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

In sum, this dissertation contributes significantly to our understanding of social networks in school teams and underlines the potential of ties for school improvement and student achievement. In this chapter, we will first describe how the current educational context has created the need to understand the social fabric of school teams, the elements that shape this social fabric, and the individual and organizational consequences that arise from it. Then, we will summarize the main findings of the studies in this dissertation in light of the nomological network that was elaborated in the Introduction of this dissertation. We will further discuss the conceptual and methodological contributions of this dissertation to social network research. These contributions will be complemented by limitations, suggestions for further research, and implications for educational leadership, reform efforts, and educational policy.

The need for increased understanding of social networks in school teams
Similar to educational systems in many countries, the past decades of Dutch education can be characterized by continuous mandated reform efforts to improve instruction and student learning. Examples of nationally mandated changes in Dutch elementary education are a shift from acquiring content knowledge to developing skills in collaborative and autonomous learning (‘new learning’ [het nieuwe leren]), a drastic change in mathematics instruction (‘realistic mathematics education’ [realistisch rekenen]), growing autonomy for schools in the form of direct allocation of national funding to the schools (‘lump sum funding’ [lumpsum financiering]), and increased pressure of accountability.

Associated with these changes are increasingly complex tasks for both principals and teachers that urge the need for collaboration among educators, such as managing instructional and financial autonomy and collectively making sense of reform implementation. It is likely that this urge for collaboration among educators will continue to grow in the future, because of a shift in instruction to more complex (higher order) skills, an increasingly diverse student population, demands for adaptive and inclusive education, and a growing diversity of functional roles in schools (principals, teachers, teaching assistants, teacher leaders, mentors, coaches, didactic experts, remedial teachers, social workers) (Rosenholtz, 1989; Little, 1987).

To understand how schools can capitalize on collaboration among educators, scholars are examining a number of concepts that focus on teacher interaction in support of school improvement, such as organizational (team)
learning, community of practice and professional (learning) community. The prevailing notion underlying these concepts is that social relationships among educators matter as these relationships are important to the exchange and diffusion of information, knowledge, and expertise. Yet, our insights in the nature of relationships among educators and the extent to which these relationships affect educational practice are scarce. Also, knowledge on the elements that may shape social relationships within social networks is limited, as well as mechanisms through which social relationships among educators may benefit school outcomes. In order to address this paucity in the current discourse, this dissertation investigated the nature, antecedents, and consequences of social networks in school teams.

The dissertation is guided by the idea that social networks in school teams may support or constrain the exchange of resources that can be accessed and leveraged to achieve schools' goals. The introduction of this dissertation elaborates this idea in a literature review on social capital theory and social network theory. Social capital literature suggests that features of social organization, such as networks, trust, and norms of reciprocity, are critical to organizational performance (Adler & Kwon, 2002; Katzenbach & Smith, 1993a; Leana & Van Buren, 1999; Nahapiet & Ghoshal, 1998; Reagans & Zuckerman, 2001) and may add to a firm's value creation through innovation (Tsai & Ghoshal, 1998).

Social network literature offers deepened understanding of the mechanisms through which the configurations of social relationships in networks may affect the exchange and diffusion of resources. Important mechanisms that may explain the flow of resources in a network include network homophily and structural balance, the strength of weak ties, and structural holes. Social capital theory and social network theory provided the conceptual background for the development of a nomological network to frame our study of social networks in school teams. Under the headings 'nature, antecedents, and consequences', we identified several elements that were expected to be related to social networks in school teams, and we designed eight studies to assess these elements.

The studies in this dissertation are conducted in two settings. The first sample included 53 Dutch elementary schools that together formed the Avvansa School District1 located in a southern province of the Netherlands. This region has in recent years been marked for its continuing low school performance in comparison to other regions in the Netherlands. Currently, the

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1 All names are pseudonyms
district serves about 11,000 students in kindergarten (age of students 4 years) through sixth grade (age of students 12 years). While the population of students is relatively homogeneous and the region is typified by few second language learners compared to Dutch standards, the district is faced with challenges related to students from low income families and language deficiencies due to strong influences of local dialects. The district participated in the study as the implementation of a district-wide program for school monitoring and professional development offered the opportunity for large-scale simultaneous data collection among principals, teachers, support staff, students, and parents.

The second sample consisted of five elementary schools located near San Diego, California USA. The five sample schools were part of the Esperanza School District, an urban fringe district in its third year of sanction from the federal government for underperformance. The district serves about 19,000 students in kindergarten (age of students 5 years) through eighth grade (age of students 14 years) in 24 schools. The five sample schools were selected as they reflected the district’s socio-economic background and academic performance levels. The five schools differed from the district’s average as they were larger than the other schools in the district, and involved in a University partnership that provided additional professional development to support ongoing reform efforts. As such, the sample schools served as a ‘best case’ laboratory to test out the extent to which social networks constrain or support the district’s efforts at reform implementation.

