Ties with potential: nature, antecedents, and consequences of social networks in school teams

Moolenaar, N.M.

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CHAPTER 5
Linking Social Networks and Trust:
A Social Capital Perspective on Professional Learning Communities

ABSTRACT

Background. The study of schools as professional communities has recently gained popularity among policy makers and educational researchers around the world. Yet, large-scale studies on teachers’ professional relationships that shape professional communities are scarce. Moreover, while literature associates strong social networks with trust, the relationship between social networks in school teams and teacher trust has received limited scholarly attention.

Purpose. This chapter adopts a social capital perspective to investigate teachers’ professional relationships in Dutch elementary schools and its influence on teacher trust as elements that characterize professional communities.

Method. Data were collected from 751 teachers and principals from 49 Dutch elementary schools using a survey with a social network question on work related discussions and a Likert-type scale to assess teacher trust. We analyzed the data using social network analysis and multilevel (HLM) analysis.

Conclusions. Results show that the pattern of social relationships in the school team as a whole is as important to teacher trust as individual relationships. Interestingly, teacher teams that show great reliance on one-to-one reciprocal relationships are characterized by lower trust in comparison to teams with fewer reciprocal relationships. This implies that certain social network configurations may be unfavorable for the development of professional learning communities.

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1 This chapter is based on:
INTRODUCTION

Fostering the professional development of teachers in schools seems to be a key challenge for governments, school districts and principals to improve the quality of education. Since teachers’ professional development mostly takes place within schools, researchers have started to examine teacher learning in its social context, using a professional learning community perspective (Hord, 1997; Mitchell & Sackney, 2000; Sleegers, Bolhuis, & Geijsel, 2005; Stoll et al., 2006; Toole & Louis, 2002). Professional learning communities are generally conceptualized as communities of educators that are characterized by elements such as a focus on student learning, shared values and vision, collaboration, trust and collective learning (Louis & Marks, 1998; Louis, Marks, & Kruse, 1996; McLaughlin & Talbert, 1993, 2006; Mitchell & Sackney, 2000; Sackney, Walker, Mitchell & Duncan, 2005; Stoll et al., 2006; Toole & Louis, 2002).

There are indications that schools with strong professional communities indeed promote teachers’ professional development, produce increased student learning, and manage educational change more easily than schools lacking these elements (Lee & Smith, 1996; Louis & Marks, 1998; Newmann, King, & Youngs, 2000; Vescio, Ross, & Adams, 2008; Wiley, 2001 ). Although research on professional communities underlines the relevance of teachers’ social interactions to support teachers’ professional development and instructional change, scholars have long overlooked what lies at the fundament of professional communities; teachers’ social networks in schools (Coburn & Russell, 2008; Smylie & Hart, 1999). As a consequence, we know little about the social fabric that signifies the ‘community’ of a professional learning community. This weak conceptual elaboration of one of the key concepts underlying professional learning communities is considered as a main problem that demands attention in future research (Westheimer, 1999; Toole & Louis, 2002).

Recently, researchers have suggested using social capital theory to elaborate on teachers social interactions by examining teachers’ social networks and trust (Coburn & Russell, 2008; Daly & Finnigan, 2009; Penuel, Riel, Krause, & Frank, 2009). Social capital theory conceptualizes how social relationships enable individuals to have access to, and make use of, the resources that reside in their social networks. Social capital theory is seen as a promising theory to increase our understanding of the crucial role of social networks among teachers for a number of valuable elements related to professional communities, including transfer of knowledge, joint problem solving, collective orientation
towards innovation, and reform implementation (Coburn & Russell, 2008; Daly & Finnigan, 2009; Penuel, Frank, & Krause, 2007b).

Two major concepts that represent social resources in social capital theory are social networks and trust. While previous research suggested that teachers’ professional relationships foster a climate of trust and a ‘safe’ environment to engage in innovative behavior and risk-taking in reform efforts (Bryk & Schneider, 2002; Louis, Marks, & Kruse, 1996; Moolenaar, Daly, & Sleeers, 2009; Penuel, Fishman, Yamaguchi, & Gallagher, 2007a), empirical evidence on the interrelatedness of the two major constituents of social capital in school organizations, social networks and trust, is missing.

This chapter examines the extent to which the structure of teachers’ social networks underlying professional communities affects teacher trust in elementary schools in the Netherlands. We will present social capital theory as a useful theoretical foundation to describe the way in which professional communities take shape in social interactions that can foster trust among teachers, setting the stage for beneficial school and student level outcomes that are associated with strong professional communities in schools. Then, using data from 751 teachers and principals from 49 Dutch schools, we will conduct a multilevel test of the influence of individual and school level social network configurations on teacher trust. By doing so, we provide a unique contribution to the empirical validation of the sociological concept of social capital in the context of education. Finally, we offer a discussion of the findings and limitations of the study, together with implications for practice in order to maximize the potential of professional learning communities and social capital for the field of education.

THEORETICAL FRAMEWORK

Professional learning communities from a social capital perspective
To better understand how the pattern of social interactions among teachers may shape the valuable outcomes associated with strong professional communities, we draw on the concept of social capital. The leading notion behind social capital theory is that individuals are situated in networks of social relationships that provide access to resources residing in these social networks (Bourdieu, 1986; Putnam, 1995). The popularity of social capital is reflected in the myriad of definitions used to describe the concept. As defined by its principal theorists (Coleman, 1990; Putnam, 1993a, 1993b), social capital refers to ‘the sum of the actual and potential resources embedded within, available through, and
derived from the network of relationships possessed by an individual or social unit. Social capital thus comprises both the network and the assets that may be mobilized through that network’ (Bourdieu, 1986; Burt, 1992; Lin, 1999; in Nahapet & Ghoshal, 1998, p. 243).

