSTW's organizational changes do not hold as clearly, though they are still evident.

Also, in HSTW, the department continues to play the strongest role (aside from friendship connections) in influencing almost all communication. This is different than FTF, where we see the SLC's becoming increasingly strong influences on communication in many areas aside from curriculum. The organizational structures that these two whole school reforms introduce do appear to have different effects on communication. However, the impacts of the two structural changes (SLCs or focus teams) are the most significant effects on communication patterns that we see based on intentional provider strategy.

Penn Literacy Network

The three PLN schools generally follow the same patterns identified for schools as a whole. Friendship relations play a very large role across networks, departmental affiliation plays a strong role particularly with regard to curriculum discussions and school administrators are a resource for many, particularly in the area of classroom management. The one striking finding

about the three PLN schools is that having been a participant in PLN training (designated as SLCC in our Appendix) dramatically increased the odds of being sought out for advice about the program. Again, this shows how teachers are aware of the people in the school who have knowledge and experience with the particular reform. When teachers have questions related to the reform, they are more likely to turn to these people for advice. It is particularly interesting that these people do not play a similarly influential role in any of the other networks. Again, this evidence points to the development of very different communication patterns based on desired information.

Additionally, if we look at the overall strength of the networks around PLN, it increases with the maturity of the program in the school. Though overall, the strength of the network around the reform is among the weakest of any provider, we do see growth based on the tenure of the reform. This implies that there are more conversations being initiated and that teachers find these conversations to be more influential on their practice as the reform remains in the schools. This is in line with PLN's philosophy of being a somewhat organic reform that spreads not through structural and organizational change but via teacher discussion and communication over time. It is, in fact, the only one of the five reforms for which we can see the steady increase in strength of provider network. Additionally, the PLN program in PLN3 is being pursued much more like a whole school reform, thus further supporting the increased strength of provider networks.

SchoolNet

SN is a tool designed to enhance teacher attention to student data and to provide teachers with resources to address the needs that are identified with the help of the data. It is meant to be used by all teachers in a school but does not prescribe any particular remedies to poor student performance. The program is introduced at the district level and the particular strategies for introducing it to teachers at the school level varies by district, as does the enthusiasm for the program at the school level.

In terms of the traditional realms of professional practice, teachers did not report any systematic difference than what we see in the 15 high schools in general. Friendship connections continue to play a very prominent role in influencing communication across the three professional networks. Common departmental affiliation is still a very significant influence on communication, most prominently in the area of course content and pacing.

In terms of communication related to SN, the pattern is somewhat different. The communication around this reform was extremely sparse, making it difficult in some cases for the model to derive statistically significant parameter estimates. It is the weakest of the provider networks among all of the reforms. Of the communication that exists, it appears that most of the provider-oriented communication is composed of requests for assistance from traditional formal school leaders. School administration, department chairs, and SLC chairs receive requests for advice about SN to a disproportionate extent in comparison with other teachers. As with PLN, the particular people who are designated as leaders for school change are indeed serving as resources for teachers in the school.

Ramp-Up

RU, though associated with the America's Choice whole school reform, is primarily a targeted assistance approach to literacy instruction. This program, which involves a prescribed use of class time, specific curriculum materials, and a daily lesson plan, is intended to accelerate the learning of a school's lowest performing students. Typically, schools train a select group of teachers with a strong background in reading instruction to hold RU classes for students who have been selected for this intervention based on their prior test performance. Given the targeted nature of RU, this program is expected to have little impact on the overall organization and communication of teachers in the school.

Reflecting the fact that this program does not alter the organization of teachers school-wide, as is the case in the whole school designs investigated in this research, the teacher communication patterns in all three schools, regardless of the length of time working with RU, are very similar across the communication domains of classroom management, curriculum, and low performers. As has been seen in other schools in this study, teacher communication regarding classroom management as well as curriculum and low performers is largely driven by teachers' informal social contacts. Teachers also turn to administrators at relatively high rates (though to a lesser degree at RU3) across each of the communication domains. As has been seen in other schools and as is presumed given the historical importance of departments in teachers' professional lives, teachers in the RU schools also turn to their departmental colleagues in matters of curriculum.

The patterns of communication for these RU schools reflect what we might expect in the traditional departmentally structured school as the program does not reach out to the entire school. Of particular interest in the context of this research is the extent to which RU participation by the few RU teachers in each school is altered by their participation. For example: 1) Do RU teachers turn to each other more frequently than they do other teachers in their departments? 2) Given that RU teachers have intensive contact with the school's lowest performing students and special training to work with these students, do other teachers turn to them more frequently for questions regarding the teaching of low performing students (pedagogy domain) than teachers not working with RU classes? Due to the very small number of RU teachers in the school, this analysis cannot be done with the modeling techniques used to explore the schoolwide context. Instead, this analysis requires a more qualitative analysis of teachers' responses

OTHER INFLUENCES LOOKING ACROSS NETWORKS

In addition to the apparent and variable impact of the reform programs, several variables stand out as impacting communication in multiple networks. First, friendship connections play a dominant role in influencing teacher communication. Teachers seek professional advice from the people with whom they are friends. Friendship networks are forged in part through working in close proximity with people and in similar disciplines. However, neither of these two variables explain a very large degree of friendship communication. The parameter estimates for the homophily attributed to physical proximity and shared department, while always statistically significant and occasionally large, do not approach the estimates in a network like curriculum, for example, where one can see that shared departmental affiliation can explain a huge part of the communication that exists. The organizational and structural variables included in this research shed some light on factors that influence friendship connections, but they do not provide

particularly large estimates of influence for this network. There are likely a large number of other variables that could be considered choice homophily, unexplored in this research, that are playing a role in determining friendship communication, and in turn much of the professional communication that occurs in schools.

Second, the importance of subject matter departments remains evident in all networks. Though its importance diminishes in the provider network, it is still clear that the preponderance of communication is influenced by the people with whom teachers share their departmental affiliation. Though it is less true in some networks in those schools with other organizational structures, department affiliation remains highly influential in predicting communication ties. Other literature has pointed to the strong influence of departments in high schools, and this finding would support that to some extent. It does not imply that the conversation is necessarily formal or coordinated within these departments but does show a significant impact of departments on professional and social communication. The diminished impact of the department and department chair in some schools gives evidence that new reforms and the organizational and hierarchical structures they bring can alter department strength to some degree.

