

**Chain Reaction:
How Teacher Communication Influences Attitude**

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Abstract

External reform programs have been introduced into schools in order to change teacher practice with the ultimate goal of improving student performance. The longevity and fidelity of program implementation within a school is determined in part by teachers' attitudes towards the reform program (Frank and Fahrback, 1999). In this study, social network data collected from teachers in nine high schools are used to investigate the role that communicative peers (and their attitudes) play in the formation of teacher attitude. Five hypotheses concerning the roles that individual attributes and peer influence play on teacher attitude toward reform are proposed and empirically tested (using the spatial autoregressive model). The results of this investigation indicate that teachers are influenced by those with whom they communicate, and that the normative pressure of peer influence is amplified with increased involvement in conversation. The influence of peers is significant above and beyond that which is typically estimated in traditional "attribute" regression research. In addition, it is recognized that the role of peer-influence is limited to those individuals with whom a teacher communicates directly; teachers who are connected only through an intermediary, or a series of intermediaries, do not influence each other's attitudes towards reform. These findings indicate that well-connected teachers can either undermine or enhance co-workers' attitudes about a reform program in a school. This implies that the social context of a school as measured through network analysis can help explain variability in reform program implementation.

Introduction

Much has been written about schools as complex organizations in which making change is a slow and difficult process. Often, research into school change has focused on the behaviors of teachers and administrators. Researchers have studied whether school staffs are enacting programs in expected ways and then asked why such behaviors are, or are not, in evidence. A large number of implementation studies have been produced that explain implementation as a function of available resources, professional development opportunities, monitoring behaviors or a host of other programmatic dimensions (e.g., McLaughlin, 1990; Fowler, 1989). However, in spite of all of this, change remains unpredictable and challenging. The loosely coupled nature of school systems (Weick, 1976) and the relative autonomy of teachers in their classrooms (Lortie, 2002), provide school teachers – and high school teachers in particular (Siskin, 1994) – with a great deal of discretion over their practice.

In contrast to the traditional teacher autonomy, a host of independently-designed school improvement programs have been created to improve teacher practice and student achievement. The introduction of a school reform program is of particular interest as a stimulus for change as ever larger numbers of schools partner with external organizations in search of new and improved practices (Glennan, Bodilly, Galegher & Kerr, 2004). However, many evaluations that focus on changes in teacher behavior (e.g., Glennan, 1998; Corcoran et al, 2000) as well as research that focuses on changes in student performance (e.g., CSRQ Center, 2006; Berends et al, 2002) have shown very limited impact of such reform programs. Part of the reason for these limited impacts is likely the fact that programs are seldom implemented and institutionalized as designed.

In this paper, we study one aspect of teacher change resulting from external school reform programs. The aspect on which we focus is teacher attitude about the reform. Our analysis is based on nine high schools that have partnered with school reform organizations and had, at the

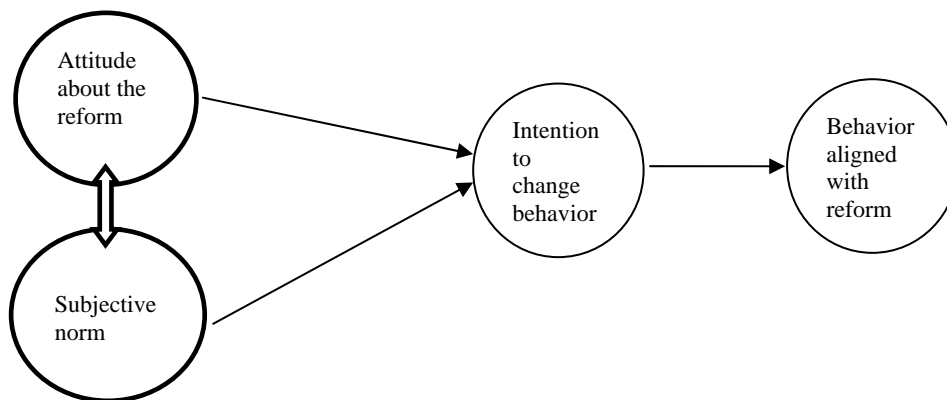
time of our survey, been working with those organizations for anywhere from one to five years. Though we recognize that the goal of these programs is to encourage teachers and schools to change their traditional practices, this paper focuses on attitudes as an essential element in the initial implementation and longer term institutionalization of a reform program.

We believe that though teachers can be compelled to perform a particular set of behaviors through an effectively designed incentive system, “enduring cooperation can occur only if actors engage in some form of communication that changes some attribute of the actors, either their beliefs, sentiments, or behaviors” (Frank and Fahrback, 1999, p. 254). Supporting this contention, Supovitz and Turner (2000) found that teacher attitude towards reform was one of the most powerful influences on teacher practices. In this paper, we focus on actors’ beliefs or sentiments about a reform as an important influence on teacher practice.

Based on the work of Ajzen and Madden (1986), we argue that teachers’ positive attitudes about reform are essential in producing behaviors aligned with reform expectations. Attitude is defined as “the degree to which a person has a favorable or unfavorable evaluation of the behavior in question” (p. 454). Ajzen and Madden argue that teacher attitude about reform is in a dynamic relationship with what they call the *subjective norm*, which is the “perceived social pressure to perform or not perform the behavior” (p. 454). We argue, and empirically test, that part of the subjective norm is informed by the prevailing attitudes of staff members that are “connected” to any given individual through networks of communication. We find empirical evidence in our data to support this argument.

The figure below, borrowed from the work of Ajzen and Madden (1986), illustrates the relationship that forms our theoretical framework for the relationship between individual attitude, prevailing norms in the school, teacher intention and practice. The figures that are bold are the area of this framework on which we focus in this paper.

Figure 1. Theoretical Framework



This general theory has been alluded to in other educational research. As Milbrey McLaughlin wrote in revisiting findings from the Rand Change Agent Study, “What matters most to policy

outcomes are local capacity and will...The presence of the will or motivation to embrace policy objectives or strategies is essential in the generation of the effort and energy necessary for a successful project” (McLaughlin, 1990, p. 14). In this analogy, the *will* to change practice can be equated with *intention* in the framework above. Attitude is then an influence on teacher’s will.