Until now, social capital theory has mainly gained interest among educational researchers with regard to students, for instance, to explain the impact of family or peer social capital on educational outcomes, such as student attainment and achievement (Goddard, 2003a; Horvat, Weininger, & Lareau, 2003; Lareau & Horvat, 1999; Morgan & Sorensen, 1999; Ream & Rumberger, 2008; Stanton-Salazar & Dornbusch, 1995; see Dika & Singh, 2002 for a review of educational research on social capital ). However, organizational literature points to the value of social capital in organizational contexts (Leana & Van Buren, 1999; Nahapet & Ghoshal, 1998). These studies argue that social capital contributes to organizational goals by facilitating the flow of information between individuals and overcoming problems of coordination (Adler & Kwon, 2002; Lazega & Pattison, 2001; Lin, 2001; Tsai & Ghoshal, 1998; Walker, Kogut, & Shah, 1997).

With many debates on the dimensions of social capital still ongoing (Dika & Singh, 2002; Halpern, 2005; Portes, 1998), two components can be found throughout most social capital literature (e.g., Bourdieu, 1986; Coleman, 1990; Halpern, 2005). The first component of social capital addresses the pattern of social relationships, and is referred to as the structural dimension (Nahapiet & Ghoshal, 1998). The pattern of social relationships can be visualized as a social network that provides individuals with the opportunities to obtain resources through the formation of ties or links between people. The use of social networks to study collaboration among teachers is growing rapidly (Coburn & Russell, 2008; Daly & Finnigan, 2009; Moolenaar, Daly & Sleegers, 2009; Penuel, Frank, & Krause, 2007b; Penuel, Riel, Krause, & Frank, 2009; Spillane, 2005). These studies suggest that strong teacher networks benefit the dissemination of information on school-wide reform efforts, an open orientation towards innovation and overall school functioning, as well as counteract negative phenomena such as absenteeism and low job satisfaction due to teacher isolation (Bakkenes, De Brabander & Imants, 1999; Imants, 2002).

A second component of social capital, the relational dimension, addresses the quality of the relationships in social networks. This quality is often described in terms of the norms, values, and expectancies that are shared by group members (Bourdieu, 1986; Halpern, 2005; Portes, 1998). In social capital literature, trust among organizational members is identified as the most important affective norm characterizing a community (Nahapiet & Ghoshal,
1998). Trust can be defined as an individual’s or group’s willingness to be vulnerable to another party based on the confidence that the latter party is benevolent, reliable, competent, honest and open (Cummings & Bromiley, 1996; Hoy & Tschannen-Moran, 2003). Trust is a central element in the debate about professional learning communities as it is believed to be the critical ingredient of all human learning (Rotter, 1967). Moreover, trust is important for the development of open school cultures, increasing the quality of schooling, and student achievement (Goddard, Tschannen-Moran & Hoy, 2001; Hoy, 2002; Hoy & Sabo, 1998; Tschannen-Moran, 2004). Trust, according to Bryk and Schneider (2002), allows teachers to be vulnerable and open to new learning experiences that are central to ongoing teacher development in schools. As a consequence, improving the quality of education and student learning becomes both an individual and collective enterprise, which motivates teachers to engage in instructional change and willing to take more risk. Research has indeed shown that trust has positive effects on teacher professionalism (Tschannen-Moran, 2009; Tschannen-Moran & Hoy, 1998) and teachers’ motivation (Smylie, 1999).

Social networks and trust are important elements in social capital theory (Nahapiet & Ghoshal, 1998; Fukuyama, 1995; Putnam, 1993a) and literature on professional learning communities (Bryk & Schneider, 2002; Bryk, Camburn, & Louis, 1999; Coburn & Russell, 2008). However, only few studies have addressed the relationship between social networks and trust. Therefore, the research question guiding this study is: To what extent are the individual and school characteristics of teachers’ networks predictive of teacher trust? In the next section, we will explore the link between social network characteristics and trust among teachers in the context of professional communities, which can benefit teacher professional development and, in turn, promote student achievement.

Linking social networks and trust
In literature on professional communities and social capital, trust and social interaction often go hand in hand as interrelated elements. Trust is based on interpersonal interdependence (Rousseau, Sitkin, Burt, & Camerer, 1998) and embedded in relationships (Hoy & Tschannen-Moran, 2003), and often associated with cooperation (Deutsch, 1958; Tschannen-Moran, 2001; Hoy & Tschannen-Moran, 2003) and group cohesiveness (Zand, 1972, 1997). Several scholars argue that trust, as a key element of professional communities, is prompted by a social context that creates vulnerability and the need for individuals to rely on each other to achieve individual or common goals (Bryk
& Schneider, 2002; Hoy & Tschannen-Moran, 2003). Trust is suggested to contribute to the efficiency of collective action because it allows collaboration to occur in the absence of sanctions and rewards (Onyx & Bullen, 2000; Deutsch, 1958; Tschannen-Moran, 2001). Positive experiences from prior social interactions may foster trust by reducing uncertainty about the engagement and involvement of the other party and decreases vulnerability between individuals (Larson, 1992; Uzzi, 1997). As such, social interactions among teachers in professional communities may shape the context in which trust can flourish by providing a blueprint for future interactions, shaping expectations and conveying information about the norms and values of social interaction within the community. While the relationship between social interaction and trust seems commonsensical, the interrelatedness of patterns of social interaction and levels of trust in teams has, to our knowledge, not yet been the subject of extensive study.