Third, much has been made of the strategy of providing teachers with common planning time during the school day. Our data show that shared unstructured time during the school day, when controlling for friendship and departmental affiliations, has almost no impact at all on communication within schools. It should be clear that this estimate does not include time in the school day during which teachers are not teaching but are required to attend team meetings or other formalized activities. Because our model controls for other similarities when trying to look for the impact of shared free periods, the estimates related to common free periods speak only to those teachers who do not share other common characteristics. It is quite possible that the most frequent scheduling strategy provides common free periods for those teachers in the same department or SLC. In such a case, these homophily measures would co-vary and the influence on communication would be explained by one of those estimates. The finding here points only to the absence of any effect that can be expected from sharing unstructured time without any other commonalities that may draw teachers together.

Fourth, the evidence in all schools points to the fact that teachers do tend to talk to a variety of individuals about different topics. While it demonstrates that there are individuals who are perceived as experts in particular areas, this variation in networks does little to strengthen networks in the school. Optimally, similar networks across different areas will mutually support and reinforce each other. In other words, the more similar two networks are in a school (e.g., provider and curriculum), the more robust the communication is likely to be around both of those areas. Using a measure known as a Jaccard correlation¹⁶, we were able to assess the extent of

¹⁶ In order to examine the overlap between the five networks, Jaccard coefficients were calculated. In our networks, the overwhelming majority of ties in the sociomatrix are not actualized ($y_{ij} = 0$), and thus, the standard Phi coefficient for binary correlation would produce a biased correlation. The Phi coefficient would overemphasize the absence of communication in one network when there was absence of communication in a second network, and thus, an alternative measure is required. The Jaccard coefficient is simply the proportion of ties that are actualized in both networks as compared to the total number of ties in either network.

overlap between networks in each of the schools. The average Jaccard correlation coefficient was 0.17 across all networks in all schools¹⁷. This means that on average approximately 17% of communication ties were the same in two networks in any given school. This reinforces the image gleaned from the model results discussed above that teachers are carefully select the individuals to whom they turn for advice in different areas rather than going to the same individuals for a variety of professional concerns.

The highest correlations could be found among the three professional networks in most schools. However even that was relatively limited. The highest correlation between any two networks was a coefficient of 0.33, indicating that 33% of the communication across two networks was shared, or that one-third of all ties in the two networks were in common. This level could be found in only two schools. It implies that in some cases ties in the curriculum, low performers, or classroom management networks look somewhat similar, though only to a very limited extent. Other networks look entirely different.

In all schools, the provider network had the least overlap with any of the other networks. One coefficient equaled zero (between the discipline and the provider networks), which implies that there was no common communication between individuals across those networks in the same school. The data consistently point to the provider network being qualitatively and quantitatively different than the other professional networks in almost all cases. This fact may diminish the potential spread of those reforms that depend on pre-existing networks. It appears that reforms are more likely to chart a new path than they are to be included in discussions occurring in other networks.

All of these examinations of the distribution and strength of network ties point to a variety of explanations for why we find the distributions that we do. Additionally, as detailed above, it highlights the fact that teachers are being very discriminating about their choices of whom to turn to for advice. Our analysis of independent variables has allowed us to identify the extent to which formal leaders influence communication patterns. However, there are also individuals within high schools that are often solicited for advice based not on their formal position but on other attributes. We now turn our analytical lens to examine these influential individuals.

INFLUENTIAL INDIVIDUALS ACROSS DIFFERENT HIGH SCHOOL NETWORKS

Within any organization, a sub-group of individuals stands out as being recipients of inordinate requests for assistance. These are the high influence individuals within a social network. These individuals both carry high amounts of social capital because of their influence with their peers, and build the social capital of the organization because they provide an important communication service. In this section, we explore the influential individuals and examine their characteristics. The individuals who are identified as influential may or may not hold formal leadership positions in their schools. They may be influential in a single network or hold sway across multiple networks.

The method for identifying influential individuals was described in the Methods section of this paper. Using the analysis technique, we identified individuals who were significantly more likely

¹⁷ Standard deviation was 0.07.

to be asked for instructional assistance than their peers. The analyses in this section of the paper are based upon those individuals who were identified as significantly influential.

Explanations for Few or Many Influential Individuals in a School

Before examining the data in our sample of schools to determine the proportions of school faculties identified as influential, we should try to understand what it could mean for a school to have a high (or low) proportion of its faculty identified as influential. Theoretically, there are two circumstances which would yield relatively high proportions of individuals in a school as influential. One is a case in which there is relatively little conversation going on in the school around a particular issue and the conversation that does occur is inordinately concentrated in a subgroup of individuals. The other case is a similar circumstance in a school with lots of conversation occurring, but again the conversation is disproportionately concentrated in a subset of people. In both of these situations, a sub-group of the population is influential. In situations where the communication is more evenly distributed, regardless of the level of overall conversation, the percentage of influential individuals (as defined by our method) would be small.

With a particular sample of schools, one could also determine whether a low or high level of conversation was producing a relatively high proportion of influential individuals by correlating the network density (see Table 2) and the proportion of faculty identified as influential. If the identification of influentials was being driven by generally low levels of conversation in combination with relatively high proportions of influential individuals, we would expect to have low or negative correlations between network density and proportions of influential individuals. If the identification of influentials was being driven by generally higher levels of conversation, we would expect to have moderate or high correlations between network density and proportions of influential individuals. These are relationships that will be tested later in this section.

Examining the Variation in the Proportion of School Faculties identified as Influential

The individuals identified as influential varied both across the schools in our sample as well as across networks. Table 6 below shows the number and proportion of the faculty who were identified as significantly influential as a proportion of the faculty in each network for each school.

Table 6.**Number and Percent of Faculty Identified as Influential for each network**

School	Network Size	Curriculum Network		Classroom Management Network		Low Performance Network		Provider Network	
		N	%	N	%	N	%	N	%
FTF1	160	30	19%	21	13%	20	13%	10	6%
FTF2	78	9	12%	17	22%	9	12%	16	21%
FTF3	187	21	11%	9	5%	21	11%	9	5%
HSTW1	114	7	6%	6	5%	9	8%	11	10%
HSTW2	115	19	17%	2	2%	15	13%	6	5%
HSTW3	91	10	11%	4	4%	9	10%	5	5%
PLN1	129	3	2%	6	5%	9	7%	3	2%
PLN2	73	8	11%	13	18%	7	10%	9	12%
PLN3	137	23	17%	18	13%	22	16%	19	14%
RU1	40	2	5%	2	5%	4	10%	5	13%
RU2	157	18	11%	19	12%	23	15%	7	4%
RU3	89	1	1%	9	10%	5	6%	3	3%
SN1	61	4	7%	10	16%	6	10%	3	5%
SN2	329	23	7%	35	11%	28	9%	7	2%
SN3	115	9	8%	21	18%	12	10%	4	3%

Several things stand out from Table 6. First, there is wide variation in the proportion of school faculty that is identified as significantly influential in each network. In the curriculum network, for example, the proportion of influentials on a faculty range from one percent (RU3) to 19% (FTF1). In the classroom management network, the proportion ranges from 2% (HSTW2) to 22% (FTF2). This variability across schools persists across each of the four networks for which measures of influence can be calculated.