Main findings
Together, the eight studies of this dissertation provide a rich contribution to the nomological network that was presented in the Introduction of this dissertation. In this nomological network, we identified various concepts that would be assessed to provide increased understanding of the nature, antecedents, and consequences of social networks in school teams. We will now summarize the studies’ main findings in order to review our acquired understanding and the current state of the nomological network of social networks in schools.

The nature of social networks in schools

Distinction between instrumental and expressive social networks
The opening study of the dissertation built on the idea that the structure of social networks may differ according to the content that is exchanged within its relationships. In the study, seven types of networks were compared and contrasted using social network analysis, QAP correlations, multidimensional
scaling, and network visualizations of the social networks in an exemplary sample school.

Results suggest that social networks in school teams can be categorized according to their content in instrumental or expressive social networks. Instrumental networks exchange content that is purely aimed at achieving organizational goals, and are therefore referred to as work related networks. Expressive social networks are not directly aimed at fulfilling organizational needs, and are more affective by nature than instrumental relationships. On average, expressive networks of friendship relationships and contact outside work were considerably less dense than work related networks. Findings further indicate that a second categorization may be based on mutual in(ter)dependence between the individuals exchanging the content. The distinction between social networks in school teams is not clear-cut, and the amount of overlap between social networks is dependent on the network questions used to delineate the content that is exchanged in the networks.

Social networks are mainly shaped by individual demographics and tendencies towards homophily
The second study focused on the extent to which social relationships are in part dependent on demographic characteristics of educators and schools. In the study, we conducted advanced social network modeling to predict the probability of relationships from various individual, dyadic, and school demographics.

Differences in the extent to which educators send and receive ties were found to be partly explained by individual demographics such as gender, age, grade level, working hours, and experience at school. In general, upper grade teachers and female teachers tended to send more ties than lower grade and male teachers, while the reception of ties was lower for full-time, female, older, and more experienced educators. Also, results indicated homophily effects for grade level and gender, supporting the notion that ‘birds of a feather flock together’ within grade levels and among teachers with the same gender. In addition, the study provided evidence that relationships among teachers were more likely when the school team was operating in the same configuration for a longer time. Other characteristics of schools, such as the percentage of female to male educators, school size by number of students, team size, socio-economic background, and average age did not affect the relational pattern among educators in the sample schools. In sum, individual variation among educators appeared to affect the pattern of social relationships to a larger extent than school characteristics.
Antecedents of social networks in schools

Teachers’ social networks are not substantially affected by helping behavior
An important underlying assumption in social network literature is that individuals’ behavior may affect the shape and size of their social network. The third study was conducted to examine the influence of teachers’ organizational citizenship behavior in the form of helping behavior on their pattern of collegial relationships. In particular, we examined whether helping behavior increased the probability of having friendship and work related relationships with colleagues. We used a recent multilevel expansion of p2 models to estimate the probability of ties across multiple levels of interest.

Findings from the p2 models replicated results from the second study that on average, friendship networks were less dense than work related networks. While in both networks, relationships tended to be reciprocated, the tendency to reciprocate relationships was stronger for friendship than for work related relationships. Helping behavior did not affect the amount of work related relationships that teachers send out, but teachers who displayed more helping behavior had a slightly higher likelihood of receiving work related relationships than teachers with less helping behavior. For friendship, we found the opposite pattern. Helping behavior appeared to slightly increase the amount of friendship ties that teachers sent out, but displaying helping behavior did not affect the likelihood of receiving friendship relationships. While these results were significant, the size of the results suggested that helping behavior only plays a trivial role in shaping the pattern of relationships among teachers.

A principal’s position is shaped by transformational leadership
An expanding avenue within social network research is the importance of the social network position of formal leaders for organizational performance. The fourth study therefore examined the significance of occupying the principal position for schools’ innovative climate, and the extent to which school principals’ network positions are shaped by transformational leadership behavior. Social network analyses, multiple regression analyses, multilevel analyses and network visualizations were combined to examine the data.

Results suggested that principals who were recognized by their teacher team as transformational leaders were sought out more often for advice on work related and personal matters than principals that enacted less transformational leadership. Transformational principals were also more closely linked to all teachers in their team. Moreover, principals’ network
position affected the innovativeness of their schools’ climate. The more principals were sought out for work related and personal advice and the more closely connected principals were to their team, the more willing teachers were to invest in change and the creation of new knowledge and practices. In contrast, the more principals occupied a ‘brokerage’ positioning in which they were the only link between unconnected teachers, the less innovative teachers perceived their school’s climate.

Consequences of social networks in schools

Social networks impact teacher trust
Social capital theory poses that social networks and trust are associated with the availability of social resources. Since Putnam (2000) suggested that norms of reciprocity and trust may arise from social networks, our fifth study was aimed at investigating the extent to which social relationships affect levels of trust. Social network analyses and multilevel analysis were conducted to examine the relationship between social network properties and teacher trust.

