

**How Relationships between the District Office and High School Sites Influence the  
Implementation of Algebra for All**

By

Patricia K. Kurtz

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Committee in charge:

Professor Cynthia E. Coburn, Chair  
Professor Christopher K. Ansell  
Professor Ruth B. Love

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## Abstract

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Federal initiatives have put great pressure on districts to show student success. Prior research on education reform focused on the school as the unit of change to improve student achievement and implement systemic reform. However, because districts have the responsibility to improve the instructional quality and performance of all their schools, researchers have begun to focus on responsibilities of the district in supporting and implementing systemic reform. Scholars are beginning to investigate how the connections between central offices and schools influence systemic reform. Social networks are a way to investigate the connections between central offices and schools, and how they matter for implementation of educational reform. I conducted a case study of how relationships between the central office and the schools influenced reform efforts in high school mathematics education. My cross case study is of four school sites in a district that was implementing Algebra for All, a reform where all students are placed in an algebra class or higher when they enter high school. I used social capital theory and the four dimensions of ties, trust, access to expertise and the content of interactions to guide my study of how district policy and support influences social interactions and fosters the development of social capital to implement mathematics reform at a school site.

I found that school sites adopted Algebra for All in spite of reservations because they trusted the district. Teachers and schools drew on the assets of social capital and their networks for resources and expertise to assist in implementing the reform. Principals played a key role and acted as boundary spanners to broker resources for their schools. Organizations outside of the district were also sources of support. However, sources of support and expertise from the district and outside resources were not always leveraged due to a lack of ties internally in the school. The teachers did not have congruent and deep discussions about the reform effort but this did not impede implementation. Informal social networks supported implementation and allowed teachers to share resources. The nature of teacher networks including proximity, educational values, longevity of ties and expertise supported the reform Algebra for All. These conclusions have practical implications for educators seeking to understand how districts and schools can work together to implement reform efforts successfully.

## **Dedication**

### For My Family

You have been so supportive through this long journey. I could not have finished without your love and your belief in me that I could do it!

### And for My Grandparents

You came to this country without a formal education but you encouraged us all to get the best education that we could – and I did.

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## CHAPTER 1: INTRODUCTION

No Child Left Behind (NCLB) initiative puts great pressure on districts to show student success by meeting adequate yearly progress (AYP) and demonstrating that all students are achieving at high levels. To prevent schools or districts from becoming identified as being in program improvement, they must meet the requirements of NCLB and close the achievement gap. In the past several decades, education reform has focused on the school as the unit of change to improve instruction and student achievement and implement systemic reform. However, there are often disparities within districts. Some schools are succeeding and some are failing and not all of the differences can be attributed to socioeconomic factors (Supovitz, 2006). Because districts have the responsibility to improve the instructional quality and performance of all their schools, researchers and educators have begun to rethink the roles and responsibilities of the district in supporting and implementing systemic reform and suggest the importance of a system wide approach to improvement. More and more they are calling for school districts to act as leaders of reorganization and change.

There has been a resurgence of interest in the role of the district office and many researchers are finding it worthy of study (Burch & Spillane, 2004; Mac Iver & Farley, 2003; Marsh, 2000; McLaughlin & Talbert, 2003; Spillane, 1996). Scholars provide evidence that district offices can play a leadership role in closing the achievement gap and implementing high standards. School districts also play a key role in mediating state and federal reforms and leading district wide school improvement efforts (Darling-Hammond et al., 2003; Elmore & Burney, 1997; Goetz, 2000; Hightower, 2002; Honig, Copland, Rainey, Lorton, & Newton, 2010; Marsh, 2000; Massell, 2000; McLaughlin & Talbert, 2003; Spillane & Thompson, 1997; Togneri & Anderson, 2003). The perceptions of the district office has changed from seeing them as tangential with little influence on schools to seeing them as central to the process and having a vital role in developing systems of support for districtwide teaching and learning improvement. Although the district office may play a role both in influencing or inhibiting restructuring, it can no longer be ignored.