A second interesting thing is that the correlations between percentages of influentials between networks are generally moderate or low, ranging from a 0.13 correlation between the classroom management and curriculum networks to a 0.40 between the curriculum and provider networks. This indicates that there is generally little relationship between the proportion of faculty who are influential in one network and the proportion of faculty who are influential in another network. This suggests that the bulk of influence within networks was not systematic across networks; having a high proportion of faculty identified as influential in one network did not indicate a similar pattern in another network. One plausible hypothesis that might explain these results is that more influentials may arise in areas of school need. That is, schools with lots of discipline problems might give rise to more influentials in the discipline network as a proportion of the faculty while having no impact on other networks. Each school then, with its own particular needs would display high percentages of influentials in different areas.

The one exception to the pattern of low correlations across networks is a high correlation of 0.84 between the classroom management and low performers networks. This may hint at an overlap between the influentials across these two networks, and may indicate similar levels of need in the schools in our sample. These two networks are also among the professional networks that showed higher degrees of network (Jaccard) correlation.

Third, there were a few notable patterns in correlations between the proportion of influentials in a school's faculty and characteristics of the school. There were virtually no correlations between the proportions of influentials in any of the five networks and school size or percentage of

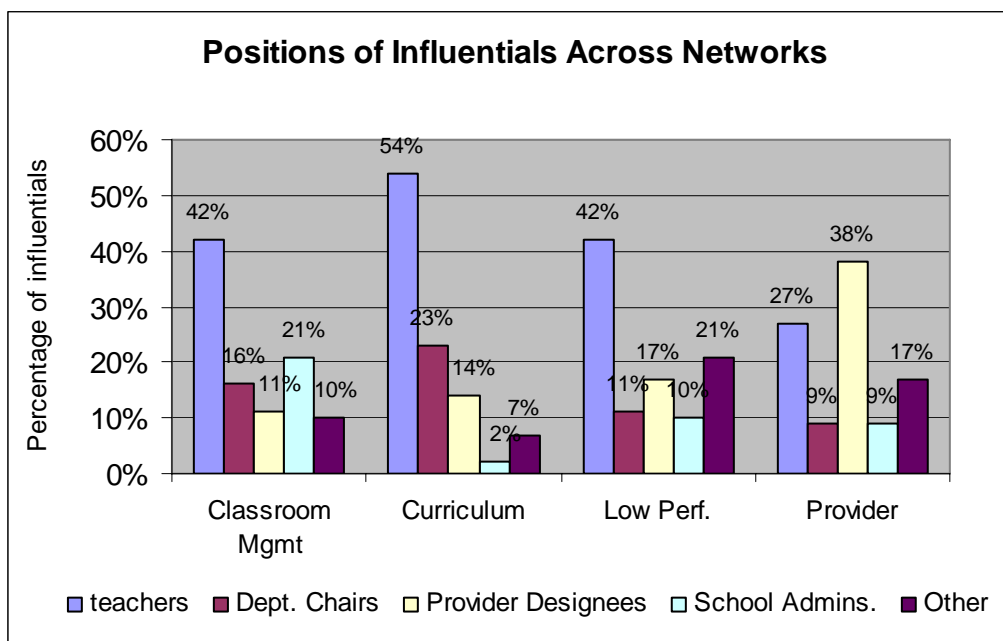
students on free/reduced lunch. There were moderately negative correlations between the proportion of individuals in the curriculum network and school performance (-.39) and proportion of influentials in the low performers network and school performance (-.25). This means that schools with higher performance tend to have fewer influentials as a proportion of their faculty in these areas and vice versa. This may support the contention above that more influentials are present in networks (curriculum and low performers, in this case) where the need is greatest. Alternatively, it could be that conversation around instructional issues is more evenly distributed in higher performing schools. This issue will be investigated in future research.

Finally, we can examine the question of whether the proportion of influentials in each network was being driven by high or low levels of conversation. This was determined by correlating the network density (average out-ties from Table 2) with the proportion of influentials in each network. In this particular sample of schools, the patterns that emerged were different for each network. The curriculum network had relatively low density of communication (an average of 1.8 out-ties per faculty member) and a relatively high proportion of influentials (11 percent of the faculty in this sample of schools, on average, were influential in the curriculum network). This resulted in a small negative correlation between the two (-.12). Therefore, for the curriculum network, the conversation was a product of relatively little curriculum conversation concentrated in a small group of influentials. In classroom management and low performers networks, by contrast, there were moderate and positive correlations between network strength and proportion of faculties who were influential. This was driven by the relatively high levels of conversation in these networks and high proportion of influentials. This is evidence of high amounts of communication infused in a subset of influentials. The provider network exhibited a different case. The proportion of faculty in the provider network was moderately correlated (0.40) with the number of provider conversations, but this was derived from few conversations (an average of 0.82 out-ties per faculty member) and a low proportion of faculty member being influential in the provider network. These findings suggest that each network has its own particular character that appears independent of others. It provides further evidence that networks tend to be quite distinct from each other; each forged for their own purpose and “led” by different influential individuals.

Positions of Influential Individuals

Who are the individuals who are identified as influential? What positions do they hold? Figure 4 shows a breakdown of the positions held by the influential individuals across the five networks. Focusing first on the three professional networks (classroom management, curriculum and low performers), we can see that teachers predominate in all three. Department chairs, who are in most cases also teachers, are commonly influential in the curriculum network, but less so in the classroom management and low performers networks. School administrators, which include principals and vice principals, are influential in the classroom management network but less so in the other professional networks.

Figure 4.