McLaughlin recognized that implementers’ will to modify their practices changes over time. Though she states that will or intention to change may develop prior to or following implementation, she does not detail why this change takes place. We argue that attitude or disposition about the reform plays a major role in developing a teacher’s intent to change or not to change. Without positive disposition to reform then, following McLaughlin’s argument, we are unlikely to find successful program implementation.

Undoubtedly, individual variables play a significant role in shaping teachers’ attitudes about a reform program. Past experiences, personal beliefs and educational philosophies can all influence a teacher’s attitude about reform (Richardson, 1996). In addition, individual attributes can play a role in the types and amount of information that teachers can and do access about a new reform. Information theory states that individuals’ attitudes are affected by the type and amounts of information that they access from their interactions with other people (Anderson, 1971; Hovland and Kelly, 1953). Teacher interactions depend on a host of individual variables including their years of experience in a school, their positions within the organization, and their general “connectedness” to others in the organization. All of these variables influence teachers’ access to knowledge and information and thus shape their attitudes about efforts that seek to change their practices.

However, we argue that another essential element in shaping a teacher’s attitudes about reform is the attitudes of his/her colleagues in the organization, as a significant component of the subjective norms perceived by any given individual. This argument is based on research in the field of social psychology that describes individuals’ search for “balance” between themselves and those with whom they have social connections. Balance theory states that people are likely to seek balance between their attitudes and those of their peers either by changing their own attitudes (Festinger, 1950; Steiner, 1966, Schachter, 1951) or by choosing to interact with people who share attitudes more similar to their own (Blau, 1977; Heider, 1958; Marsden, 1981). The bulk of this paper is composed of an empirical examination of the extent to which balance theory is realized in high schools undergoing reform.

Investigation

In order to organize our exploration into the relationships between attitudes, attributes, and social context, we propose five research questions:

1. Are individual attributes associated with individual attitude about a reform? If so, which ones?
2. Are teachers’ attitudes about reform correlated with the attitudes of those with whom they engage in conversation about the reform?
3. Are teachers’ attitudes about reform correlated with the attitudes of those with whom they engage in conversation about *any* topic of professional or social concern?

4. What is the relationship between the number of communication partners that a person has and the correlation between partners' attitudes and the person's attitude about reform?
5. Is the correlation between the attitudes of individuals not directly connected to a focal teacher and that focal teacher similar to or different from the correlation with the attitudes of those individuals in direct communication with the focal teacher?

The theoretical foundation for each of these questions will be addressed in turn.

Research question 1: Are individual attributes associated with individual attitude about a reform? If so, which ones?

As stated above, individual attributes that influence both personal beliefs and connections to knowledge and information can influence individual's attitudes about reform. In this research, we examine a set of individual level variables and their relationship to attitudes about reform. These variables are described below.²

- *Years of Teaching Experience* – Some school administrators recruit new teachers because of their enthusiasm and willingness to try new programs and practices. New teachers have been found to be more open to innovative practices as they do not have a “track record” with which to justify their preferred practice (Ghaith and Yaghi, 1997). Given this research, we expect that years of teaching experience will be negatively correlated with individual attitude towards reform; that newer teachers will feel more positively disposed toward the reform.
- *Membership on a Faculty Committee* – Research has shown that environments in which teachers can collaborate with co-workers and take a role in shaping school culture beyond their classrooms are related to teachers having more positive attitudes about their work (Rosenholtz, 1989; Little, 1981 and 1986). Given that some teachers are participating on committees that are both collaborative and involved in the larger work of the school, research would suggest that they are more likely to be positively disposed toward changes underway in the school. As such, we expect teachers who are members of a faculty committee to have more positive attitudes towards reform than non-members.
- *Department Chair* – In the majority of schools, the only formal leadership position delegated to teachers is that of department chairperson. Unlike the committee membership described above, department chairs are often selected as the result of seniority and have a quasi-administrative function (Smith & Lewis, 1999; Siskin, 1994). These department chairs may have some of their power diminished or may be placed in a position of uncertainty due to the introduction of new programs and reforms in schools (Bliss et al, 1996). As such, we hypothesize that department chairs will tend to have a relatively more negative attitude towards reform than non-chairs.
- *Network Degree* – The final attribute of interest utilizes a component of the communication networks in the schools and describes the number of connections to other people that any given individual has in the school. These connections are a potential

² Race and gender of participants was measured, but was unrelated to the attitude outcome variable. It was eliminated from our analysis both because of the lack of a theoretical relationship to attitude and in order to conserve degrees of freedom.

source of information for teachers and, drawing on information theory described above, would be positively associated with attitudes about the reform.

While Research Question #1 will provide us with information about the relationship between individual attributes and individual attitudes, it will not provide information about the degree to which teachers' attitudes are related to the subjective norms of the communities in which they find themselves. Research questions two through five explore the relationships between teachers' self-selected communities and their attitudes about a new high school reform.

Research question 2: Are teachers' attitudes about reform correlated with the attitudes of those with whom they engage in conversation about the reform?

Previous research has investigated the social and organizational factors that were associated with communication in high schools and found that teachers are quite selective in who they talk with about different areas of professional concern. For example, teachers tend to talk with individuals in their departments when requesting help regarding course content and pacing and are likely to turn to administrators for advice about classroom management. Clearly, teachers utilize different resources for different purposes, and they obtain information from a variety of sources (Weinbaum et al, 2006).

Given this finding, we want to investigate whether the people that a teacher contacts for advice about a reform program have a particular influence on the individual's attitudes about reform. A teacher who is involved in conversations about the reform with individuals whose attitudes towards the reform were generally negative may feel pressure to be more skeptical about the value of the reform. Similarly, a teacher whose peers verbalize their endorsement of the reform may feel more inclined to value components of the reform. Therefore, individual attitude may not only be a function of one's own individual attributes (as investigated in research question one), but also may be impacted by the attitudes of conversational partners.