The current literature on districts is concluding that “for better or for worse, districts matter fundamentally to what goes on in schools and classrooms and that without effective district engagement, school-by-school reform efforts are bound to disappoint” (McLaughlin & Talbert, 2003, p.5). I define the district as the central office and functions of that office. Researchers use the terms district office and central office interchangeably but both refer to a group of individuals that include the superintendent, school board and central office staff that collectively work together to support schools to help them develop and implement solutions to problems. By virtue of their roles in the central office, these leaders are involved in identifying, selecting and implementing district policies, especially in response to state and national reform efforts (Daly & Finnigan, 2011; Rorrer, Skrla & Scheurich, 2008).

However, although the profile of the district office has been raised in recent years, scholars are only beginning to investigate how the connections between central offices and schools matter for achieving systemic reform (Burch & Spillane, 2004; McLaughlin and Talbert, 2003). For example, McLaughlin and her colleagues found that increased collaboration between the district and school site played a critical role in achieving educational equity and closing achievement gaps between student populations (McLaughlin and Talbert, 2003).

Social networks may be an ideal way to investigate the connections between central offices and schools, and how they matter for implementation of educational reform. Social



networks are the social relations through which individuals can access resources and expertise. Social network data can provide useful information to school leaders about the success of initiatives designed to promote greater collaboration in schools. Strong social networks can also play an important role in reform implementation because teachers are more likely to make changes in instructional practice and produce increases in student achievement (Coburn & Russell, 2008; Penuel, Riel, Krause, & Frank, 2009). Researchers have begun to look at the role of social networks in the implementation of educational policy reform (Coburn & Russell, 2008; Frank, Zhao, & Borman, 2004; McLaughlin & Talbert, 2003; Smylie & Hart, 1999). However, most of the literature has been on the social networks within schools. There is little research that has been directed at the influence of social relationships between the district office and the school sites on reform implementation.

Daly and Finnigan (2009) are one of the few researchers who have studied the relationship between central office and schools. They argue that while most researchers focus on formal structures for supporting school improvement, a review of broader research on social networks is suggesting that leaders should also invest in informal social relations to support reform efforts. Similarly, Honig's (2010) study found that it was essential for schools and the district office to work together to create an organization of schools that serve the needs of students well and provide the resources for teachers to make productive changes in teaching and learning.

I conducted a case study of how relationships between the central office and the schools influenced reform efforts in high school mathematics education. I selected high school mathematics reform because these reform efforts have received numerous national and state resources and the mathematics community has forged a consensus about how to reform their discipline (Spillane, 2000). Over the past two decades, expectations for all students to meet high academic standards have increased. In turn, so have the expectations for students to complete and excel in more rigorous math courses. Mathematics is no longer for the few but for the "all." The mathematical reform that I studied was Algebra for All. This is a concept in which all students begin algebra in ninth grade and has been adopted by school districts across the country. In this reform, algebra is moved from being an elective to a pivotal course because algebra is seen as a beginning gate keeper course for successful preparation of students for college and the world of work (Bitter & O'Day, 2010; Chazan, 2008; Kilpatrick & Izsak, 2008). Students who are initially assigned to college preparatory classes such as algebra and geometry not only learn more but they are increasingly likely to pursue higher mathematical courses and enroll in academic science courses in subsequent years (Gamoran & Hannigan, 2000). Many educators feel that unequal access to academic curricula produces inequities in student learning of mathematics. Algebra for All has become a response to these inequities and reformers advocate placing all students in college preparatory mathematics upon entry into high school.