In the provider network, not surprisingly, the biggest group of those who were sought after for assistance were those who were playing some sort of provider specified role. For FTF these were SLC chairs, for HSTW these were focus team leaders, for RU these were literacy coaches and RU trained teachers, for PLN these were those who attended PLN's intensive workshops, and for SN these were individuals in the school who were tapped by the program to show teachers how to use SN. However, teachers who were not playing a formal role in the provider's program were still frequently influential. Department chairs or school administrators were less commonly influential in the provider network. These findings support our earlier statements that teachers tend to go to their friends for advice, and that they are most likely to be friends with peers as opposed to administrators. Additionally, it supports our contention that provider networks tend to be different than other networks. It also shows that administrators are most often viewed as resources in dealing with classroom management issues, often discussed by teachers as issues of discipline, as opposed to areas more directly related to instruction.

Interestingly, the finding that teachers (as opposed to titular leaders) are most often the influential individuals in three of the four networks undermines somewhat the theory that influence can be vested in titular leaders in order to limit the effects of turnover. While titular leaders (department chairs, school administrators, provider designees) are certainly among the influential individuals, it appears that in all cases aside from the provider network, their proportion is dwarfed by the percentage of teachers cited as influential. This raises the question of the extent to which influential individuals, the majority of them teachers without other formal position, are similar or different from other faculty members. It is to this question that we turn in the next section.

Comparison of Characteristics of Influential Individuals with Other Faculty Members

We explored the extent to which the influential individuals are similar or different from other faculty members on a number of demographic dimensions. Before proceeding, it should be

noted that our data only represent the faculty members responding to the survey, and therefore do not include administrators. Consequently, we only have demographic characteristics for the teachers who were identified as significantly influential. Table 7 shows comparisons of the characteristics of influentials in contrast to other faculty members.

As shown in Table 7, there were several areas in which the influential individuals differed from other members of the faculty. The influentials were more likely to be male than other members of the faculty in the sample of schools, and more likely to be white than the rest of the population in this sample. The influentials had similar experience levels to other faculty members, both in terms of teaching experience overall and years in the school. But the influentials were significantly more likely to have reported that they play some other leadership role in the school than did other faculty members.

Table 7.

Comparison of Characteristics of Influential Individuals and Other Faculty Members

Characteristic	Influentials	Other Faculty Members
Percentage Female	0.33***	0.45
Percentage White	0.84**	0.75
Percentage African American	0.1	0.14
Percentage Hispanic	0.03	0.07
Mean Years Teaching Experience	13.96	13.96
Mean Years at School	9.67	8.54
Percentage in Leadership Role	0.72***	0.50

*** $p < .001$ ** $p < .01$ * $p < .05$ (after Bonferonni correction)

It would appear from this data that race and gender play some role in the perceived influence of individuals in high school. This question is beyond the scope of our work in this paper but raises intriguing questions for further research. Setting these differences aside for the moment, given the absence of any difference in teaching experience and the fact that the largest percentages of influentials in most networks are teachers, as opposed to administrators, it appears that there must be something qualitatively different about the influential individuals. This difference will be explored in the Leadership¹⁸ paper.

Influence Across Networks

Finally, we turn to the question of the extent to which influence is distributed across networks. Do influentials tend to be influential in one or multiple networks? Table 8 shows the percentage of individuals at each school who are influential in one, two, three, and four of the networks.

¹⁸ Riggan, M., & Supovitz, J. A., & Hovde, K. (2006). *They come in all shapes and sizes: Leaders and high school reform efforts*. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Table 8.**Extent of Influence Across Multiple Networks**

	One Network	Two Networks	Three Networks	Four Networks
Average proportion of school faculty in number of networks	0.62	0.22	0.09	0.06
Minimum proportion of school faculty in number of networks	0.41	0.07	0.00	0.00
Maximum proportion of school faculty in number of networks	0.79	0.34	0.21	0.12

As can be seen from Table 8, most of the influential individuals are influential in just one network. On average across the sample, about 62 percent of those identified as influential were influential in just one network. The proportion of individuals that were influential in just one network ranged from a low of 41 percent in FTF2 to 79 percent in RU3. About 22 percent of the individuals were influential in two networks; RU3 having the fewest (7 percent) and FTF2 having the most (34 percent). Just under 10 percent of individuals were influential in three networks, with FTF3 having the largest percent (21 percent). Thus, it appears that it is most common for individuals to be influential in one or two cases, with only a few situations where an individual is influential across more than two networks. This finding is likely related to the school reform model. Those models with a broad focus (FTF and HSTW) may spawn influentials with broader scope while very targeted programs (like RU) spawn influentials with narrower focus. These cases would be worthy of qualitative investigations to explore the characteristics of these individuals and the dynamics of the situations within which they reside.

Further investigation into those who are influential in the provider network shows that of the 486 individuals that were identified in all networks, 117 of them, or 24 percent, were identified as influential in the provider network. Of those 117 individuals, 45 (38 percent) were influential in only the provider network. There were 29 individuals (24 percent) who were influential in another network besides the provider network; which was most commonly the curriculum or low performers network. An additional 43 (36 percent) were influential in three or more networks including provider. This suggests a slightly bimodal distribution between those who were associated solely with the provider design and those who were influential in at least two additional networks in addition to the provider network. Again, this likely points to differences in reform strategy. We see one group of influentials who focuses on the provider (likely in the more narrowly targeted reforms) while there is another group that is multivocal, and is influential in multiple networks.

CONCLUSIONS

In sum, it is clear that communication networks in high schools are impacted by a combination of within school variables and provider design. As a result, communication networks vary in terms of density, strength, and distribution. When teachers are talking to each other about curriculum, classroom management, low performing students, a school reform, or personal issues, communication patterns are very different. Friendship communication dominates conversation in schools, with classroom management also being a very prominent topic of conversation. Whatever the topic of discussion, teachers are most likely to seek advice from

people with whom they share friendship connections. In addition, they are most likely to have friendship connections with other teachers in their department or small learning community and, to a lesser extent, with those people who work in close physical proximity. Overall, the traditional departmental structure, or the small learning community structure where it had been in place for at least two years, continues to play a very significant role in influencing teacher communication.

However, teachers demonstrate a relatively discriminating sense of whom to approach for advice. While the primary source of influential advice for most teachers is other teachers, our data show that teachers approach their department chairs for advice about curriculum, other school formal leaders for advice about classroom management, and a more varied set of individuals for advice about helping low performing students. When teachers are seeking advice about their school reform program, they are more likely to turn to individuals designated as leaders of the reform. Even when teachers turn to their peers for advice in a particular area, they have different peers to whom they turn for different topics. While the individuals who are influential for teachers have some different characteristics than the teacher population at large, further study is needed to better understand what makes some teachers more likely than others to be sought out for advice.