Beginning with this research question, and for the remainder of this paper, we focus much more on an analysis of teacher attitude as it relates to balance theory. Using methods described below, we are able to describe the extent of conversation about the reform programs as well as the impact of the attitudes held by the communication partners of any given individual.

Given that teachers are quite discriminating about the people they seek out for advice for different purposes, we begin our study of the impact of social connections by examining only that social network that is most closely related to the reform program itself. However, teachers exist in a much broader school environment and likely are exposed to attitudes about a new reform program from sources that they do not necessarily seek out for advice about the reform. For this reason, we next turn to an examination of a broader range of teachers' social connections within their schools.

Research question 3: Are teachers' attitudes about reform correlated with the attitudes of those with whom they engage in conversation about any topic of professional or social concern?

It is plausible that teachers gain insight into peer attitudes regarding reform through the full range of conversations in which they engage. The narrowly defined pathway of “conversation about reform” may not be a sufficient network from which to glean the prevailing attitudes or subjective norms in a teacher’s environment. In their effort to achieve balance, teachers would then be likely either to adjust their attitudes to more closely match the full spectrum of people with whom they communicate or they will select people with whom they want to communicate based on similar sentiments about the reform. Though we will not be able to determine from our data which of the causes of balance in attitude is relevant here, we will be able to assess the extent to which a teacher’s attitude is correlated with his/her full communication network.

However, it is also true that the size of any given individual’s communication network varies greatly. Some individuals communicate with a great number of co-workers while others communicate with no one or almost no one during the course of their work day. For this reason, we next consider the relationship between a teacher’s attitude and the changing impact of peer attitudes, according to the number of conversations in which that person is involved.

Research question 4: What is the relationship between the number of communication partners that a person has and the correlation between partners’ attitudes and the person’s attitude about reform?

Individuals can maintain their attitudes or behaviors if they spend their time in relative isolation. However, once an individual engages with others, any attitude that deviates from the group norm becomes more visible to both the individual and his/her communication partners, also known as alters. As the individual interacts with more and more alters, any deviation from the group norm becomes more apparent and should make the individual more inclined to modify his/her attitudes. In an analogous situation, Rogers (1979) recognized that the likelihood of adopting innovations greatly increased once half of an individual’s alters had taken on a new program. The contribution of numerous alters’ opinions on attitude change will likely have a similar effect to this impact on adoption of a new practice.

Coleman’s 1988 work on social capital also speaks to the impact of peer pressure on an individual’s attitude. Groups, he points out, tend toward “attitude closure.” This concept is similar to the common idea of peer pressure. The larger an individual’s social network, the more pressure can be exerted for him/her to align his/her attitude with the group. Alternatively, (and again, the cause can not be pinpointed from our data) an individual who has an attitude that is more aligned with the group norms, will find it easier to identify and locate appealing communication partners. Either a change in attitude to meet group norms or a selection of communication partners that align with an individual’s attitudes should result in a correlation between larger network size and the impact of alter attitudes on a given teacher.

Up until now, we have considered the impact of peers with whom a teacher communicates *directly*. However, individuals may be exposed to attitudes about the reform through other people and the general mood of the school communities of which they are members. We begin to examine the issue of impacts of attitude from a broader social context in our next research question.

Research question 5: Is the correlation between the attitudes of individuals not directly connected to a focal teacher and that focal teacher similar to or different from the correlation with the attitudes of those individuals in direct communication with the focal teacher?

Individuals are not limited to the information that they obtain through direct contact. Attitudes, like information, can be passed or conveyed through individuals and will contribute to the general zeitgeist of an institution even if an individual is not in direct communication with many individuals. This would suggest that there should be a correlation between the attitude of individuals surrounding a focal actor, even those that are connected through an intermediary, and the attitude of that actor.

However, information will tend to be diluted or will contain less of the original message as it passes from alter to alter, much like the children’s game of “Telephone.” The flow of information from person i to person j is inversely proportional to the length of the path from i to j (Davis, 1967). Similar findings are noted by Bidwell, Frank and Quiroz (1997), where a greater number of steps between an influential individual and an advice seeker led to a greater distortion of the message sent.

From these findings, it becomes clear that information does indeed flow from indirect alters. However, information is more unclear for the recipient as s/he becomes more distant from the “sender” of the information. This final research question seeks to learn whether attitudes follow a similar pattern and if co-workers attitudes are less strongly related to a given individual’s attitude as s/he has less close communication with those co-workers.

Data

In order to answer the five research questions posed above, social network data and teacher attitude data regarding the reform were collected through surveys. These surveys were administered as part of a larger two and a half year investigation by the Consortium for Policy Research in Education (CPRE) into the role of reform in a national sample of fifteen high schools. Three types of school improvement programs were examined. The emphasis on these three reform types grew out of findings from a prior phase of CPRE’s Study of High School Strategies for Instructional Improvement (Gross & Goertz, 2005). Among the major findings of that study was that comprehensive school reform programs, programs to improve student literacy, and programs to increase data-driven instruction and decision-making were three of the major efforts that high schools chose to improve performance. Informed by these findings, these three categories of interventions were chosen as the focus of this research.

Of the three reform categories in that larger study, only the comprehensive school reforms (CSRs) and the data-driven decision-making reforms were intended to have schoolwide changes, and as such, only schools involved in these reforms were investigated for the purposes of this paper. Two CSRs were investigated for the purposes of the CPRE study: First Things First (FTF) and High Schools that Work (HSTW). Both of these programs seek to influence the organization of schools as well as teacher practices. Though collaborative planning and increased communication about teaching and learning, these reforms promote particular practices

that have been shown to lead toward increased student achievement. One data driven reform was examined under the CPRE study: SchoolNet (SN). SchoolNet provides a range of services that are intended to help school staff to use data in ways that will lead to increased student achievement. Its services allow teachers to access student performance data and related standards, test items, or lesson materials in order to better target instruction. All of these programs seek to change the practices of all teachers in their partner schools.