The study demonstrated that the more relationships educators maintain, the more they perceive their team as characterized by trust. Above and beyond this effect of individual level relationships, the school’s social network also appeared to affect teachers’ perceptions of trust. The more densely connected teachers were in their schools’ social networks, the more they perceived trust to prevail in their school team. In contrast, school teams with high levels of reciprocity among teachers were characterized by lower trust than teams with lower levels of reciprocity. This implies that the pattern of social relationships in the school team as a whole is as important to teacher trust as individual relationships. It also implies that certain network configurations may be less favorable for nurturing trust among teachers.

Social networks affect shared decision-making and schools’ innovative climate
In debates on school change and reform implementation, a growing focus on the potential of social networks can be noticed. The sixth study in this dissertation was aimed at examining the potential of ties to support schools’ innovative climate through increased teacher involvement in decision-making. This examination was conducted using social network analyses and a multilevel framework and analyses.

Densely connected work related and personal advice networks were found to be supportive of school climates that were innovation-oriented and open to change. Highly dense work related networks were also associated with
increased teacher involvement in the decision-making process. Findings thus suggest that schools with dense networks are more change-oriented since teachers in dense networks perceive greater involvement in the school’s decision-making process.

**Schools’ advice networks influence perceived collective efficacy, and in turn, student achievement**

Social network studies in education often suggest that social networks among educators may ultimately affect student achievement. In the seventh study, we aimed to substantiate this suggestion by investigating the extent to which schools’ social networks affect student achievement, as potentially mediated by teachers’ collective efficacy beliefs. Social network analysis and multiple regression analyses were conducted to study the data.

Findings did not support a direct relationship between teachers’ advice networks and student achievement. Instead, we found that being embedded in dense networks around work related and personal advice increased teachers’ perceptions of the collective capacity of their team, which in turn was strongly positively associated with students’ language achievement. As such, this study offers insights in a potential mechanism that could translate the potential of ties into increased student achievement.

**Social networks support and constrain the implementation of reform**

Social networks are increasingly being studied as important facilitators or inhibitors of organizational change. The final study in this dissertation aimed to shed light on the social forces among educators that may support or constrain the implementation of school reform. In addition, we aimed to substantiate findings of the previous studies by conducting a study in a different setting, namely Californian elementary schools, and using a different methodological approach. We designed a mixed-method exploratory case study, triangulating data from quantitative sources, such as social network analysis and teacher work measures; qualitative data, gathered through interviews with educators from representative grade levels; and the visualization of social networks in representative sample schools.

The study suggests that reform-related social networks in the Californian sample schools varied greatly both within and between schools, thereby reflecting the variation in social network properties within and between the Dutch sample schools found in chapter 1. The importance of principal centrality for innovative climates, as described in chapter 4, was substantiated with triangulated data supporting the principal as the central ‘hub’ for the diffusion
of change-related information. The finding that densely connected teacher
teams also perceived greater involvement in shared decision-making, reported
first in chapter 6, was confirmed in the US sample. Also, the relationship
between dense Dutch teacher teams and the schools’ open orientation towards
innovation was mirrored by the collaborative learning orientation towards the
reform, a sense of collective action and a professional focus on teaching and
learning related to the reform that characterized dense US grade level teams.
Finally, densely connected grade levels were associated with increased
perceptions of grade level efficacy in the US sample, a finding that closely
resembles results described in chapter 7. Overall, this study substantiated
findings from the previous studies and deepened our understanding of the
extent to which the structure of reform-related networks support and constrain
the uptake, depth, and spread of the reform implementation in the schools.

Contributions to social network research

**Conceptual contribution to social network research**

As elaborated in the introduction of this dissertation, our aim was to explore
three main elements of a nomological network, namely the nature, antecedents,
and consequences of social networks in school teams. Besides the contextual
importance of studying these elements, several additional aspects highlight the
conceptual contribution of this dissertation to social network research.

**The nature of social networks in school teams**

The first conceptual contribution of this dissertation is that social networks in
school teams are shaped by their content and demographic composition. As
such, we validate earlier suggestions from organizational literature (Scott, 2000;
Ibarra, 1993; Lazega & Pattison, 1999; McPherson, Smith-Lovin, & Cook, 2001)
for the context of education. The structure of social networks in school teams,
and the extent to which teachers are socially embedded, are dependent on the
content that is exchanged, such as friendship, advice, or work related
communication. This dissertation also confirmed that the extent to which
individuals are actively engaged in relationships is shaped by their
demographic characteristics. Certain regularities appear to affect work related
communication in school teams, such as a tendency towards homophily and
structural balance with regard to reciprocity. Findings also underline the
importance of stable, low-turnover school teams for the nurturing of strong
relationships among team members. As such, this dissertation has increased our
understanding of different types of networks that weave the social fabric of school teams.