The distribution of communication in schools varies widely. For example, in some areas, like curriculum, the distribution is often highly segmented. In other cases, like classroom management or reform strategy, it is often focused around a few key individuals. This fact, in combination with the differing identity of influential individuals in networks, indicates that different strategies may be required to spread information and norms regarding different areas of school function. The fact that communication patterns, in some cases, appear to be significantly influenced by reform strategies indicates that paths of communication can be changed and new ones forged. It is the challenge of school leaders to make the best use of existing networks, create new ones where needed, and utilize the influential variables identified in this paper to build the social capital of schools in an effort to improve instruction and achievement.

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APPENDIX
PARAMETER ESTIMATES FOR P2 MODEL FOR ALL SCHOOLS

School	Indep. Var.	Classroom Management			Curriculum			Low Performing Students			Friendship			Provider		
		log odds	odds	sig.	log odds	odds	sig.	log odds	odds	sig.	log odds	odds	sig.	log odds	odds	sig.
FTF1	adjacent	0.65	1.92	(0.00)	1.38	3.97	(0.00)	0.31	1.36	(0.04)	0.71	2.03	(0.00)	0.86	2.37	(0.00)
FTF1	Intercept	-6.31	0.00	(0.00)	-8.79	0.00	(0.00)	-6.71	0.00	(0.00)	-5.24	0.01	(0.00)	-13.18	0.00	(0.00)
FTF1	recAdmin	2.56	12.93	(0.00)	2.02	7.56	(0.03)	1.30	3.66	(0.16)	-0.19	0.83	(0.80)	4.39	80.36	(0.01)
FTF1	recDeptC	0.43	1.54	(0.31)	1.19	3.30	(0.02)	0.00	1.00	(1.00)	0.52	1.68	(0.07)	0.45	1.57	(0.69)
FTF1	sameDept	1.66	5.26	(0.00)	3.81	45.04	(0.00)	2.31	10.08	(0.00)	3.10	22.26	(0.00)	2.13	8.42	(0.00)
FTF1	sameSLC	0.32	1.38	(0.03)	1.06	2.88	(0.00)	-0.08	0.92	(0.59)	0.80	2.22	(0.00)	2.39	10.92	(0.00)
FTF1	sharedFree	0.31	1.36	(0.03)	0.33	1.38	(0.00)	0.09	1.10	(0.45)	0.05	1.05	(0.68)	0.07	1.08	(0.46)
FTF1	socrelation	4.17	64.48	(0.00)	3.07	21.57	(0.00)	3.36	28.73	(0.00)				4.05	57.35	(0.00)
FTF2	Intercept	-7.10	0.00	(0.00)	-8.07	0.00	(0.00)	-6.70	0.00	(0.00)	-5.14	0.01	(0.00)	-11.86	0.00	(0.00)
FTF2	recAdmin	2.75	15.59	(0.01)	3.32	27.56	(0.00)	1.85	6.36	(0.16)	0.75	2.11	(0.35)	6.00	404.14	(0.00)
FTF2	recDeptC	0.66	1.94	(0.41)	2.20	8.99	(0.00)	-0.52	0.60	(0.64)	-0.82	0.44	(0.21)	0.53	1.70	(0.75)
FTF2	recSLCC	1.93	6.88	(0.02)	2.40	11.02	(0.00)	0.76	2.13	(0.49)	0.94	2.56	(0.11)	5.56	260.35	(0.00)
FTF2	sameDept	0.21	1.23	(0.48)	4.49	89.07	(0.00)	-0.11	0.89	(0.72)	1.42	4.15	(0.00)	0.65	1.91	(0.03)
FTF2	sameSLC	1.84	6.31	(0.00)	1.39	4.00	(0.00)	1.31	3.71	(0.00)	1.99	7.31	(0.00)	4.06	57.79	(0.00)
FTF2	socrelation	4.68	107.40	(0.00)	3.48	32.51	(0.00)	3.84	46.75	(0.00)				5.05	156.72	(0.00)
FTF3	adjacent	0.50	1.65	(0.00)	0.08	1.08	(0.62)	0.85	2.34	(0.00)	1.29	3.65	(0.00)	0.52	1.68	(0.00)
FTF3	Intercept	-9.45	0.00	(0.00)	-8.73	0.00	(0.00)	-8.44	0.00	(0.00)	-6.08	0.00	(0.00)	-12.51	0.00	(0.00)
FTF3	recAdmin	4.29	73.22	(0.00)	2.32	10.20	(0.01)	2.74	15.49	(0.00)	0.18	1.20	(0.73)	4.34	76.77	(0.00)
FTF3	recDeptC	1.24	3.46	(0.15)	0.70	2.02	(0.30)	1.51	4.51	(0.04)	0.45	1.57	(0.29)	1.61	5.02	(0.12)
FTF3	recSLCC	0.88	2.41	(0.36)	0.45	1.58	(0.57)	0.79	2.20	(0.34)	0.75	2.12	(0.12)	0.66	1.93	(0.57)
FTF3	sameDept	2.26	9.57	(0.00)	4.21	67.58	(0.00)	2.36	10.59	(0.00)	1.82	6.19	(0.00)	2.60	13.40	(0.00)
FTF3	sameSLC	3.36	28.89	(0.00)	2.17	8.74	(0.00)	2.98	19.69	(0.00)	2.43	11.39	(0.00)	3.69	39.99	(0.00)
FTF3	sharedFree	0.29	1.33	(0.02)	0.22	1.25	(0.10)	-0.42	0.66	(0.00)	0.15	1.17	(0.24)	0.16	1.17	(0.20)
FTF3	socrelation	3.01	20.19	(0.00)	3.17	23.91	(0.00)	2.50	12.22	(0.00)				2.58	13.19	(0.00)