At the request of the CPRE researchers, staff from each of the reforms identified three schools to serve as representatives of a given reform - two schools in their first or second year of implementation and a third “mature” site that had worked with the reform for three to five years.

Surveys were conducted at the nine schools in the spring of 2005. We collected 717 surveys from these nine schools, with teacher response rates ranging from 51% to 83%, with an average teacher response rate of 67%. Thirty-six of the 717 survey respondents (5%) could not be positively identified as teachers, but were included in our analyses because they were viewed as participating members of teachers’ communication networks. The specific school response rates can be found in Appendix A.³

Methods

Attitude Scale Development

Ten questions were used to measure teachers’ attitudes about the reforms. For each of the reforms, the questions were identical except for the name of the reform with which any particular school and teacher were working. Individuals were asked to indicate the degree to which they agreed or disagreed (measured on a four point Likert scale ranging from “strongly disagree” to “strongly agree”) with prompts that assessed their attitudes with respect to the reform program in their schools. The survey questions that we used can be found in Appendix B.

As the three programs emphasized different strategies, it was assumed that the factor structures might differ across reforms. For each reform program, a common factor analysis was performed on these ten questions. A single attitude factor was extracted for each reform-specific set of questions, as a multiple factor solution to these items would not have been conceptually meaningful. Precision weighted scale scores were generated according to the obtained factor structure. The α coefficients for each reform attitude scale score were sufficiently reliable to be considered as unidimensional constructs.⁴ For the purposes of analysis, attitude scale scores were school centered to have a mean score of zero and a standard deviation of one.

Social Context Measurement

The survey instrument that was used to obtain data about the schoolwide communication networks included five “network” questions, three of which focused on traditional professional

³ For the purposes of anonymity, the school sites are named by their reform type and length of implementation in the school. Accordingly, FTF1 is a school that had just begun its partnership with a the FTF reform program, HSTW2 indicates a school that was in its second year of work with HSTW, and SN3 indicates a school involved with SchoolNet for three to five years at the time of survey administration.

⁴ Cronbach’s (1951) α for the HSTW, FTF, and SN scales were .90, .90 and .94, respectively.

concerns for teachers, one on communication about the reform being studied, and one on friendship connections. Table 1 describes these five networks.

Table 1. Five Networks.

Network label	Survey question	Group
Classroom Management	To whom, in your school, have you turned to for advice about classroom management during this school year?	Professional
Course Content and Planning	During this school year, to whom in your school have you gone for help in selecting and planning course content coverage and pacing?	
Low Performing Students	During this school year, to whom in your school have you turned for advice on strategies to assist low performing students?	
Reform	Please list the people inside or outside your school to whom you turned for advice in using [reform name] during this school year.	Reform
Friendship	During this school year, with whom among your colleagues at this school do you “hang out” and discuss family, home, and/or personal issues?	Friendship

For the first four network questions listed in Table 1, respondents were prompted to name the individuals from whom they sought advice in that area. The fifth network, friendship, was not an advice-seeking relationship. Under each question, there was space on the survey for respondents to list up to five names for each network.⁵ Using these individual responses, we created ego-networks (the connections between each node or “ego” and the nodes with whom “ego” communicates) for each individual, and then combined these individual ego-networks into a school-wide social network for each network type in each of the nine schools. We loosely refer to the communication patterns that resulted from the survey responses to the five questions as “communication networks” or “social networks.”

Social network data are a collection of the communication between the n nodes/actors in an organization. The collection of all possible pairs for all n actors in the organization can be structured as a sociomatrix (Wasserman & Faust, 1994), whereby the strength of the relational tie emanating from actors i and received by actor j will be the variable w_{ij} . The matrix W below illustrates the connections between all of the individuals in the network. Note that the diagonal values are all zero, indicating that individuals cannot be connected to themselves.

$$(1) \quad W = \begin{pmatrix} 0 & w_{12} & \dots & w_{1n} \\ w_{21} & 0 & \dots & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ w_{n1} & \dots & \dots & 0 \end{pmatrix}$$

The variable w_{ij} can be represented as a dichotomous zero/one value, indicating whether or not actor i is connected at all to actor j , or this variable can be operationalized to indicate the degree

⁵ Limiting the potential responses to five colleagues may have impacted the data collected. However, few of our respondents provided up to five names, suggesting that the limit did not constrain the potential information. Only 15% of respondents provided either four or five names.

of connectedness between the actors. For example, in this study, pairs that spoke to each other in more than one network were considered to be more strongly connected than pairs that communicated in only one network. For the purposes of this study, each relational matrix was symmetrized such that $w_{ij} = \max(w_{ij}, w_{ji})$. In doing so, we convert advice-seeking conversation into a more general indicator of shared communication. Therefore, it is assumed that teachers access peer attitudes through general conversation, and that teachers are not restricted to only glean peers' attitudes through advice relationships.

In this paper, we utilize the data from the survey to create different sociomatrices to reflect different mechanisms through which attitudes might spread.

- In the investigation of Research Question 2, a direct tie matrix created from the reform network question was employed. If an individual i is involved in conversation with individual j regarding the reform, then $w_{ij} = 1$, otherwise zero.
- In the investigation of Research Question 3, the five direct tie matrices were summed together to create a new matrix of communication representing the total amount of conversation measured within a school. Under this rule, w_{ij} represents the number of times that individuals i and j were in conversation with each other.
- In the investigation of Research Question 5, the total communication matrix were modified so as to account for indirect communication between individuals, thus creating a reachability matrix. The value w_{ij} represents the shortest path between individuals i and j . As such, a value of $w_{ij} = 1$ indicates that i and j are directly tied, while $w_{ij} = 2$ means that a path exists from i to j through an intermediary. By taking the reciprocal of each element w_{ij} , an inverse-distance weighted matrix was created, whereby individuals who are further from a given actor were given less weight in the matrix.⁶

In Research Questions 2 through 5, we postulate that individual i 's attitude is a function of his/her individual characteristics ($x_1 \dots x_k$), as well as the attitude of all other individuals j with whom individual i is connected to (w_{ij}). If we allow Y to be a vector of the n random variables y_i , X to be a $n \times k$ matrix of the k individual attributes, β to be the vector of the k unknown parameters for the individual attributes, and ρ to be the unknown parameter indicating social context, then the general linear model can be expressed in matrix form as:

$$(2) \quad Y = \rho WY + X\beta + \varepsilon.$$

The parameter ρ is the network effects coefficient, measuring the degree to which an individual's attitude is a function of the attitude of his/her communication partners. If ρ is positive and statistically significant, then we can be confident that social context plays a role in an individual's attitude about the reform (Land, Deane and Blau, 1991).