In this study, we investigate whether the social network configuration of individuals is predictive of their trust in their colleagues within the school team. Moreover, we examine whether schools with high levels of social interaction are also characterized by higher levels of trust than schools with low levels of social interaction, as indicated by the schools' social network configurations. We acknowledge that causality may be an issue of debate. A circular relationship between social interactions and trust may also be defendable, in which interactions provide opportunities for trust to develop, be nurtured, or terminated, but in which trust in turn also shapes the conditions for interactions to occur (Coburn & Russell, 2008). However, in this first large-scale exploration on the relationship between social network characteristics and teacher trust, we argue that social interactions, as an inevitable precondition for the formation of professional learning communities, precede the formation of trust by providing opportunities for trust to develop, nurture, grow, and decline.

Recently, scholars have started to voice the importance of studying social capital at multiple levels of analysis, for instance the individual teacher and the school level (Halpern, 2005; Ibarra, Kilduff, & Tsai, 2005). Multilevel research is imperative since studies have suggested that the size and direction of a relationship between variables at individual level may vary from the size and direction of the relationship between the variables at the school level (Chen & Bliese, 2002). In reality, the configurations of teacher interactions at the individual level (e.g., individual activity in the maintenance of social relationships) may have a considerable different meaning than the configurations of teacher interactions at the team level (e.g., the density of social relationships in a team). Therefore, we may expect that the effect of having
multiple professional relationships is different for teachers and for schools. Considered at the school level, professional communities may benefit from a dense social network structure in which all teachers are tightly connected to one another. However, having to maintain a high number of relationships may be less beneficial to individual teachers because of the constraints that multiple relationships can pose with regard to time, attention span, and possibly conflicting interests between various connections. Therefore, it is crucial that studies on professional learning communities adopt a multilevel framework to assess relationships at multiple levels of analysis. Research on professional learning communities, too, can be criticized for a lack of attention for the multiple level character of studying individuals in teams (Smylie & Hart, 1999; Coburn & Russell, 2008; Geijsel, Sleegers, Stoel, Krüger, 2009). Therefore, this study addresses the patterns of teachers’ social interactions in professional school communities and its capacity to foster trust among teachers at multiple levels of analysis.

In social network analysis, two approaches can be discerned that are related to the level of analysis. The ‘egocentric network approach’ employs a micro-level perspective by focusing on the patterns of relationships of individuals. The social relationships of an individual (‘ego’) are examined by, for instance, the amount of ego’s incoming and outgoing relationships, and the extent to which these relationships are mutual (also called ‘reciprocal’). Reciprocal relationships are often indicated to be stronger relationships that reflect mutual interest, shared experiences, and risk-taking in the relationship. The idea behind an egocentric approach is that an individual’s position in a social network can push or inhibit certain behaviors and/or attitudes, for example, a relationship between students’ peer relationships and achievement (Lubbers, Van der Werf, Kuyper, & Offringa, 2006), a teacher’s isolated position and his/her job satisfaction (Bakkenes, De Brabander & Imants, 1999) or the position of a teacher in a social network and teachers’ attitude to innovation (Cole & Weinbaum, 2007).

The ‘whole network approach’ examines the social network of a collective, group, organization, or community as a whole (Wasserman & Faust, 1997). Whole social networks encompass a finite number of individuals and relationships between these individuals within a bounded community of people (e.g., a class, a school team, or a district office). Studies using this approach argue that collective level characteristics of a social network as a whole (e.g., overall density and reciprocity) are related to individual and collective variables, such as individuals’ behavior and attitudes and organizational outcomes. Putnam’s rationale, that the presence of stable social
networks in a community facilitates coordination and communication, and thus allows dilemmas of collective action to be resolved, is an example of a collective-level approach to social networks and social capital (Putnam, 1993a).

Since multilevel social network studies are scarce, we pose similar expectations at multiple levels of analysis for the relationships under study, based on the limited evidence available. Earlier work on social interactions in teams (Coburn & Russell, 2008; Hodson, 2005) suggests that having more relationships is beneficial to positive experiences and teacher trust. We therefore assume that teachers who maintain more relationships, as well as experience more mutual relationships, will foster higher levels of trust in their colleagues.

As collaborative experiences and the exchange of knowledge and ideas are at the core of professional learning communities, adopting a social capital framework to study the way teachers are situated in the social contexts of their school community can provide valuable insights in the social fabric that signifies the ‘community’ of schools as professional learning communities. Moreover, by focusing on trust, social capital attends to shared norms among community members that may foster or inhibit the development and valuable outcomes of strong professional communities. As mentioned earlier, professional community literature lacks studies conducted at multiple levels of analysis. We believe that insights in the relationships between teachers’ social networks and teacher trust at multiple levels of analysis will contribute to a more nuanced perspective on the individual and school-wide fundamentals of professional communities. In the next section, we will describe a large-scale empirical study among teachers and principals of 49 Dutch elementary schools, designed to address our research question.

**METHOD**

**Context**

Similar to the United States, educational policies in the Netherlands are introducing the concept of professional learning communities within schools as a way to incorporate life-long learning and professional development, with the ultimate goal to improve teacher practice and, in turn, student achievement. We conducted a survey study at 49 elementary schools in the south of the Netherlands, representing 751 educators. The schools resided under a single school board in the Avvansa School District\(^1\), which coordinated collective

\(^1\) All names are pseudonyms
resources such as financial, IT and personnel support. The sample schools were selected as the school board had initiated a district-wide ongoing school and teacher monitoring process around school improvement.