School	Indep. Var.	Classroom Management			Curriculum			Low Performing Students			Friendship			Provider		
		log odds	odds	sig.	log odds	odds	sig.	log odds	odds	sig.	log odds	odds	sig.	log odds	odds	sig.
HSTW1	adjacent	1.51	4.51	(0.00)	1.43	4.19	(0.00)	1.14	3.12	(0.00)	1.25	3.49	(0.00)	1.34	3.83	(0.00)
HSTW1	Intercept	-6.83	0.00	(0.00)	-8.11	0.00	(0.00)	-6.80	0.00	(0.00)	-4.39	0.01	(0.00)	-7.77	0.00	(0.00)
HSTW1	recAdmin	4.03	56.24	(0.00)	1.93	6.90	(0.03)	1.07	2.90	(0.33)	0.59	1.80	(0.29)	1.81	6.12	(0.05)
HSTW1	recDeptC	0.74	2.09	(0.16)	1.09	2.96	(0.07)	-0.33	0.72	(0.67)	0.15	1.16	(0.69)	0.12	1.13	(0.86)
HSTW1	recSLCC	-0.42	0.66	(0.46)	-0.68	0.51	(0.30)	-0.81	0.45	(0.33)	0.37	1.45	(0.32)	0.85	2.34	(0.21)
HSTW1	sameDept	3.17	23.76	(0.00)	5.00	149.15	(0.00)	2.06	7.85	(0.00)	2.56	12.93	(0.00)	1.45	4.27	(0.00)
HSTW1	sameSLC	-0.06	0.94	(0.80)	0.26	1.29	(0.31)	0.73	2.07	(0.00)	0.12	1.13	(0.60)	2.33	10.31	(0.00)
HSTW1	sharedFree	-0.05	0.95	(0.78)	0.19	1.21	(0.30)	-0.33	0.72	(0.08)	0.18	1.19	(0.31)	-0.13	0.88	(0.55)
HSTW1	socrelation	2.95	19.03	(0.00)	3.75	42.42	(0.00)	3.51	33.58	(0.00)	.	.	.	3.35	28.43	(0.00)
HSTW2	adjacent	0.64	1.89	(0.00)	1.90	6.71	(0.00)	0.92	2.52	(0.00)	1.70	5.48	(0.00)	1.31	3.70	(0.00)
HSTW2	Intercept	-8.76	0.00	(0.00)	-7.96	0.00	(0.00)	-7.12	0.00	(0.00)	-4.79	0.01	(0.00)	-10.37	0.00	(0.00)
HSTW2	recAdmin	-0.84	0.43	(0.76)	-1.31	0.27	(0.58)	0.03	1.03	(0.99)	-1.63	0.20	(0.17)	-0.78	0.46	(0.81)
HSTW2	recDeptC	2.81	16.62	(0.00)	1.53	4.62	(0.02)	1.43	4.17	(0.04)	0.24	1.27	(0.46)	0.45	1.56	(0.64)
HSTW2	recSLCC	7.59	1972.65	(0.00)	3.99	53.97	(0.03)	3.77	43.51	(0.06)	2.18	8.85	(0.01)	6.48	650.02	(0.01)
HSTW2	sameDept	2.59	13.32	(0.00)	3.46	31.68	(0.00)	1.83	6.22	(0.00)	2.15	8.60	(0.00)	2.01	7.45	(0.00)
HSTW2	sameSLC	0.25	1.28	(0.04)	1.00	2.72	(0.00)	0.83	2.29	(0.00)	0.35	1.42	(0.03)	0.87	2.38	(0.00)
HSTW2	sharedFree	0.99	2.68	(0.00)	0.51	1.66	(0.03)	-0.08	0.93	(0.67)	0.43	1.53	(0.01)	1.07	2.93	(0.00)
HSTW2	socrelation	4.11	61.02	(0.00)	2.27	9.66	(0.00)	2.81	16.56	(0.00)	.	.	.	3.33	27.80	(0.00)
HSTW3	adjacent	1.16	3.18	(0.00)	2.64	13.96	(0.00)	1.14	3.11	(0.00)	1.14	3.13	(0.00)	1.13	3.10	(0.00)
HSTW3	Intercept	-7.07	0.00	(0.00)	-9.80	0.00	(0.00)	-9.01	0.00	(0.00)	-4.12	0.02	(0.00)	-8.73	0.00	(0.00)
HSTW3	recAdmin	5.31	203.17	(0.00)	5.52	249.69	(0.00)	5.74	310.54	(0.00)	0.70	2.01	(0.23)	4.11	60.84	(0.00)
HSTW3	recSLCC	0.28	1.33	(0.74)	0.23	1.25	(0.86)	0.19	1.21	(0.89)	0.39	1.48	(0.35)	3.40	29.92	(0.00)
HSTW3	sameDept	1.78	5.94	(0.00)	3.57	35.63	(0.00)	2.04	7.73	(0.00)	1.33	3.79	(0.00)	1.73	5.67	(0.00)
HSTW3	sameSLC	-0.23	0.80	(0.32)	-0.15	0.86	(0.43)	-0.29	0.75	(0.18)	0.05	1.05	(0.77)	1.32	3.73	(0.00)
HSTW3	socrelation	3.91	50.11	(0.00)	1.74	5.69	(0.00)	4.54	93.79	(0.00)	.	.	.	3.81	45.26	(0.00)