Ord (1975) and Doreian (1981) explored maximum likelihood estimators of the parameters, while Roncek and Montgomery (1984) considered an alternate approach which we will employ for the purposes of this paper. The product of the weight matrix W and the dependent variable Y

⁶ The original total conversation matrix will be subtracted from the reachability matrix, such that the contribution of the inverse-weighted matrix will be orthogonal to the contribution of the direct tie matrix in the estimation of the social context variables.

can be considered as an independent variable $Y_I^* = WY$. This new variable Y_I^* is then substituted into equation (2), which can then be solved through OLS. These estimates can be biased, and as such we will interpret them with caution (Anselin, 1988). However, as OLS is the most parsimonious and is usually the most familiar regression method for the reader, we will utilize this method for the purposes of this paper. As indicated by Burt (1987), we will only interpret the social context contagion effects when the null hypothesis is extremely unlikely, with a 0.01 or less probability.

Assuming that W has been row-normalized, Y_I^* is a measure of the average alter attitude score, and therefore an indicator of the “attitude norms” for each actor. As levels of Y_I^* increase, the normative pressure to have a positive attitude increases, and thus, an individual’s Y score should be positively impacted (according to RQ2 through 5).

Research Question 4 will build on the model described in equation (2) with an interaction term between ego-network size⁷ and Y_I^* . This will allow the effect of peer-attitude to differ according to the number of individuals in a given actor’s peer group. In Research Question 5, a new Y_2^* variable will be added to the model indicated in equation (2). This Y_2^* variable will represent the attitude norms of those individuals who are indirectly tied to a focal actor, above and beyond those that are accessible through direct ties.

In all of the models proposed, fixed effects for each school will be included to account for the clustering of attitude scores within an organization. Therefore, the differences in average school attitude will be partialled out of this model, and the resulting parameter estimates will be independent of the unmeasured differences across schools.

Limitations

There are limitations to this study that need to be acknowledged. First and foremost, the results obtained from our analyses are not causal. We were able to identify associations between variables; however, as mentioned in the introduction to this paper, the causal direction between attributes, peer attitudes, and individual attitude could not be determined with these cross-sectional data.

Secondly, for the purposes of network analysis, we imposed boundaries on the communication networks. Although we recognize that sources external to schools are likely frequent sources of advice, other research has identified schools as bounded organizations (e.g., Frank & Fahrbach, 1999) and we based our analysis on a similar belief. For this reason, conversations with individuals outside of the schools were not included in our analyses. In addition, while boundaries on the organization were imposed, the actual number of individuals included in our

⁷ For the purposes of Research Questions 3-5, the phrase “ego-network size” will take on a slightly nuanced meaning. Instead of merely representing the number of individuals with whom and individual is in contact, this variable will indicate the number of communication partnerships in which that individual is involved, taking all networks into consideration. As an individual communicates with more people, this variable will increase, but it will also increase if the individual speaks with the same person in multiple networks. By allowing a single alter to contribute multiple conversations to an individual’s ego-network size, we claim that this individual has more opportunities to glean his/her alter’s attitude, and therefore this alter plays a greater role in the normative pressure on the given individual.

analysis was a smaller subset of these bounded organizations, due to the requirement of the attitude scale as a dependent variable. As such, when creating the communication matrices for each school, the dimensions of the matrices were determined by the survey respondents, and not by the total number of teachers in the school. In doing so, we have constrained our research to examine only the relationship of how attitudes are related within the survey respondent population, and not within the school as a whole.

Finally, as indicated in the methods section above, the analysis of these data could have been accomplished through maximum likelihood estimations of equation (2) and not through OLS, which we have utilized for the purposes of this paper. While provisos have been placed on the interpretation of the results, the results are still potentially biased and as such require careful interpretation of significance.