**Antecedents of social networks in school teams**

The second conceptual contribution of this dissertation is that social networks in school teams are affected by transformational leadership, but not by helping behavior. The extent to which principals attend to the school’s vision, tailor to teachers’ individual needs and provide intellectual stimulation affects their centrality in the advice network. It may be that transformational leaders themselves are more actively pursuing the dissemination of advice (Coburn, 2005b), but it may also be that transformational leaders are more central because they are sought out more often for advice than less transformational leaders. Yet, in chapter 2, we did not find significant differences in the probabilities of teachers and principals of sending or receiving work discussion relationships. Since the network content of both studies is not similar (advice and work related discussion), and the statistical methods used to arrive at the findings differ for both studies, comparing the studies post-hoc can merely feed the suggestion that transformational principals may be more central because they occupy a more strategic network position in regard to the whole network, and not simply because they might have more dyadic relationships. Future research should provide more insights in the position of school leaders in their school’s social network and the mechanisms through which transformational leaders achieve and utilize their principal position.

An equally interesting finding is that individual helping behavior did not significantly affect social relationships among school team members. The size of the effects suggests that helping behavior only trivially contributed to having relationships, and that the amount of relationships that individuals maintain may be explained by other mechanisms than helping behavior. This finding arguably requires the most attention in further research, since social networks studies until now have are only scarcely aimed at exploring potential antecedents of relationships within and between organizations.

**Consequences of social networks in school teams**

The third key finding of this dissertation is that social networks in school teams hold valuable potential for beneficial school outcomes. As such, the studies all emphasize the potential of ties to positively impact educational practice. Relational linkages were found to foster trust among teachers, contribute to teachers’ willingness to innovate, and boost teachers’ efficacy beliefs. The social embeddedness of teachers in their school team appears to facilitate or constrain
the exchange of information, knowledge, and social support in such a way, that it affects teacher practice and school organizational conditions. What is an even more important find is that teachers’ social embeddedness affects their beliefs in collective efficacy, which in turn affects student achievement. Finally, the results of the Dutch studies were largely substantiated by the findings from a U.S. study. This study underlined the significance of attending to the social relationships to which reform efforts are targeted, and increased our understanding of the way in which reform implementation is facilitated and constrained by the social network configurations in schools.

The dark side of social networks
Besides underlining the advantages of relational linkages, we found several clues to suggest that some configurations of social relationships in social networks may be less favorable than others. Since social capital is often examined for its positive outcomes for individuals, organizations, and communities, it is important to note that the social structure in which resources are exchanged may also take unfavorable forms to prevent a normative standpoint from which social capital is interpreted as an ‘unmixed blessing’ (Portes, 1998). Two of our studies provide examples of the ‘dark side’ of social network configurations.

A first counterproductive outcome of social network configurations pertains to principals who span structural holes in the social network of their school team. Findings indicated that school teams in which a leader is spanning structural holes by occupying a brokerage position are often characterized by less innovative school climates (see Chapter 4). Confirming previous research, it appears that principals who occupy an in-between position constrain the generation of new knowledge and practice by reducing the opportunity for teachers to exchange knowledge and share experiences (Hargadon, 2003; Obstfeld, 2005). While this brokerage position may be beneficial to the principal in terms of control over the flow of information and influence over what knowledge and materials are distributed among team members (Burt, 2000), this situation may inhibit the school team to capitalize on the potential of relationships for teacher development and school improvement. As such, our study provides an illustrative example of undesirable collective outcomes that may result from the potential individual gain of spanning structural holes.

A second negative outcome of social network configurations relates to the downside of strong social relationships, or strong bonding, within groups. Social capital literature suggests that social capital can have at least four downsides: exclusion of outsiders, free-riding within groups, strong social
control resulting in restrictions on individual freedom, and downward leveling norms that socialize group members into accepting lower standards (Field, 2003; Portes, 1998). Social psychologists have identified several mechanisms that are negatively associated with strong relationships within groups, such as group think (Janis, 1982), in-group out-group differentiation (Tajfel, 1981; Tajfel & Turner, 1979), and social loafing (Karau & Williams, 1993; Latané, Williams, & Harkins, 1979).

Results from this dissertation indicate that high levels of reciprocity among teachers are associated with lower levels of trust among teachers (see Chapter 5). It appears that social networks may be characterized by a high number of one-to-one reciprocal relationships, and that too much dyadic bonding may harm the development of trust among teachers. Apparently, for trust to flourish there has to be a certain ‘healthy’ spread of relationships among the team. The more social relationships are clustered in pairs of team members, the lower the trust that school team members perceive in their school team. Highly clustered teams, therefore, may be at a disadvantage because they cannot operate from a solid trust base. It may be that the relationship between trust and clustering is circular, and that because of lower trust, teachers tend to concentrate their relationships on those colleagues, with whom they already have a (strong) relationship. An opportunity for building trust could lie in the diffusion of relationships through increased contact among teachers.