School	Indep. Var.	Classroom Management			Curriculum			Low Performing Students			Friendship			Provider		
		log odds	odds	sig.	log odds	odds	sig.	log odds	odds	sig.	log odds	odds	sig.	log odds	odds	sig.
PLN1	adjacent	1.22	3.40	(0.00)	1.08	2.93	(0.00)	0.93	2.54	(0.00)	1.22	3.40	(0.00)	3.90	49.62	(0.00)
PLN1	Intercept	-7.64	0.00	(0.00)	-7.05	0.00	(0.00)	-6.08	0.00	(0.00)	-5.10	0.01	(0.00)	-23.85	0.00	(0.00)
PLN1	recAdmin	3.86	47.48	(0.00)	0.82	2.28	(0.36)	0.60	1.83	(0.51)	0.89	2.44	(0.16)	.	.	.
PLN1	recDeptC	1.50	4.50	(0.12)	0.77	2.16	(0.32)	-1.45	0.24	(0.17)	1.03	2.81	(0.06)	1.67	5.29	(0.65)
PLN1	recSLCC	0.23	1.26	(0.79)	0.76	2.13	(0.26)	1.44	4.22	(0.06)	-0.12	0.89	(0.81)	10.80	48995.67	(0.00)
PLN1	sameDept	3.47	32.03	(0.00)	3.67	39.38	(0.00)	2.39	10.86	(0.00)	3.31	27.27	(0.00)	5.63	279.52	(0.00)
PLN1	sharedFree	-0.48	0.62	(0.01)	-0.08	0.92	(0.58)	-1.22	0.30	(0.00)	0.30	1.35	(0.04)	-1.93	0.14	(0.00)
PLN1	socrelation	3.64	37.95	(0.00)	2.41	11.16	(0.00)	3.56	35.12	(0.00)	.	.	.	0.43	1.54	(0.07)
PLN2	adjacent	1.38	3.97	(0.00)	1.85	6.37	(0.00)	0.98	2.66	(0.00)	1.33	3.77	(0.00)	-0.18	0.83	(0.34)
PLN2	Intercept	-6.78	0.00	(0.00)	-6.96	0.00	(0.00)	-5.06	0.01	(0.00)	-4.18	0.02	(0.00)	-24.44	0.00	(0.00)
PLN2	recAdmin	4.93	137.76	(0.00)	.	.	.	-0.36	0.70	(0.81)	1.22	3.39	(0.13)	.	.	.
PLN2	recDeptC	1.91	6.73	(0.04)	3.17	23.90	(0.01)	0.46	1.58	(0.72)	0.93	2.53	(0.23)	.	.	.
PLN2	recSLCC	1.20	3.30	(0.05)	0.12	1.12	(0.88)	0.51	1.67	(0.53)	0.53	1.69	(0.28)	13.62	824963.59	(0.00)
PLN2	sameDept	2.15	8.55	(0.00)	2.92	18.60	(0.00)	1.10	3.01	(0.00)	1.68	5.35	(0.00)	1.66	5.26	(0.21)
PLN2	sharedFree	-0.07	0.93	(0.77)	-0.98	0.37	(0.00)	-0.77	0.47	(0.00)	0.13	1.14	(0.43)	-5.92	0.00	(0.00)
PLN2	socrelation	3.30	27.20	(0.00)	3.44	31.14	(0.00)	2.66	14.31	(0.00)	.	.	.	5.06	157.97	(0.00)
PLN3	adjacent	1.03	2.79	(0.00)	1.70	5.49	(0.00)	0.74	2.10	(0.00)	1.05	2.85	(0.00)	1.58	4.83	(0.00)
PLN3	Intercept	-6.50	0.00	(0.00)	-7.56	0.00	(0.00)	-6.25	0.00	(0.00)	-4.75	0.01	(0.00)	-11.20	0.00	(0.00)
PLN3	recAdmin	3.70	40.57	(0.00)	2.45	11.60	(0.03)	2.30	10.01	(0.04)	-0.23	0.80	(0.77)	.	.	.
PLN3	recDeptC	2.16	8.66	(0.00)	3.02	20.41	(0.00)	1.47	4.35	(0.06)	0.74	2.10	(0.05)	4.09	59.44	(0.00)
PLN3	recSLCC	0.19	1.21	(0.57)	0.01	1.01	(0.99)	0.35	1.42	(0.37)	0.31	1.36	(0.11)	2.06	7.83	(0.00)
PLN3	sameDept	1.80	6.05	(0.00)	3.13	22.87	(0.00)	1.27	3.55	(0.00)	1.90	6.66	(0.00)	1.44	4.22	(0.00)
PLN3	sharedFree	-0.10	0.90	(0.48)	-0.33	0.72	(0.04)	-0.03	0.97	(0.84)	0.08	1.08	(0.54)	-0.02	0.98	(0.85)
PLN3	socrelation	4.35	77.25	(0.00)	3.58	36.04	(0.00)	2.89	18.03	(0.00)	.	.	.	3.84	46.70	(0.00)

School	Indep. Var.	Classroom Management			Curriculum			Low Performing Students			Friendship			Provider		
		log odds	odds	sig.	log odds	odds	sig.	log odds	odds	sig.	log odds	odds	sig.	log odds	odds	sig.
RU1	adjacent	0.65	1.91	(0.08)	2.64	14.07	(0.00)	0.53	1.70	(0.09)	1.36	3.90	(0.00)	.	.	.
RU1	Intercept	-6.39	0.00	(0.00)	-12.15	0.00	(0.00)	-8.81	0.00	(0.00)	-3.65	0.03	(0.00)	.	.	.
RU1	recAdmin	5.41	223.20	(0.00)	8.25	3828.71	(0.00)	6.60	738.71	(0.00)	0.11	1.12	(0.91)	.	.	.
RU1	recDeptC	1.86	6.44	(0.05)	2.51	12.31	(0.21)	-0.23	0.80	(0.90)	0.82	2.27	(0.20)	.	.	.
RU1	recSLCC	0.41	1.51	(0.71)	-4.11	0.02	(0.12)	.	.	.	-0.81	0.45	(0.32)	.	.	.
RU1	sameDept	3.65	38.40	(0.00)	4.75	115.05	(0.00)	4.10	60.32	(0.00)	1.28	3.59	(0.00)	.	.	.
RU1	sharedFree	-0.60	0.55	(0.23)	1.63	5.09	(0.00)	0.42	1.53	(0.36)	-0.05	0.95	(0.88)	.	.	.
RU1	sorelation	3.51	33.39	(0.00)	2.99	19.85	(0.00)	3.51	33.31	(0.00 )	.	.	.	.	.	.
RU2	adjacent	1.06	2.89	(0.00)	0.68	1.97	(0.00)	0.90	2.45	(0.00)	0.89	2.43	(0.00)	1.18	3.25	(0.00)
RU2	Intercept	-9.25	0.00	(0.00)	-8.50	0.00	(0.00)	-7.43	0.00	(0.00)	-5.59	0.00	(0.00)	-15.18	0.00	(0.00)
RU2	recAdmin	7.09	1196.45	(0.00)	2.31	10.08	(0.05)	3.60	36.47	(0.00)	1.44	4.23	(0.09)	1.48	4.39	(0.43)
RU2	recDeptC	1.51	4.52	(0.18)	3.49	32.85	(0.00)	0.86	2.36	(0.39)	0.92	2.52	(0.24)	.	.	.
RU2	recSLCC	1.32	3.74	(0.07)	.	.	.	1.09	2.99	(0.08)	0.59	1.81	(0.22)	.	.	.
RU2	sameDept	3.16	23.58	(0.00)	4.63	102.53	(0.00)	1.26	3.53	(0.00)	2.06	7.85	(0.00)	-0.85	0.43	(0.00)
RU2	sameSLC	-0.15	0.86	(0.55)	.	.	.	-0.23	0.80	(0.51)	0.06	1.07	(0.74)	.	.	.
RU2	sharedFree	0.30	1.36	(0.13)	0.32	1.37	(0.05)	0.80	2.22	(0.00)	0.49	1.64	(0.00)	0.86	2.37	(0.00)
RU2	sorelation	3.30	27.19	(0.00)	2.52	12.48	(0.00)	3.69	40.01	(0.00)	.	.	.	1.79	6.01	(0.00)
RU3	adjacent	-0.25	0.78	(0.37)	0.26	1.29	(0.39)	-0.10	0.90	(0.66)	1.97	7.20	(0.00)	-7.72	0.00	(0.00)
RU3	Intercept	-6.54	0.00	(0.00)	-6.04	0.00	(0.00)	-6.75	0.00	(0.00)	-4.62	0.01	(0.00)	-22.19	0.00	(0.00)
RU3	recAdmin	2.27	9.70	(0.00)	1.28	3.58	(0.11)	1.84	6.30	(0.03)	-1.43	0.24	(0.15)	2.70	14.87	(0.29)
RU3	recDeptC	1.99	7.29	(0.03)	1.62	5.07	(0.03)	1.44	4.23	(0.11)	0.16	1.18	(0.80)	3.94	51.46	(0.12)
RU3	recSLCC	-0.71	0.49	(0.42)	0.54	1.71	(0.40)	0.90	2.47	(0.25)	0.57	1.77	(0.27)	5.56	259.25	(0.01)
RU3	sameDept	2.17	8.74	(0.00)	3.03	20.66	(0.00)	1.80	6.04	(0.00)	2.04	7.66	(0.00)	3.49	32.76	(0.00)
RU3	sorelation	3.53	33.98	(0.00)	2.31	10.12	(0.00)	3.21	24.86	(0.00)	.	.	.	9.67	15773.33	(0.00)