Sample
In total, 751 educators (principals and teachers) participated in the study by filling in a questionnaire, reflecting a response rate of 93.8 %. Of the respondents, 72.5 % was female, 46.8 % worked full-time (32 hours or more) and 51.0 % was 50 years or older. All respondents had been working at the school for at least 6 months, and the school teams were functioning in the same team composition for at least 6 months. Additional sample demographics are presented in Table 1.

Instruments
Social networks. In order to study the social network characteristics among educators in professional school communities, we used social network analysis. Social network analysis provides researchers with an approach to systematically map patterns of interpersonal interaction in order to understand how individual action is situated in structural configurations (Valente, 1995). Insights in organizational social networks can help to ‘explain how organizational knowledge is accumulated and applied’ (Kilduff & Tsai, 2003, p.

Table 1. School demographics (N = 49, n = 751)

<table>
<thead>
<tr>
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<th>M</th>
<th>Sd</th>
<th>Min.</th>
<th>Max.</th>
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<tbody>
<tr>
<td>Socio-economic status</td>
<td>8.2</td>
<td>10.1</td>
<td>0.4</td>
<td>47.3</td>
</tr>
<tr>
<td>(SES)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of students</td>
<td>226</td>
<td>117</td>
<td>61</td>
<td>545</td>
</tr>
<tr>
<td>Average age</td>
<td>45.9</td>
<td>10.6</td>
<td>21</td>
<td>63</td>
</tr>
<tr>
<td>Average FTE</td>
<td>0.54</td>
<td>0.49</td>
<td>0.23</td>
<td>1</td>
</tr>
<tr>
<td>Team size</td>
<td>18.1</td>
<td>6.7</td>
<td>7</td>
<td>31</td>
</tr>
<tr>
<td>Gender ratio</td>
<td>72.4</td>
<td>9.6</td>
<td>50.0</td>
<td>90.9</td>
</tr>
</tbody>
</table>

1 SES is calculated as the weighted percentage of students for whom the school receives extra financial resources
2 FTE represents the percentage of working hours. For example, a teacher with 0.40 fte is employed at the school for (a total of) two days per week.
3 Gender ratio is calculated as the ratio of female to male team members with 100 % referring to a team with only female team members
and may therefore be useful in the study of schools as professional communities. To map social interactions that would contribute to building organizational knowledge and professional communities, we examined the social network of work communication within schools. We asked the respondents to answer to the question ‘Whom do you turn to in order to discuss your work?’ Respondents were asked to name the people in their school team whom they turn to in order to discuss their work (e.g. Flap & Völker, 2001). A school specific appendix was added to each questionnaire, in which the names of all school team members were represented by a letter combination (e.g., Mr. Eric McEwen\(^1\) = AB). Respondents could indicate a relationship by answering the letter combination of the intended colleague(s), and they could name as many colleagues as they wanted (free choice).

**Trust.** We measured trust by a Dutch translation of the ‘trust in colleagues’ scale of Hoy and Tschannen-Moran (2003). The items were scored on a four point scale, ranging from 1 (strongly disagree) to 4 (strongly agree). The scale for trust was composed of five items, for instance ‘I trust my colleagues’ (\(\alpha = .87\)). Scale scores were composed using the mean score of all trust items. When an individual missed more than one item from the scale, the trust scale score was not computed and considered missing. Principal component analysis confirmed that the five items loaded highly on a single factor that explained 65.6 % of the variance. The items and factor loadings are presented in Table 2.

<table>
<thead>
<tr>
<th>Trust ((\alpha = .87))</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I trust my coworkers</td>
<td>.66</td>
</tr>
<tr>
<td>2. Even in difficult situations, I can depend on my coworkers</td>
<td>.71</td>
</tr>
<tr>
<td>3. I find that my coworkers are open to me</td>
<td>.72</td>
</tr>
<tr>
<td>4. I share personal information with my coworkers</td>
<td>.52</td>
</tr>
<tr>
<td>5. I find that my coworkers are honest to me</td>
<td>.68</td>
</tr>
</tbody>
</table>

\(^1\) All names are pseudonyms
Demographic variables. The survey for teachers and principals also included questions on background demographics, such as age, gender, and number of working hours (fte). Information on team size, number of students served, and socio-economic status (SES) was collected from the district main office. Additional school level demographics were calculated by aggregating individual level demographics, such as average age, gender ratio (percentage of female educators in the team), and average number of working hours (fte). All demographic variables were standardized to facilitate interpretation of the multilevel models.

Data analysis
Social networks. Social network analysis is a technique to systematically examine patterns of relationships in order to understand how individual action is situated in structural configurations (Valente, 1995). We calculated several social network measures at both the individual and collective (whole network) level (cf. Borgatti, Jones & Everett, 1998; Burt, 1983b). As indicators of an individual’s social network, we included in-degree, out-degree, and ego-network reciprocity. Indicators of the schools’ social networks were density, reciprocity, and centralization. All social network characteristics were calculated and analyzed by means of UCINET 6.0 (Borgatti, Everett, & Freeman, 2002). Moreover, all predictors were standardized to facilitate interpretation of the multilevel models. We will now describe these network characteristics in detail.

Individual level social network measures. We included three characteristics of the social network of individuals. Both in- and out-degree provide information on the relationships of an individual. Out-degree refers to the number of people chosen by the respondent. In other words, a respondent will have a high out-degree, if s/he indicates to turn to many (different) colleagues in the school team to discuss work. As such, out-degree can be interpreted as an indicator of relational activity. In-degree refers to the number of people by whom the respondent is chosen. A respondent will have a high in-degree, if s/he is chosen by many (different) colleagues as a person with whom they discuss work. In-degree can therefore be interpreted as an indication of an individual’s popularity, or influence over a network (a higher in-degree means being chosen by many team members). Both measures were divided by the team size of the individual’s school (normalization) in order to facilitate comparisons between schools. The social network characteristic of reciprocity mirrors the two-way nature of the relationships in the network. A relationship between two people is reciprocal when both respondents indicated to have a relationship with the each other. We calculated ego-network reciprocity (ego-reciprocity) as each
individual’s proportion of reciprocal ties to the total amount of ties in which the individual is involved. Ego-reciprocity thus reflects the extent to which the network surrounding an individual (ego-network) consists of reciprocal relationships.