However, although educators and policy makers may believe that all students benefit from algebra and that it is a gateway course to higher education, it is the teacher who faces the difficult challenge of teaching a high standards course to a classroom with a wide ability of mathematical skills (Choike, 2000). The students may come into algebra with beginning content knowledge that ranges from far below to far above the course prerequisites. It becomes dependent upon the school site and the district to build teacher capacity to use appropriate instructional strategies that will enable all students to successfully complete algebra. To do this, teachers must be given support and access to expertise to internalize new skills and strategies and work with their colleagues to address the needs of their students (Bitter & O'Day, 2010). My

study provides insight into the ways that the relationship between the central office and the schools enables teachers to take on this difficult task.

The outcome of this study is a richer understanding of how relationships between the district and school sites influence the successful implementation of a school wide systemic reform. The study also allowed for a deeper understanding of how the social networks between schools and the district office influence the implementation of the mathematical reform, Algebra for All. This work is important because a deeper understanding of school site and district relationships and how they are used to advance systemic reform can point to new possibilities to improve connections in ways that have the potential to influence instruction and student learning. It also has implications for how district office leaders can exercise essential leadership, in partnership with school site leaders, to build capacity to implement future reforms.

### **Literature Review**

For the past twenty years, there has been much anti-central office rhetoric. Districts were viewed as incompetent institutions that stymied school reform efforts due to excessive rigidity, bureaucratic practices, internal politics, and weak personnel that prevented the district from providing support to schools, teachers and administrators (Chubb & Moe, 1988; Elmore, 1993; Peterson, 1999).

Reform research often focuses at teachers, seeing them as being central to implementing reform (Cohen & Hill, 2001; Elmore, 2000; Floden et al., 1988). In this body of research, the district's role is to provide teachers with resources and support and if they did not then the reform would fail. When success did happen at schools, it was often interpreted as having happened in spite of rather than because of the district office's support (Cohen & Hill, 2001; Floden et al., 1988). Scholars suggested that the district's influence on school instructional practices was inconsistent and weak and did not usually affect a teacher's decisions of what to teach or how to teach it (Elmore, 2000). Some educators even questioned the need for the district office at all. In 1991, Chester Finn wrote that "the school is the vital delivery system, the state is the policy setter and nothing in between is important" (cited by Mac Iver & Farley, 2003, p. 1). Because of the belief that districts were not necessary for reform, new initiatives were begun such as the New American Schools Development that ignored the district office and gave funds directly to the schools to support instructional improvement (Marsh, 2000). Perhaps because of this antipathy to districts, few researchers actually investigated the role of the district in leading or impeding change or the role of the district in school reform.

More recently, however, new studies have begun to focus on the role of the central office in instructional improvement. This new research illustrates that school districts matter and are agents of change (Elmore & Burney, 1997; Fullan, Bertani, & Quinn, 2004; Massell, 2000; Spillane, 1996). Recent case studies of district initiatives have shown that district leadership can improve student outcomes and reduce ethnic and socioeconomic gaps in achievement (Darling-Hammond et al., 2003; Elmore & Burney, 1997; Hightower, 2002; Marsh et al., 2005; Massell, 2000; McLaughlin & Talbert, 2003; Snipes, Doolittle & Herlihy, 2002; Togneri & Anderson, 2003). Much of the research has focused on expansive urban districts serving communities with large numbers of students who are defined as low performing based on ethnic, socioeconomic and linguistic diversity (e.g. San Diego, New York City and Philadelphia). In addition, many of the initial case studies on the role of the district office in systemic reform focused on reforms

involving elementary schools (Elmore & Burney, 1997; Hightower, 2002; Snipes et al., 2002; Togneri & Anderson, 2003).

There is a notable convergence of findings around district characteristics that are correlated with success in reform implementation that results in improved student achievement (Darling-Hammond et al., 2003; Hightower, 2002; Massell, 2000; Marzano & Waters, 2009; McLaughlin & Talbert, 2003; Snipes et al., 2002). Districts that are successful have developed the following elements: 1) they established district goals and encouraged the concerted efforts by all school and district actors to support the goals; and, 2) they developed and acquired human, social and financial capital to achieve district goals and sustain capacity building activities to support district goals.