Analysis

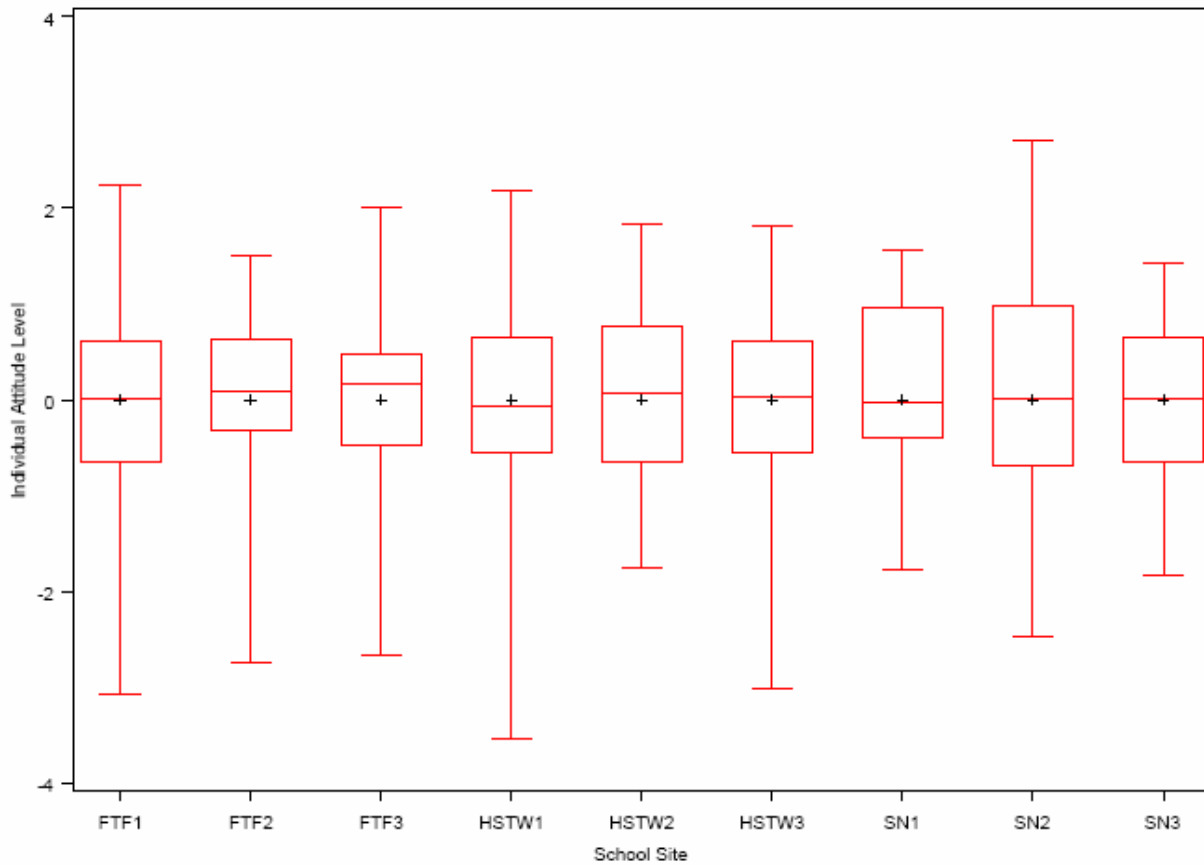
In this section, we first provide some general descriptive statistics in order to acquaint the reader with our data. We then move on to test a series of hypotheses related to our five research questions. As stated above, 717 respondents were included in this study. They are all staff members at nine comprehensive US high schools that have partnerships with one of three external school reform organizations. Only 8% of the teacher respondents were department chairs in their schools. The majority of the survey respondents (55%) were involved in a faculty committee. There was great variability in teaching experience in this sample, ranging from new teachers to veterans with 44 years of experience, with the average experience level at 13.60 years.

Individuals were relatively unconnected to others with respect to communication regarding the reforms in their school, as the average ego-network size was 1.17. This indicates that on average, respondents were involved in conversation about the reform with only one individual. However, in these schools teachers did tend to be involved in more general communication (involving friendship and more typical “professional” communication). Individuals were noted as having an average of 11.13 communication connections across all network types.⁸ A table with descriptive statistics for the study sample can be found in Appendix C.

In addition to individual attribute and network data, this analysis focuses on the attitudes of all teachers in the network. For the purposes of the network investigation, the attitude scale (aggregated across all schools) needed to have adequate variability within each school. Figure 2 illustrates the variability in individual attitude scores in each site.

⁸ Again, if an individual indicated one alter in the “Classroom Management” network and two alters in the “Friendship” network, then his/her total communication ego-network size would be 3 (if he/she was not mentioned by any other survey respondents). It must be noted that even if a respondent indicated the same individual in his/her friendship response as he/she had written for the classroom management response, the ego-network size would still be 3. This measure does not indicate the number of people an individual is in contact with, rather, it indicates the number of communication opportunities in which an individual might obtain information regarding an alter’s attitude regarding reform.

Figure 2: Individual Attitude Levels
School Centered at Mean = 0, STD = 1



Note that the individual attitude scores were centered at the school level, such that the mean score for each school was zero (indicated by a “+”) and the standard deviation in attitude was one. As such, individuals with positive attitude scores were more positively predisposed toward the program than the “average” individual, and individuals with negative attitude scores were more negatively predisposed toward the program than the average individual. By centering the scores at the school level, the attitude scores were more comparable across the sample, which reduced the noise in the estimation process that involved pooling the data across all schools.

We now turn to the hypotheses generated from our research questions and describe the analyses that tested results that either confirmed or disconfirmed those hypotheses. Following this section, we will discuss the implications of these findings.

Hypothesis 1: Individual attributes for which we have data will be significantly related to attitude scores.

In order to test this hypothesis, multiple regression was employed using the individual attributes as independent variables and attitude scores as the dependent variable. The first column of Table 2 contains the results associated with this analysis.

Table 2
Regression Results for Hypotheses 1-5

	Attribute Variables	Reform Alters	Total Communication	Peer Pressure	Indirect Alters
	H1	H2	H3	H4	H5
Intercept	-.358** (.136)	-.360** (.137)	-.588*** (.151)	-.568*** (.154)	-.545** (.151)
Years Teaching	.003 (.004)	.003 (.004)	.004 (.004)	.005 (.004)	.005 (.004)
Member of Faculty Committee	.198* (.082)	.198* (.082)	.179* (.082)	.178* (.082)	.180* (.082)
Department Chair	-.227 (.139)	-.223 (.139)	-.250 ⁺ (.140)	-.221 (.141)	-.219 (.141)
Network Degree (direct) ^a	.127*** (.022)	.127*** (.022)	.025*** (.005)	.021*** (.006)	.022*** (.006)
Average Alter Attitude (direct) ^a		.003 (.062)	.289*** (.069)	.108 (.112)	.111 (.113)
Degree * Average Alter Attitude (direct)				.022* (.011)	.021* (.011)
Average Indirect Alter Attitude					-1.066 (.828)
R-square	0.064	0.064	.072	.077	.079

Note: N = 715 (2 observations were missing the Years Teaching variable)

Standard Errors in Parentheses

⁺ $p < 0.10$

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

^a In Hypotheses 1 and 2, Network Degree and Average Alter Attitude refer only to the reform network.