**Methodological contribution to social network research**

This dissertation comes to light in a defining decade for social network research. The popularization of the study of networks in various research fields, such as sociology, organizational science, psychology, and educational research, is supported by the emergence and development of more sophisticated and widely accessible statistical tools for social network analysis (e.g., Monge & Contractor, 2003). While the significance of this dissertation from a contextual and conceptual perspective is evident, there are several additional aspects with regard to methodology that make this dissertation a valuable contribution to the research base of social networks in education.

**Advanced social network analysis techniques combined with ‘traditional’ statistical methods**

A recent upsurge in the availability of advanced statistical methods to study social networks has expanded and advanced the field of social network research tremendously. A particularly interesting recent development is the introduction of $p^2$ and $p^*$ (exponential random graph) models, that provide opportunities to
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study the influence of covariates (such as behavior or individual and school demographics) on the probability of ties on multilevel and longitudinal network to gain insights in network dynamics (Goodreau, 2007; Robins, Pattison, Kalish, & Lusher, 2007; Robins, Snijders, Wang, Handcock, & Pattison, 2007; Snijders, 2002; Van Duijn, Snijders, & Zijlstra, 2004; Zijlstra, 2008).

This dissertation combined various techniques that are specifically developed for the analysis of social network data with statistical methods that can be considered more ‘traditional’. For instance, in Chapter 1, the Quadratic Assignment Procedure (QAP; Krackhardt, 1987) is used in combination with multidimensional scaling to study multiplexity among social networks. Chapter 2 and 3 both demonstrate applications of multilevel p2 models to examine how demographics and helping behavior affected the probability of relationships in a network. In addition to these advanced social network analysis techniques, studies in this dissertation use ‘traditional’ statistical procedures, such as correlation analysis, multiple regression analysis and hierarchical linear modeling (HLM, multilevel modeling) to study derived social network data (Chapters 3 to 8).

Diverse palette of methods

The studies in this dissertation employ a variety of methods to analyze social network data, including visualizations of networks (chapters 2, 4, and 8), raw network data (chapters 1, 2, 5, 8), and derived (calculated) network characteristics, for instance the density, reciprocity, and/or centralization of relationships within a network (all chapters) or the centrality of individuals within a network (chapters 4 and 8). While most studies apply social network analysis in a quantitative manner, Chapter 8 is the exception to this rule. This chapter capitalizes on the diversity of social network methods through the employment of a mixed-method design. Conclusions are drawn from a combination of graphical representations of social networks, raw network data and derived network properties (such as density, reciprocity, and centrality), and interviews with educators that occupy different structural positions in the social network of their school. By triangulating data acquired through multiple methods, this work represents additional advances in how scholars may come to better understand the supports and constraints that are posed by social networks.
Multilevel analysis
An important contribution of this dissertation concerns the examination of teacher relationships at multiple levels of analysis. The need for multilevel studies is evidenced by the multilevel nature of (most) educational research data (Raudenbush & Bryk, 2002; Snijders & Bosker, 1999). Data is said to have a ‘multilevel’ structure when the data is hierarchically structured. The multilevel structure of data in this dissertation can be exemplified when examining teachers in schools: when teachers work at the same school, they may share some similarity that is defined by teaching at the school. For instance, teachers’ individual perceptions of their school’s innovative climate may be partially determined by the extent to which the school’s policy is aimed at innovation. Therefore, these ‘individual perceptions’ cannot be considered entirely independent. Other examples of the multilevel character of the dataset underlying this dissertation are; students from the same school in the same district; and multiple dyadic relationships from a single teacher (since these relationships, similarly, share this single teacher as a common characteristic) Multilevel analysis techniques such as hierarchical linear modeling (HLM) for linear data and p2 models for network data allow researchers to take this interdependency into account.

Until recently, most social network studies only examine social networks and related concepts at a single level of analysis, for instance the individual, the dyadic, or the network level. Social networks, however, ‘are complex systems composed of components and properties that exist and can be explained at all levels’ (Monge & Contractor, 2003, p. xii). Therefore, all chapters in this dissertation explicitly address the importance of studying social relationships at multiple levels of analysis and, if possible, apply multilevel techniques to account for the interdependence of hierarchically nested data.

Limitations
Although we see the potential of this paper for a unique conceptual and methodological contribution to social network research in education, we acknowledge its limitations. Five general limitations to this dissertation will be discussed in more detail.