School	Indep. Var.	Classroom Management			Curriculum			Low Performing Students			Friendship			Provider		
		log odds	odds	sig.	log odds	odds	sig.	log odds	odds	sig.	log odds	odds	sig.	log odds	odds	sig.
SN1	adjacent	1.57	4.81	(0.00)	0.64	1.90	(0.01)	0.46	1.59	(0.16)	1.63	5.08	(0.00)	1.81	6.12	(0.00)
SN1	Intercept	-7.62	0.00	(0.00)	-11.97	0.00	(0.00)	-5.62	0.00	(0.00)	-4.76	0.01	(0.00)	-11.55	0.00	(0.00)
SN1	recAdmin	.	.	.	5.93	375.06	(0.04)	2.05	7.79	(0.15)	1.96	7.12	(0.08)	.	.	.
SN1	recDeptC	0.33	1.40	(0.80)	3.36	28.68	(0.02)	1.43	4.17	(0.04)	0.76	2.13	(0.16)	3.86	47.43	(0.01)
SN1	recSLCC	2.91	18.29	(0.02)	3.84	46.71	(0.01)	2.52	12.47	(0.00)	1.25	3.51	(0.03)	4.04	56.78	(0.02)
SN1	sameDept	1.00	2.72	(0.00)	6.00	401.45	(0.00)	1.01	2.75	(0.00)	1.09	2.97	(0.00)	2.98	19.62	(0.00)
SN1	sameSLC	0.93	2.53	(0.00)	-0.05	0.95	(0.80)	0.95	2.59	(0.00)	0.80	2.22	(0.00)	-0.35	0.71	(0.08)
SN1	sharedFree	0.08	1.08	(0.67)	1.60	4.97	(0.00)	-0.27	0.76	(0.27)	0.42	1.52	(0.02)	0.14	1.15	(0.44)
SN1	socrelation	3.26	26.10	(0.00)	1.81	6.13	(0.00)	2.12	8.34	(0.00)	.	.	.	2.26	9.58	(0.00)
SN2	adjacent	2.33	10.26	(0.00)	2.41	11.08	(0.00)	2.12	8.30	(0.00)	3.54	34.60	(0.00)	4.17	64.76	(0.00)
SN2	Intercept	-9.36	0.00	(0.00)	-9.52	0.00	(0.00)	-10.05	0.00	(0.00)	-7.12	0.00	(0.00)	-19.63	0.00	(0.00)
SN2	recAdmin	5.10	163.29	(0.00)	2.06	7.83	(0.02)	2.99	19.86	(0.00)	0.92	2.51	(0.13)	3.20	24.54	(0.12)
SN2	recDeptC	3.07	21.50	(0.00)	2.28	9.76	(0.00)	2.80	16.43	(0.00)	0.77	2.16	(0.05)	3.03	20.75	(0.02)
SN2	recSLCC	0.19	1.21	(0.90)	1.29	3.65	(0.31)	3.25	25.84	(0.02)	0.46	1.58	(0.61)	9.47	13029.33	(0.00)
SN2	sameDept	2.04	7.67	(0.00)	3.39	29.52	(0.00)	2.54	12.72	(0.00)	2.30	9.97	(0.00)	2.30	9.93	(0.00)
SN2	sharedFree	0.27	1.31	(0.01)	0.39	1.47	(0.00)	0.32	1.37	(0.00)	0.11	1.12	(0.21)	0.11	1.11	(0.10)
SN2	socrelation	4.75	115.88	(0.00)	4.04	56.55	(0.00)	4.26	71.16	(0.00)	.	.	.	5.01	150.14	(0.00)
SN2	adjacent	2.01	7.50	(0.00)	0.56	1.75	(0.05)	1.10	3.01	(0.00)	2.76	15.85	(0.00)	-14.74	0.00	(0.00)
SN3	Intercept	-9.23	0.00	(0.00)	-7.27	0.00	(0.00)	-8.29	0.00	(0.00)	-5.29	0.01	(0.00)	-32.02	0.00	(0.00)
SN3	recAdmin	5.96	389.22	(0.00)	.	.	.	1.32	3.76	(0.50 )	.	.	.	.	.	.
SN3	recDeptC	1.17	3.23	(0.08)	1.31	3.72	(0.00)	0.21	1.24	(0.81)	0.58	1.78	(0.17)	.	.	.
SN3	sameDept	2.81	16.62	(0.00)	4.12	61.81	(0.00)	1.80	6.03	(0.00)	2.60	13.53	(0.00)	-2.29	0.10	(0.00)
SN3	sharedFree	0.25	1.29	(0.16)	0.15	1.16	(0.52)	0.73	2.09	(0.00)	-0.17	0.85	(0.25)	3.59	36.33	(0.00)
SN3	socrelation	5.06	158.25	(0.00)	3.07	21.47	(0.00)	4.50	90.00	(0.00)	.	.	.	22.04	3732875500.93	(0.00)