School Fixed Effects are not reported to conserve space. In none of the models was there a significant school effect

Contrary to our hypothesis, only two of the individual attributes were statistically significant in terms of their relationship to individuals' attitudes. The two significant variables were membership on a faculty committee, and "communicative connectedness" (ego-network size). Individuals who were members of a faculty committee were associated with increased attitude scale scores, after controlling for all other variables. Furthermore, each additional communication partner in an individual's ego network (for the reform network) was associated with an increase in his/her respective attitude score. The other attributes (years of teaching experience and being a department chair) were unrelated to individual attitude levels. Because the attitude dependent variable is standardized to have a mean of zero and a standard deviation of one, parameter estimates can be interpreted in terms of standard deviation units. For example, each additional conversational partner in the reform network is associated with a 0.127 standard deviation increase in attitude score, after controlling for all other variables.

Hypothesis 2: Teacher attitudes about reform will be positively correlated with the attitudes of those people with whom they communicate *about the reform program*.

In order to test this hypothesis, the attitudes of communication partners (alters) in the reform network were included as an independent variable in the model. The results of this model do not support our hypothesis. The impact of communicative alter attitude (in the reform network) was not significantly related to individual attribute scores ($p = .94$). After including alter attitude in the model, the aforementioned individual attributes of being a member of a faculty committee and having increased ego-network size (in the reform network) remained positive and statistically significant predictors of attitude towards the reform. This finding indicates that the attitude of alters in the reform network had no significant bearing on individual teachers' attitudes.

Hypothesis 3: Teacher attitudes about reform will be positively correlated with the attitudes of those people with whom they communicate *for any reason*.

Unlike the test above for Hypothesis 2, the test for this hypothesis considered the role of the attitudes of an individual's direct communication partners in *all five* of the communication networks in the school as a predictor in the model. When the total amount of communication within the school was used as a measure of the social structure (through which individuals can access information about their alters' attitudes about the reform), there was evidence found to support Hypothesis 3. A positive and statistically significant effect was noted for the impact of average alter attitude on an individual's attitude. An increase in average alter attitude by one standard deviation was associated with an increase in individual attitude by 0.29 standard deviations, after controlling for all other variables. In this model, the impact of an individual's "connectedness" (the size of one's ego network) was diminished, but still statistically significant.

Hypothesis 4: The more direct communication in which a person is involved, the stronger the association will be between that person's attitude and the attitude of the person's direct communication partners.

Hypothesis 4 was tested by examining the effect of the interaction of average alter attitude with ego-network degree (level of "connectedness"). A positive and significant effect for this

interaction was noted, thus confirming our hypothesis ($p < .05$).⁹ The impact of average alter attitude on an individual can be assessed by calculating the unique impacts according to different ego-network sizes. The interaction term demonstrates that the impact of alters' attitudes will differ depending on ego-network size. For example, the impact of average alter attitude when an individual has three alters is equal to the sum of the main effect for average alter attitude (0.108) and the product of the number of alters (3) and the interaction effect (.022), $[0.108 + 3(0.022)=0.174]$ indicating that an increase in attitude score of one standard deviation for the average alter will result in an increase in attitude score for the individual of 0.174 standard deviations.

The impact of average alter attitude on an individual reaches statistical significance once that individual has at least three individuals in his/her ego-network ($p < .05$). Parameter estimates become increasingly significant as ego-network size increases. With five alters, the estimated alter attitudinal impact of 0.221 is significant at the $p < .001$ level. When an individual has an "average" ego-network size (approximately 11 alters), the parameter estimate of 0.355 indicates that an increase in average alter attitude score by one standard deviation is associated with an increase in an individual's attitude score by 0.355 standard deviations, after controlling for all other variables in the model ($p < .0001$). Thus, having additional individuals in one's ego network makes it more likely that an individual's attitude will align with the attitudes of his/her communicative alters. Once the "tipping" point of three to five conversations is breached, alter attitude plays a significant (and increasingly powerful) role in the prediction of individual attitude.

Hypothesis 5: The correlation between the attitudes of individuals *not* directly connected to the focal actor and the attitude of the focal actor will be less strong than the correlation between the attitudes of individuals directly connected to the focal actor and the attitude of the focal actor.

The test for this hypothesis examines the role that *indirect* connections play in an individual's attitude, above and beyond that which was explained through direct communication. Essentially, this test examines the additional influence on an individual's attitude that is exerted by individuals who are two or more "links" away from the individual in a communication network; this is the impact of people with whom the individual does not directly converse but who the individual could "reach" by playing a game of "Telephone." The results of the hypothesis test can be found in the final column of Table 2. Our findings indicate that an individual's attitude is not significantly influenced by the attitudes of those with whom s/he is indirectly connected ($p = .25$). The results obtained in Hypothesis 4 were unchanged (with respect to direction and significance) with the introduction of this final variable.

⁹ The reader will note that in this model the main effect of average alter attitude was diminished from that found when testing Hypothesis 3, and is no longer statistically significant. However, this main effect is not meaningful, as in this model it describes the average alter effect when an individual has zero alters (i.e. the normative influence from peers when an individual has zero peers).

Discussion

The hypotheses proposed in this paper met with mixed findings. Two primary findings result from our analysis. First, certain individual attributes were found to be related to teachers' attitudes about the reform program in their schools. Second, we find strong evidence to support the contention that the social context in which a teacher works can play a role in the way that s/he feels about a program. However, the influence of peers is dependent upon the way that social context is defined. Each of these findings will be discussed in turn.

Attributes with a social element contribute to individual attitude

Some support was found for the hypothesis that there are individual attributes that will be correlated with attitude towards reform. However, even those variables that we have considered "individual attributes" for the purposes of our analyses have a social component to them. The two individual attributes that were found to be related to teacher attitude about reform were teachers' membership on a faculty committee or being involved in greater numbers of conversations. Both of these have a social element in that they require relationships with peers and administrators. Though the types of faculty committees vary widely (everything from school improvement teams to committees that choose the flowers for graduation), membership implies a degree of collaboration and communication with peers. Clearly, the other individual attribute, the number of conversations in which an individual is involved, is also a measure of participation in the social context of the school.

Other individual attributes, having less to do with social context (including years of teaching experience and designation as a department chair) were not significantly related to teacher attitude. It is possible that there are individual attributes, unrelated to in-school work, that are related to teacher attitude about reform. However, the individual attributes to which we had access (teacher race and gender) were not related to attitude. This finding implies that most measurable individual attributes unrelated to social connectivity are of limited, if any, utility in predicting teacher attitude about reform. The social context in which a teacher works is of much greater importance.