Test of the complete nomological network
This dissertation was guided by a nomological network of the nature, antecedents, and consequences of social networks in schools. The studies describe various individual and school level elements in relation to social networks. As such, the nomological network is developed by examining parts
of the nomological network separately. Yet, the integral chain of variables that lead from antecedents to consequences of social networks has not been explored. The reason for this is that the employed statistical techniques (p2 models and ‘traditional’ methods) could not be combined into a structural equation model to assess causal paths among the elements of the nomological network. It would have been possible to study antecedents of social networks without accounting for the multilevel interdependency of the data (also using ‘traditional’ methods), for instance by considering network properties of individuals as ‘individual attributes’ rather than relational properties. Yet, this would only be possible from an ego-network perspective. An example of such an approach is given in chapter 4, where we studied transformational leadership behavior as an antecedent of principals’ network centrality. Doing so for all individuals in a network simultaneously, however, would have ignored the interdependency of the individuals in the network and as such violated basic assumptions about social networks (see the Introduction and chapter 2). We acknowledge that this is a limitation that requires attention in the near future. The history of leadership literature (e.g., Yukl, 1981) teaches us that the call for integral frameworks often originates when an idea is gaining momentum. Considering the dramatic increase in social network studies over the past decade (see chapter 1), we expect that scholars will voice the need for such integral models more often, and with more emphasis.

Network measures
Although the studies in this dissertation clearly underline the relevance of relationships among educators, results have mainly focused on the density of social networks and the amount of relationships shared among school team members. Less explicit attention has been paid to the frequency and intensity of network contacts, thereby limiting our opportunities to provide insights in the importance of strength of weak ties. Future research in this direction would certainly contribute to a more detailed understanding of the importance of social networks in school teams for various school outcomes. Also, the study in this dissertation only address ‘basic’, fairly comprehensible network measures. Currently, social network studies are including more detailed and intricate measures to gain fuller understanding of the complexities of social network structure and its relation to behavior. Often, these network measures are based on characteristics of ‘relationships-of-three’, that is, patterns of relationships among three individuals, such as triads, triplets, and three-cycles (see for an extensive discussion Degenne & Forsé, 1999; Wasserman & Faust, 1997). A detailed examination of such network configurations would potentially yield
more insights in the intricate pattern of relationships and behavior in school teams.

Generalizability
Another limitation to this dissertation is posed by the extent to which our findings can be generalized to other settings. Our final study validated many of the findings from the Dutch sample in a different context, namely five larger elementary schools in California USA, and our findings resemble results from similar recent studies all over the world (Baker-Doyle & Yoon, in press; Cole & Weinbaum, 2007; Hite, Williams, & Baugh, 2005; Lima, 2009; McCormick, Fox, Carmichael, & Procter, in press). Nevertheless, we acknowledge that our findings may not be generalizable to other countries, as well as other educational settings, such as secondary, vocational, or higher education. It would be interesting to compare and contrast recent findings from various international contexts to explore potential culture differences in relation to social network structure.

Causality
The concept of social capital is often criticized for its logical circularity. Social capital is often interpreted as simultaneously a cause and an effect; leading to positive outcomes and being inferred from the same outcomes (Portes, 1998). In this dissertation, causality between the relationships under study and the elements of the nomological network were funded by suggestions from reviewed literature. However, our research design was not aimed at assessing the causality of the relationships under study. The empirical literature base for social networks in education is small, and studies testing causality in regard to social networks in education are even more scarce. Yet, readers are advised to proceed with caution when inferring causal conclusions from our findings. Thus, in future empirical studies more attention should be given to the examination of causality, attempting to break through its logical circularity.

Network dynamics
Social networks are dynamic and change over time (Kilduff & Tsai, 2003). Unfortunately, the cross-sectional data of this dissertation only allowed for a static examination of social networks in school teams. Therefore, longitudinal studies are indicated to enhance our understanding of the exchange of different types of content in social networks, the implementation of change strategies, and resulting outcomes over time. A promising lens on the interplay between individual behavior and social structure that has remained largely empirically
untouched is Burt’s structural theory of action in a longitudinal perspective (Leydesdorff, 1991).

In general, the dissertation emphasizes that individual and collective action is embedded in a social context and that we should attend to the structure of this social context as it poses opportunities, as well as delimiters, for individual and collective action. To explain how social structure and individual action are intertwined, Burt (1982) views social structure as a dynamic response to individual interactions that simultaneously poses constraints for interaction to occur. His structural theory of action poses that individuals act to achieve goals in line with their personal interests, and that both interests and the resulting actions are constrained by existing social structure. By adding a temporal dimension, Leydesdorff (1991) highlights the circular character of the theory, illustrating that social structure is both an antecedent and a consequence of individual social action (see Figure 1). Since this longitudinal extension to Burt’s (1982) theory is potentially meaningful for future research, scholars would be advised to methodically explore the interplay between network dynamics, individual action and preferences in future research.

Figure 1. Burt’s (1982) structural theory of action, plotted over time
Suggestions for future research
Taken together, this dissertation provided deepened understanding of social networks in school teams and the individual and organizational conditions that shape, and result from, the pattern of social relationships that may support or constrain school outcomes. Various other questions remain to be answered.