*School level social network measures.* At the school level, we included three indicators that provided information on the patterns of social relationships within the school teams. For each of the schools’ social networks as a whole, we calculated *density* as the proportion of existing relationships to the maximum number of relationships possible in the network. The value of density varies between 0 (no relations in the network) and 1 (all actors are connected to each other). Density can be used to indicate group cohesion (Blau, 1977; Wasserman & Faust, 1997). *Reciprocity* was calculated as the ratio of the number of observed reciprocated relationships to the total number of relationships in the team (see Zeggelink, 1993). A network with a high centralization depicts a large difference between one or a few highly central person(s) and other (more peripheral) people in the network (Wasserman & Faust, 1997). *Centralization* represents the variability in the in-degree scores of the individuals in a network. The value of in-degree centralization will reach the maximum of 1 if a single respondent occupies a very central position in the network (is chosen by others as a valuable person to discuss work with) and other actors are not central at all, whereas the lowest value of 0 indicates that all actors in the network have the same in-degree. In other words, a team with high in-degree centralization is typified by only one or a few central (popular) persons, who are frequently selected by other team members, and more peripheral team members.

*Analysis strategy*
First, we will provide a description of social network characteristics of work-related discussions among educators as the ‘social fabric’ within schools. Second, in order to account for the nested structure of our data (teachers in schools), we applied multilevel analysis (HLM) to examine our research question. Several multilevel models were analyzed. We started with a random intercept model (the baseline model) to decompose the variance of the dependent variable ‘teacher trust’ into an individual level component and a school level component. After including significant individual level demographic variables, we added the individual level predictors to the model to account for the influence of individual level social network characteristics on trust (Model 1). Next, after adding school level demographics to the equation (Model 2), we tested whether school level social network characteristics added to the prediction of trust in school teams (Model 3). As such, these hierarchical
multilevel models tested whether the schools’ social network as a whole contributed to the prediction of trust above the social network characteristics of individual educators and individual and school level demographics. This way, we were able to test whether between-school relationships differed from within-school relationships between social network characteristics and trust.\(^1\)

**RESULTS**

*Describing individual and school-level social networks*

On average, an individual in a sample school indicated to discuss work-related matters with roughly a third of their colleagues (average out- and in-degree is 34.6 %). In general, about a third of all relationships in which an individual is involved, is reciprocated. These numbers are reproduced at the school level, where we can notice an average density of 32.0 %. This means that of all possible relationships that could exist in a school team around work-related discussions, almost a third of these relationships is actually confirmed to exist by the respondents. Of all existing relationships, 36.5 % were mutual relationships in which individuals turn to each other to discuss their work. The sample school teams were on average rather decentralized, which means that mostly, discussion relationships are dispersed among many team members with few educators being more popular as discussion partners than others. Table 3 contains the social network characteristics at both the individual and school level.

*Correlation analyses*

Our research question focused on the relationships between individual and school level social network characteristics on trust. Correlations are presented in Table 4 (individual level relationships) and Table 5 (school-level relationships).

At the individual level, the correlations between trust and social network characteristics were found to be statistically significant and in the expected direction. Moreover, the social network characteristics correlated moderately with each other, reflecting the interdependence of the network data; per definition, the denser a social network gets, the higher the mere chance that relationships will be reciprocal. At the school level, correlation analyses did not show significant relationships between patterns of social relationships and trust

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\(^1\) In addition, random slopes were tested, as well as school-level univariate regression models to test the impact of the schools’ social network structure on trust \((n = 49)\). None of these tests provided additional insights and are therefore not reported here.
Table 3. Descriptives of social network characteristics and trust at the school (N = 49) and individual level (n = 751)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individual level social network characteristics</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Out-degree</td>
<td>749</td>
<td>.35</td>
<td>.24</td>
<td>.00</td>
<td>1.00</td>
</tr>
<tr>
<td>In-degree</td>
<td>749</td>
<td>.35</td>
<td>.21</td>
<td>.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Ego-reciprocity</td>
<td>746</td>
<td>.37</td>
<td>.23</td>
<td>.00</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>School level social network characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team density</td>
<td>49</td>
<td>.35</td>
<td>.09</td>
<td>.15</td>
<td>.52</td>
</tr>
<tr>
<td>Team reciprocity</td>
<td>49</td>
<td>.38</td>
<td>.09</td>
<td>.17</td>
<td>.57</td>
</tr>
<tr>
<td>In-centralization</td>
<td>49</td>
<td>.34</td>
<td>.11</td>
<td>.14</td>
<td>.64</td>
</tr>
<tr>
<td>Trust</td>
<td>737</td>
<td>3.22</td>
<td>.56</td>
<td>1.00</td>
<td>4.00</td>
</tr>
</tbody>
</table>

Table 4. Correlations between individual level social network characteristics and trust (N = 732)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out-degree</td>
<td>1.00</td>
<td>.35**</td>
<td>.40**</td>
<td>.23**</td>
</tr>
<tr>
<td>In-degree</td>
<td>1.00</td>
<td>.42**</td>
<td>.13**</td>
<td></td>
</tr>
<tr>
<td>Ego-reciprocity</td>
<td>1.00</td>
<td>.12**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trust</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: ** p < .01*