Social Context Matters

Looking across our results, we find support for balance theory and the general concept that an individual's attitudes about reform are related to the attitudes of co-workers in the organization. Our results indicate that this is true only for those co-workers who are directly connected to an individual through multiple conversational contexts. These findings qualify the theory put forth at the beginning of this paper that suggests that attitude as part of a subjective norm in the organization has a clear influence on individual attitude. This does *not* appear to be true if one considers the subjective norm to be a sort of organizational zeitgeist to which *all* organizational members who are connected through conversation, even indirectly, contribute. If one looks at the subjective norm more narrowly, as a norm defined *only* by the members of an organization with whom an individual interacts *directly*, then our findings support the theory of a relationship between subjective norm and individual attitude.

It is interesting to note that when we analyzed the impact of direct communication connections only looking at conversation about the reform program itself, there was no significant impact of

communication partners' attitudes. This finding merits further investigation though we can hypothesize two potential reasons for the lack of a relationship here. First, conversation about the reform was much less frequent and involved fewer teachers than conversation about any of the other topics. People reported few conversations about the reforms and thus provided relatively few avenues whereby attitude information might "flow" between teachers. Second, all of these reforms designated certain individuals as resource people among the staff in each school. Thus, while many teachers reported turning to these individuals for advice about the reform, they were not necessarily the people that teachers would have *chosen* and thus been more likely to have similar attitudes. The other communication networks may leave more room for teacher choice in communication partner and thus demonstrate a greater relationship to teacher attitude. Also, these other four communication networks may define more of the norms, mores, and culture of the school. Therefore, it is more likely that people will align with their peers defined by the other, more familiar and broader, structures of communication rather than by the limited "conversation about reform."

Normative Pressure Plays Increasing role as Communicative Visibility Increases

The more that someone is involved in conversation with others, the stronger the relationship between that person's attitude and his/her communication partners' attitudes. As an individual becomes more involved in communication (be it through connections with more people, or through more frequent communication with the same people but about different topics of professional and personal concern), the impact of partners' attitudes increases. When an individual is only connected to a few people (or involved in only a few conversations), there does not appear to be sufficient normative pressure on that individual to align his/her attitudes with his/her alters. However, as that individual becomes more central, more visible in terms of being more of a "player" in the communication structure of the school, that person appears to be increasingly affected by the attitudes of his/her alters. This supports the idea that the subjective norm with which an individual will balance his/her attitude is partially composed of the attitudes of individuals connected to that focal actor. The more individuals connected to that actor, the stronger the pressure of the subjective norm to convey similar attitudes.

Conclusion

Significant research has been done about how a new *practice* spreads through an organization (see Rogers 1983 for discussion of this work) including innovations in schools (see Frank, Zhao, and Borman, 2004 for a fine example). Much less work has been done examining the relationship of teacher *attitude* and how that is related to individual attributes and interpersonal connections. This paper illustrates a relationship between teacher attitude and social structure. We find significant evidence for the influence of social ties on attitude development among teachers. Such a finding has significant implications for education research and practice. In the realm of practice, our research would argue that a small (but well connected) clique of individuals can easily influence the attitudes toward, and implementation of, a reform through communication. That small clique could enhance or undermine attitudes about a reform in a school through conversations. Because of the influence of attitude on intention and behavior, our findings indicate the power of the subjective norms in a school to influence teachers apart from (and potentially preceding) their demonstration of particular behaviors and practices. This helps to explain the variability in reform program implementation by shedding light on prevailing school attitudes.

We believe that the research discussed in this paper only begins to explore this territory. Further research remains to be done. Through the use of longitudinal data, we hope to continue along these lines to better understand how attitude and social connections change and develop over time. Such analyses would also allow us to explore the particular dimensions of relationships that appear to be most influential in attitude formation. Additional schools in studies of this type would allow researchers to test hypotheses regarding the ways that different school contexts might facilitate or hinder the attitude/behavior link between individuals. Finally, it would be productive to conduct a study similar to the one conducted here but to focus on individual behavior and its relationship to the behavior of conversational alters, as opposed to looking at attitude relationships as we did here. This work could then be brought full circle to look at the relationships between social networks, attitudes, and behaviors.

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Appendix A:

School Response Rates

School	Number of Respondents	Total Teachers in school	Response Rate
FTF1	113	136	0.83
FTF2	38	60	0.63
FTF3	137	151	0.91
HSTW1	68	87	0.78
HSTW2	77	94	0.82
HSTW3	52	68	0.76
SN1	30	56	0.54
SN2	149	280	0.53
SN3	53	88	0.60
Total	717	1020	0.70

Appendix B:

Survey questions on attitude

How much do you agree or disagree with the following statements about <reform program>?

- A. I understand the purpose of <reform program>.
- B. <reform program> has a detailed plan for improving instruction.
- C. <reform program> is consistent with other programs in the school.
- D. <reform program> is a unifying strategy for the different programs in the school.
- E. <reform program> requires me to make major changes in my classroom practice.
- F. I am capable of making the changes called for by <reform program>.
- G. The changes called for by <reform program> are helping or will help my students to reach higher levels of achievement.
- H. My involvement with <reform program> has exposed me to examples of student work the program seeks to foster.
- I. My involvement with <reform program> has exposed me to examples of classroom teaching the program seeks to foster.
- J. <reform program> provided me with useful ideas and resources for changing my classroom practice.

Appendix C:

Individual Attribute Descriptive Statistics

	N	Min	Max	Mean	Standard Deviation
Attitude (school-centered)	717	-3.54	2.70	0.00	0.99
Years Teaching Experience	715	0	44	13.60	10.14
Faculty Committee (indicator)	717	0	1	0.55	0.50
Department Chair (indicator)	717	0	1	0.08	0.27
Reform Ego Network Size	717	0	21	1.17	1.76
Total Communication Ego Network Size	717	0	49	11.13	7.57