Connecting ties to other phenomena
In addition to the elements that were included in our nomological network, there may be other variables that can be studied in relation to social networks. As a valuable addition to the nomological network, future research would be advised to include teacher level variables that may explain mechanisms through which relational linkages affect student achievement. One such element is teachers’ instructional practice. This dissertation has provided insights in how teachers’ social networks affect team level characteristics, such as collective efficacy, perceptions of shared decision-making and innovative climate. What remains unaddressed, however, is how relational linkages affect teachers’ instructional practice and their professional development. Although we assume that our measure of trust is related to teacher learning, and our assessment of innovative climates reflect a fertile ground for innovations to flourish, we do not actually examine teacher learning or the development and implementation of actual innovations. Further investigations, preferably through mixed-method analyses, are therefore required to provide deepened understanding of the potential of ties in relation to particular innovations and efforts to change instructional practice (McCormick et al., in press)2.

Other elements that are suggested to be related to relational linkages, but have not yet been scrutinized in an educational context, are organizational attachment (cf. Tsui, Egan, & O’Reilly, 1992), solidarity (Koster & Sanders, 2006; Koster, Stokman, Hodson, & Sanders, 2007), social identity, and social identification (cf. Mehra, Kilduff, & Brass, 1998; Van Dick & Wagner, 2002).

Moreover, it would also be interesting to study the extent to which certain configurations may impact variables that are at the core of human resource management interest, such as job satisfaction, stress, burnout, absenteeism, motivation, turnover, mobility, and employability (e.g., Brass, 1984, 1995; Mossholder, Settoon, & Henagan, 2005; Sanders, 2004; Sanders & Hoekstra, 1998; Sanders & Nauta, 2004; Van Emmerik & Euwema, 2003). While this type of studies is popular in organizational literature (Collins & Clark, 2003;

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2 See McCormick et al. (in press) for an interesting discussion on our findings, as well as findings from related social network studies in education
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Kaše, Paauwe, & Zupan, 2009; Kinnie, Swart, & Purcell, 2005; Lengnick-Hall & Lengnick-Hall, 2003), knowledge in educational settings is missing.

Ties and leadership
Another field that has been touched by this dissertation, but deserves a closer examination of its relationship with social linkages, is the field of leadership. A number of leadership studies focus on social networks in relation to formal and informal leadership (Coburn, 2005b; Pitts & Spillane, 2008; Spillane, Hunt & Healey, 2008b), distributed leadership (Spillane, 2006; Spillane, Camburn, Pustejovsky, Pareja, & Lewis, 2008a), and how school leaders use their networks for acquiring resources (Hite, Williams, Hilton, & Baugh, 2006b). Yet, we expect that the study of the flow of resources in teachers’ social networks can provide extensive insights in how leadership is distributed among educators, what kind of leadership is distributed, and how various patterns of distribution affect school outcomes such as the implementation of reform and student achievement. Research in this direction is currently being conducted in the greater Chicago area by Spillane and his research team (e.g., Pitts & Spillane, 2008; Spillane, 2006; Spillane, Camburn, & Pareja, 2007; Spillane, et al., 2008a; Spillane et al., 2008b; Spillane & Zuberi, 2009) and in California and New York by Daly and Finnigan (e.g., Daly & Finnigan, 2009; Daly, Moolenaar, Bolivar, & Burke, in press; Daly, in press).

Ties with other stakeholders
Outside the scope of this dissertation, but worth investigating in relation to social networks in education, are teachers’ relationships with other stakeholders outside the boundaries of their school team (e.g., Bidwell, 2001; Hite et al., 2006b; Lieberman, 2000; Veugelers & Zijlstra, 2002). Research suggests that external ties, or ties that span organizational boundaries to other organizations and individuals, are important for innovation and the development of new knowledge, ideas, and practices (Hansen, 1999) since these ties may provide access to information and knowledge that may not be available within the organization (Adler & Kwon, 2002; Reagans & McEvily, 2003). In the Netherlands, relationships with stakeholders outside the school are becoming more and more important (Hofman & Dijkstra, 2007; Leenheer, Vrieze, Van Kuijk, & Kwakman, 2003; Netherlands Ministry of Education, 2009c; Veugelers & Zijlstra, 2002; Vrieze & Van Kuijk, 2004). For instance, schools are getting involved in local partnerships with preschools, companies that offer pre- and after-school care (often located in the same building, so-called ‘brede scholen’), schools for children with special needs, school support service centers,
university partnerships, Ministry partnerships, networks of similar schools from the same district, and companies that offer teacher professional development.

As such, in addition to teachers’ social embeddedness in their schools, another form of embeddedness applies to schools; future research will have to address the institutional embeddedness of schools in their local community. Schools may play an important role in fostering social cohesion in their community and citizenship of their students (Moolenaar, 2007; Westheimer & Kahne, 2004). Social capital theory may provide a suitable lens for explaining differences between schools that have strong ties with external stakeholders (‘bonding social capital’) and actively pursue new contacts with external stakeholders (‘bridging social capital’) and schools that are poorly embedded in their institutional context. Schools’ external relationships and institutional embeddedness may thus offer valuable potential for the exchange and diffusion of information, knowledge, and expertise that may facilitate schools’ ability to achieve desired goals. The need for increased insights in the potential of these relationships to support schools functioning is therefore evident.