Table 5. Correlations between school level social network characteristics and aggregated trust (N = 49)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>1.00</td>
<td>.43**</td>
<td>.10</td>
<td>.17</td>
</tr>
<tr>
<td>Reciprocity</td>
<td>1.00</td>
<td>.10</td>
<td>-.27</td>
<td></td>
</tr>
<tr>
<td>Centralization</td>
<td>1.00</td>
<td>.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trust</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: ** p < .01*
among school team members. Moreover, density and reciprocity were moderately correlated, again reflecting the interdependence of the social network data. Both density and reciprocity were unrelated to centralization in the sample schools. Next, we will consider the multilevel analyses conducted to provide additional insight in the effect of individual and school level social networks on trust in professional communities.

Multilevel analyses
The first multilevel model, the baseline model, showed that a statistically significant amount of variance in individual trust scores can be attributed to the school level. The intraclass correlation coefficient for trust was .134 (p < .001), thus indicating the need to use multilevel analysis techniques to examine the relationship between social network characteristics and trust. In other words, 13.4 % of the variability in individual trust of school team members in their colleagues occurs between schools, and the remaining 86.6 % of the variance occurs within schools at the individual level. Results for the multilevel models are depicted in Table 6.

The importance of work related discussion for teacher trust at multiple levels
To address our research question, we first consider the effect of individual level demographics on trust. As demographics, we included educators’ age, gender, number of working hours (fte), tenure, years of experience in education, years of experience in their current school, and whether they fulfilled additional administrative tasks in support of the principal. All individual level demographics were found to be unrelated to trust and were thus excluded from further analyses.

In Model 1, we examined the effect of individual level social network characteristics on teachers’ trust in their colleagues. Results indicated that the number of people with whom an individual discusses work had a positive predictive relationship with the individual’s trust in his colleagues. A teacher who displayed high relational activity by indicating to have work-related discussions with many colleagues (high out-degree), showed greater trust in these colleagues than teachers with lower out-degree. Moreover, the more a teacher was chosen, or the more popular a teacher was as a colleague to discuss work with (high in-degree), the more trusting he reported to be of his colleagues. Surprisingly, the amount of reciprocal relationships in which an individual was involved did not affect the individual’s trust. The individual level model added significantly to the random intercept model (χ²D (3) = 57.55, p < .001).
Table 6. Multilevel regression analyses of the effect of individual level and school level social network characteristics on trust (N = 49, n = 732)

<table>
<thead>
<tr>
<th></th>
<th>Baseline model</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Est.</td>
<td>S.E.</td>
<td>Est.</td>
<td>S.E.</td>
</tr>
<tr>
<td>Intercept</td>
<td>3.21</td>
<td>.03</td>
<td>3.18</td>
<td>.04</td>
</tr>
<tr>
<td>Individual level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-Degree</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.05 *</td>
<td>.02</td>
<td>.07 *</td>
<td>.02</td>
</tr>
<tr>
<td>Out-Degree</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.13 *</td>
<td>.02</td>
<td>.15 *</td>
<td>.02</td>
</tr>
<tr>
<td>Ego-Reciprocity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.03</td>
<td>.02</td>
<td>.02</td>
<td>.02</td>
</tr>
<tr>
<td>School level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team size</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.13 *</td>
<td>.03</td>
<td>.17 *</td>
<td>.05</td>
</tr>
<tr>
<td>Team density</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.11 *</td>
<td>.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team reciprocity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-.08 *</td>
<td>.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centralization</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-.01</td>
<td>.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2*log likelihood</td>
<td>1166.06</td>
<td></td>
<td>1108.51</td>
<td></td>
</tr>
<tr>
<td>( \chi^2 \text{ DIFF. (3)} ) =</td>
<td>57.55,</td>
<td>p &lt; .001</td>
<td>69.14,</td>
<td>p &lt; .001</td>
</tr>
<tr>
<td>Explained (total)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School</td>
<td>(13.4 %)</td>
<td>5.0 %</td>
<td>9.7 %</td>
<td>11.7 %</td>
</tr>
<tr>
<td>Individual</td>
<td>(86.6 %)</td>
<td>0.0 %</td>
<td>17.7 %</td>
<td>27.7 %</td>
</tr>
</tbody>
</table>

Note: * p < .05
Next, we added school-level demographics to the multilevel equation. We included average age, gender ratio, average tenure, team size, average years of experience in education, average years of experience in the current school, and average percentage of additional administrative tasks in support of the principal. Of these demographic variables, only team size showed a statistically significant positive relationship with teachers’ trust in their colleagues. The larger the school team, the more trust individuals reported in relation to their colleagues. Apparently, smaller school teams are characterized by lower trust than larger teams. Therefore, only team size was included in Model 2 as a school-level demographic covariate. The addition of team-size added significantly to the prediction of trust ($\chi^2_D (1) = 11.59, p < .001$).