**Goal Setting.** High achieving districts develop goals that promote successful outcomes for all students. In these studies, goals often were a response to state and national reform policies but when confronted with disaggregated data that showed a need for reform the districts took action because it was the “right thing to do” (Thompson, Sykes, Skrla, 2004, p.140). To promote reform among teachers and principals, district administrators saw themselves as part of a learning community and modeled themselves as goal oriented learners (Cobb et al., 2003; Elmore and Burney, 1997; McLaughlin & Talbert, 2003). Interpersonal relations were developed through intensive interactions and trust was built across and within different levels of district and school personal (Bryk & Schneider, 2002; Spillane & Thompson, 1997). Teachers and principals, in turn, supported strong central office roles if they were involved in helping set the goals and norms. By building the belief in the goals across all levels from the central office to the classrooms, district leaders ensured that the goals remained stable throughout leadership changes and staff continued to implement the articulated goals (Hightower, 2002; McLaughlin & Talbert, 2003; Skrla, Scheurich, & Johnson, 2000).

**Capacity Building.** One of the critical themes that characterized effective districts was the ability to build the capacity of administrators and teachers to develop and implement policies that support challenging instruction. The research suggests that it is the responsibility of the district leaders, administrators and teacher leaders, to construct a learning environment for teachers that influences changes in teachers’ knowledge, beliefs and experiences and in turn encourages the development of new instructional strategies. To support learning and equity, the district office builds capacity by developing site and systems knowledge, commitment to goals, professional networks, staff, materials, time, and relationships that build on trust and collaboration time (Honig, 2003; Marzano & Waters, 2009; Spillane & Thompson, 1997). The capacity that districts build consists of human capital, the knowledge and skills of the leaders in the district; social capital, social linkages inside and outside the district and the establishment of open communication and trust within these links; and financial capital, resources for staff, time and materials (David & Shields, 2001; Fullan, Bertani & Quinn, 2004; Honig, 2003; Honig et al. 2010; Marsh, 2000; Marsh et al., 2005; Spillane & Thompson, 1997). Open communication and trust are essential to the process so social and human capital must work cooperatively (Bryk & Schneider, 2002). Financial capital is important but at least one study argues that it will not carry the reform alone without staff commitment and organizational trust that the reform will help students learn (Spillane & Thompson, 1997).

It is important to note that scholars suggest that district goals and capacity building efforts are interrelated and each one reinforces the other. Research finds that a district cannot be

successful at improving learning and student achievement by only possessing one characteristic (Massell, 2000; Shannon & Bylsma 2004; Snipes et al., 2002). As Snipes and his colleagues (2002) suggest: “to do only one or a few elements may be a wasted effort” (p.7). The case study literature provides convincing arguments because of the similarity of findings across multiple sites and studies that change is happening at the district level to improve the quality of student learning and teaching in schools and those districts that are effective are attending to goals setting and capacity building (Darling-Hammond et al., 2003; Elmore & Burney, 1997; Hightower, 2002; Marsh et al., 2005; Snipes, Doolittle & Herlihy, 2002; Togneri & Anderson, 2003).

Although research on the district’s role in fostering student learning is still young, it is becoming clear that districts, through capacity building, are expected to craft and carry out policies that support instructional reform. The present research provides evidence that districts build instructional leadership capacity through communication and collaboration, accountability of goals, instruction and professional development activities and securing human and fiscal resources (Floden et al, 1988; Massell, 2000; McLaughlin & Talbert, 2003; Rorrer et al., 2008). This suggests that a district’s effort to build these dimensions of capacity - human, social and financial capital - plays a role in the choices that schools make to improve teaching and learning.

My study will focus on one dimension of capacity: social capital. More specifically, I will focus on how social networks between the district and the schools influence the implementation of systemic reform. Existing research proposes that the district office and schools can benefit from being connected to each other to communicate information. These connections allow them to transfer knowledge and resources, develop expertise, be innovative and share instructional strategies (Daly & Finnigan, 2009). This suggests that if there are strong communication bridges between the district office and schools there is a greater potential for organizational change and districtwide reform implementation.