Implications for educational leadership, policy, and reform
This dissertation offers unique insights in the pattern of social relationships that make up the social fabric of Dutch elementary schools. We elaborate on several implications of this dissertation for educational leadership, reform, and policy to translate the potential of this dissertation for educational practice.

Encourage dense teacher networks
One route through which educational leaders and policy-makers may increase the potential of ties is by stimulating the development of densely connected teacher networks, especially with regard to work related discussions and communication. An illustration of a successful effort to stimulate dense networks is Spillane’s example of a principal who set up a ‘breakfast club’ (Wassink, Mioch, & Van Veen, 2009). By initiating a morning meeting once a week in which teachers discussed a recent article on teacher practice, this principal created an opportunity for teachers to discuss recent developments, share experiences, and get engaged in a continuous process of teacher and school development. When teachers discuss their work and exchange advice, best practices may be shared through their discussion, which in turn affect teachers’ instructional practice (Little, 2003b; Stoll & Louis, 2007). Initiatives like this ‘breakfast club’ are currently scarce in Dutch educational practice, but leaders and policy-makers are encouraged to engage in ideas to stimulate work
Conclusions & Discussion

related teacher networks in support of beneficial school outcomes as discussed in this dissertation.

Consider relationships in reform
In relation to reform, educational leaders and policy-makers would be wise to look beyond the technical aspects of the reform and enactment of transformational leadership behavior (Spillane, Reiser, & Gomez, 2006; Wassink, Mioch, & Van Veen, 2009). Reform efforts are often socially co-constructed (Coburn, 2003; Datnow, Lasky, Stringfield, & Teddlie, 2006). Besides attention to the technical aspects of reform to which current policy instruments are often directed, it is also crucial to consider the social forces upon which the reform efforts are layered, since these social forces may support or constrain the flow of information, knowledge, and expertise necessary to the successful implementation of reform (Tsai, 2001). Insights in the importance of social linkages for reform implementation may provide policy-makers with a valuable starting point for tailoring reform efforts to the underlying social structures to which the reform is targeted in order to optimize the potential of ties for improving school practice. Our findings also point to the need for extensive support for principals when implementing specific reforms. Principals are the primary conduits through which reforms are disseminated, and the way in which principals act upon the formal reform mandate is often crucial to the way in which the reform is subsequently understood and enacted in the school.

Combine leadership behavior and position
Our findings suggest that teachers who perceive their school’s climate as innovative are often guided by leaders that both display transformational leadership and occupy a position close to their teachers. Leaders who aim to create a school climate that is conducive to the implementation of innovations are thus advised to not only enact transformational leadership behaviors, but also occupy a strategically close position to all teachers to ensure that they maximize the impact of their attention to vision building, individual consideration, and intellectual stimulation. Our findings point to the value of a strategic leadership position and being a central ‘hub’ in advice networks. However, leaders should also be aware not to find themselves in a brokerage position, in which they are the only link between otherwise unconnected teachers. Such a position, while advantageous in regard to the potential of controlling the flow of information, is negatively associated with innovative climates. Apparently, principals’ control of the flow of information inhibits
teachers’ perceptions of the school team’s willingness and ability to invest in innovations and create new knowledge and practices.

*Use social network data*

Using social network data in practice may also be a way to improve change efforts. Social network data may provide valuable information about which individuals occupy the most strategic positions for a successful dissemination of reform information and knowledge (Daly & Finnigan, 2009). The likelihood of successful reform implementation may be increased by a more targeted effort at molding the social structure in support of the flow and uptake of reform information (Daly et al., in press; Coburn & Russell, 2008; Kogut & Zander, 1996; Smylie & Evans, 2006).

**Ties with Potential**

In conclusion, this dissertation contributes to educational research, policy, and practice by exploring the nature, antecedents, and consequences of social networks in school teams. The results demonstrate how the nature of relationships defines the social fabric in school teams, and how individual behavior of educators shapes their school team’s social networks. In addition, findings indicate that a social network perspective on school teams can add to our understanding of how social networks in school teams impact a variety of school and teacher outcomes, as well as suggest direction for more relationally oriented educational policy instruments.

Acknowledging the importance of social relationships and its interplay with behavioral antecedents and organizational outcomes has important implications for educational research, and the social sciences in general. There is a growing urge to integrate social network theory in traditional, mainstream research in advancing our understanding of the embeddedness of individuals and their behavior in a social milieu. The recent upsurge of social network research in a multitude of settings and scientific disciplines reflects a promising indication towards this integration. By building a nomological network around social networks in schools, this dissertation validates social network theory as an autonomous research area as well as a valuable addition to the current perspectives on educational organization and management. While many avenues still remain open to exploration, the main road appears to be signed with the adage that ‘relationships matter’. It is through these ties with potential that strong communities turn individual efforts into collective action in realization of powerful school outcomes.