Finally, Model 3 included the school level social network characteristics. With this model, we tested whether the social configurations of the schools' social networks had any additional affect on trust among teachers above the effect of individuals' own social network characteristics. The addition of school level social network predictors added significantly to the prediction of trust ($\chi^2_D (3) = 7.89, p < .05$), indicating that school social network characteristics contributed to the prediction of teacher trust on top of the prediction by the pattern of relationships that an individual maintained. Results suggest that the density of the social configurations in a team is a strong indicator of trust among school team members, above and beyond the relational activity of individuals (the number of out- and ingoing relationships). That is, the more densely connected a school team was, the more trusting the individual school team members were of each other. Density of a team is thus at least as important for fostering trust in schools as the maintenance of individual relationships. Interestingly, while the amount of individual level reciprocal relationships did not affect trust-levels of the individual, school level reciprocity had a negative predictive relationship with trust among educators. A teacher’s trust in his colleagues did not appear to be affected by the amount of mutual relationships in which s/he was involved, but this teacher’s trust in colleagues was negatively influenced by an abundance of reciprocal relationships at the school level. The higher the school level reciprocity, the lower the level of trust among school team members. Conversely, schools with few reciprocal relationships were characterized by higher trust than schools with more reciprocal relationships. Both effects of density and reciprocity were found to be highly significant ($p < .001$). The centralization of the work-related network did not affect teacher trust significantly. The significant school level effects of density and reciprocity on individuals' trust in their co-workers above individual level effects of in- and out-degree suggest the importance of the
overall social configurations in a school team as a whole for important elements of professional communities such as trust.

Summarized, the relationships between social network properties and trust tell a compelling story about teacher interactions that make up the social fabric underlying professional school communities. Not only the amount of individual relationships defines an individual’s trust in his/her coworkers, but this trust is also influenced by the social network configurations of the professional community as a whole. Moreover, it appears that while certain social network characteristics nurture the growth of trust, such as density and individual social activity, other social network configurations may be less favorable to the development of school-wide trust, such as work-related reciprocity. In the next section, we will discuss our findings, provide limitations to the study and offer implications for research and practice.

CONCLUSIONS AND DISCUSSION

Professional communities are increasingly studied as the key to strengthening teachers’ professional development and schools’ capacity to address ongoing changes in educational policy and practice. Several scholars have suggested that the theory of social capital would provide a valuable lens to describe collaborative structures, such as professional communities (Coburn & Russell, 2008; Daly & Finnigan, 2009). Social capital theory provides a framework of elements that revisit characteristics of strong professional communities, such as social interaction in social networks, trust, a focus on both the individual and the collective, and beneficial outcomes. However, both social capital theory and literature around professional communities lack insights in the interplay of elements that form the concept. Also, large-scale empirical studies on social capital in educational organizations are scarce, and most empirical research only focuses on a single level of analysis. This chapter adds to the existing literature on social capital and professional communities by describing an empirical examination of the relationship between two main elements that social capital and professional communities have in common, namely social networks and trust. In addition, it offers a unique contribution by testing the relationship between teacher trust and social network characteristics at multiple levels of analysis.

The aim of this chapter was to deepen our understanding of schools as professional communities by examining social networks as the social fabric of which professional communities are woven. Building on social capital theory,
we hypothesized that social interactions would provide communities with the
opportunity to build trust among teachers. Moreover, we argued that social
networks in professional communities need to be studied at two levels of
analysis: the school level and the individual (teacher) level. We analyzed the
relationship between social networks and trust in 49 Dutch elementary schools
among 751 educators, using multilevel analysis. To assess social interactions
that lie at the core of professional learning communities and may support
school-wide capacity for school improvement, we focused on social interactions
around the discussion of work-related matters. Findings indicated that several
characteristics of social networks predict trust among teachers. For instance,
teams with a dense pattern of work-related social interaction reported higher
trust than teams with more sparse work-related interaction. Also, the more a
teacher discusses work-related issues with different team members, the more
the teacher indicated to trust his/her school team members. These results
support the notion that patterns of social interaction at both individual and
school level may strengthen or diminish school-wide trust among educators in
support of individual and collective teacher learning and, ultimately, student
achievement and school improvement. We guide this section by the key themes
from our findings, limitations and future directions for research, and
implications for educational policy and practice.

**Strengthening trust through social interaction**

The current educational focus on professional communities urges the need to
examine collaborative structures among teachers across schools, and revisit
how educators capitalize on their social relationships (Honig, 2009). While
recently emerged studies point at the importance of teacher social networks
underlying professional learning communities for the dissemination of reform
and innovations (Coburn & Russell, 2008; Cole & Weinbaum, 2007; Daly &
Finnigan, 2009; Daly, Moolenaar, Bolivar, & Burke, in press) and the generation
of new knowledge and practice (Moolenaar, Daly, & Sleegers, 2009), the
interplay of social network characteristics and other key elements of
professional communities, until now, has a limited empirical base. Our work
suggests that social network characteristics have a predictive relationship with
trust among educators, and underlines the importance of studying the
relationship between elements of professional communities at multiple levels of
analysis. To illustrate, we discuss the influence of the amount of relationships at
both individual and school level on teacher trust.

At the individual level, the amount of individual relationships appeared
to positively influence teacher trust; the more teachers indicated to have work-
related discussions with other team members, the higher the trust they reported in their colleagues. When we took a more nuanced perspective and added school-level network characteristics, we found that the density and reciprocity of the overall school social network of work discussion had an additional, and as important, effect on individual teachers’ trust. In sum, the more relationships, the more trust, and this assumption holds at both levels of analysis. This result corroborates and extends earlier findings in a single-level smaller scale qualitative study (Coburn & Russell, 2008). Our finding implies that stimulating the individual bonding and recognition of relationships between individual teachers will enhance their trust, as well as enlarge the density of relationships within the organization, which will in turn raise individual levels of trust as well. While it pays to start building relationships one by one, this study shows that it is at least as important to attend to the social configurations of the team as a whole for the fostering of beneficial elements of professional communities, such as trust. Being embedded in a strong social network of work-related relationships is as important as maintaining individual relationships. This finding clearly emphasizes the need for policymakers and principals to attend to the value of strong social networks as a power base for building professional communities. In this case, multilevel analysis offered a more detailed picture of the relationships under study, and therefore we argue that multilevel analysis should be employed in large-scale educational research involving social network analysis as much as possible.

The dark side of social network configurations
Results from our large-scale study suggest that while individual and collective social activity nurture the growth of trust, other social network configurations may be less favorable to the development of teacher trust. While at the individual level, social network characteristics only fostered trust or had no significant effect, at the school level we found evidence that certain social configurations could also have negative consequences for the development of professional communities. In this regard, findings of network reciprocity at both levels of analysis showed an interesting picture. At the individual level, the amount of an individual’s reciprocal relationships did not affect his/her trust in colleagues. On the contrary, at the school level, we found a negative predictive relationship between reciprocity and teacher trust. An explanation may be found in the dyadic nature of the measurement of reciprocity. Reciprocity is a measure based on relationships between a pair of two people, also called a ‘dyad’. It could be that school teams in which individuals rely heavily on one-on-one reciprocal relationships are generating lower levels of
trust, because people outside these reciprocal relationships may feel like outsiders and distrust these ‘cliques' of heavily reciprocated relationships. When a school is characterized by many reciprocal relationships, it may indicate an environment in which it feels ‘unsafe’ to discuss work-related matters and be vulnerable and open to many people in the team (Hoy & Tschannen-Moran, 2003; Daly & Finnigan, 2009; Daly, 2009). In these settings, teachers may only be vulnerable to the people they know will not ‘harm’ them, that is, the colleagues with whom they have had many experiences of long-lasting, safe exchange of knowledge and information. In contrast, teams that share work-related matters among a more dispersed group of colleagues instead of having to rely on one-on-one relationships may thus generate a ‘safe' atmosphere in which trust can grow. In such a social configuration of relationships, knowledge is transferred, modified, and shared among the whole team, in which teachers have to be less worried about being ‘left out of the loop’ or socially excluded. The reciprocation of resources in this type of climates is not necessarily restricted to dyadic relationships but may occur in larger groups of people than dyads, thus resulting in lower (dyadic-based) reciprocity between individuals.

In this regard we also have to address the possibility of a circular relationship, in which patterns of social interactions may influence trust that in turn may influence individuals' behavior and patterns of social interactions. Of course, when reciprocal dyadic relationships generate distrust among faculty, this climate of distrust may very well cause more dyadic ‘closure’ in the relational patterns in schools, in which people tend to only go to ‘safe’ others with whom they already have frequent contact, thereby in turn increasing the number of reciprocal relationships.

In sum, our findings suggest that in order to push professional communities and nurture trust, it is more important to focus on building relationships across the whole team, than small-scale one-on-one relationships that carry the risk of damaging trust by highly closed reciprocal relationships. Future research could further investigate this assumption by examining relational patterns at levels between the dyad and the school team, such as triplets. Moreover, our results underline the need for more extensive social network research into the ‘dark’ side of social network configurations.

Limitations and future directions

Although this chapter offers a valuable contribution to theory on social capital and professional communities, several limitations with regard to generalization of the study have to be addressed. While causality between the relationships
under study is suggested by the reviewed literature, our research design was not developed to specifically test causality. It would be interesting to study the emergence of trust in newly formed professional communities, using experimental designs, and the development of trust alongside social interaction over a period of time by means of longitudinal research. Moreover, although the number of schools participating in the study was sizeable, it is desirable to examine larger samples in order to substantiate our claims. That way, advanced technical statistical analyses, such as multilevel structural equation modeling, may be conducted to validate the findings of this study and test more complex conceptual models. These models can contribute to a better understanding of the paths through which social networks and trust have an impact on teacher practice and student outcomes. However, our sample of 49 schools provided reasonable statistical power, and the magnitude of the reported significant effects can be regarded at least as a first indication of the importance of the relationships under study (Mohammed & Ringseis, 2001).

Because the embeddedness of individuals in social networks may differ in various contexts, it would be valuable to explore social interactions and trust underlying professional communities in various international contexts and educational settings, such as secondary, higher, and vocational education. A next step in the study of professional communities and social networks would be to empirically validate the relationship between elements that foster professional communities, and suggested outcomes of professional communities, both for teachers and schools (for instance, teacher satisfaction and turnover, orientation towards innovation, collective involvement, collective efficacy) as well as for students (cognitive and non-cognitive achievement). Much is still to explore on factors that affect social interaction, such as leadership and teacher behaviors. This chapter showed that social network analysis across schools enriches our understanding of the foundation of social relationships on which professional communities are built, and offers great opportunities to explore the potential of social relationships for the development of professional communities.

Building professional communities: implications for educational policy and practice
Scholars around the globe draw attention to teacher collaborative structures, such as professional learning communities and communities of practice, as the vehicles to establish a system of life-long learning and teacher development in daily school practice. Knowledge on how teacher collaboration, fundamental to professional learning communities, impact levels of trust among teachers gives valuable insights in the chain of variables that characterize professional
learning communities, provide school-wide capacity for teacher development and will ultimately contribute to teacher and student learning. In this chapter, we suggest that a first step to build and maintain successful professional learning communities is to understand the social fabric of which professional communities are woven. While the number of work-related relationships is a material that makes for strong social fabric underlying professional communities, other materials, such as high dyadic reciprocity, might be less favorable. To enhance trust in professional communities, and ultimately student performance, educators, scholars and policy-makers justifiably emphasize the importance of social interaction and collaborative structures. In the right configuration, this social fabric provides the structure to nurture an open and safe climate in which trust prevails and school-wide capacity for teacher development is consequently advanced.