### **Research Questions**

Building off these previous studies, I will do a careful exploration and analysis of the network of social relations between the district office and schools that may offer a better understating of the facilitative and constrictive conditions for implementing mathematical reform.

I will ask the following research question:

- How do relationships between the district office and high school sites influence the implementation of Algebra for All?

I will also seek to answer the following sub questions:

- How are district central offices connected to schools?
- How do the dimensions of social networks including social ties, trust, content of interactions and access to expertise foster the development of social capital between the district office and schools?
- What aspects of district office interactions with schools matter for successful implementation of systemic reform?

### **Conceptual Framework**

I will draw on social capital theory as it was developed in sociology and political science (Coleman, 1988; Portes, 1998) to address these questions. This theory argues that individuals use the resources available to them through their position in the network or organization to realize important outcomes such as increased human capital and successful implementation and dissemination of reform efforts (Adler & Kwon, 2002). The importance of social capital is becoming increasingly evident as recent studies have found that informal structures may be more influential to teacher learning and reform implementation than formal structures (Daly & Finnigan, 2009; Frank et al., 2004; Reagans & McEvily, 2003). The structure of the networks may influence the spread and depth of the organizational change and provide insights into the social activities that facilitate or constrain reform efforts (Daly, Moolenaar, Bolivar, Burke, 2010).

Social capital theory can help us understand how district leadership can support or deter the development of productive social interactions that allow schools to successfully implement reform and design positive instructional change. Social capital is the resources and expertise that individuals can access through their ties and relationships with others. It is a non-monetary form of capital that can be an important source of power and influence and is produced through social interactions (Portes, 1998). Adler and Kwon define social capital as “the resources available to actors as a function of their location in the structure of social relations” (Adler & Kwon, 2002, p.18). Social capital allows individuals to secure benefits not only because of their membership in a social network or social structure but also based on their position in the network (Adler & Kwon, 2002; Coleman, 1988; Portes, 1998). Existing studies show benefits of social capital in information exchange and knowledge development (Daly & Finnigan, 2009; Hansen, 1999; Uzzi & Lancaster, 2003). Coleman (1988) discusses the importance of social capital in the development of human capital and argues that social capital must complement human capital in an organization to make the human capital useful in the organization. Pil and Leana’s (2009) findings suggest that public school are overselling human capital and undervaluing the benefits of social capital. Their work shows that teacher collaboration and trust have as great an effect on student achievement as human capital. Other studies found that social capital influences transfer of complex knowledge, reform implementation, and access to expertise (Frank, et al, 2004; Hansen, 1999; Penuel, et al, 2009; Uzzi & Lancaster, 2003). However, Portes (1998) cautions that there are negative consequences of social capital including exclusion of outsiders, excess claims on group members, demand for conformity, and possible downward leveling of norms.

Most studies that examined the influence of social capital on changes in an organization have been done outside of education (Granovetter, 1982; Hansen, 1999; Reagans & McEvily, 2003; Uzzi & Lancaster, 2003). Recently, some scholars have begun to apply the concept of social capital as a lens through which to view how social factors shape instructional innovation (Frank et al., 2004; Smylie & Evans, 2006; Smylie & Hart, 1999). This work has surfaced important characteristics of social networks that influence reform implementation (Adler & Kwon, 2002; Coburn & Russell, 2008). For example, Coburn and Russell in their study of district policy implementation and teacher social networks identified four dimensions of social networks that are important to reform implementation: structure of ties, trust, access to expertise and the content of interaction. I used these same dimensions to guide my study of how district policy and support influences social interactions and fosters the development of social capital to implement mathematics reform at a school site.

**Structure of Ties.** The structure of ties between individuals is a dimension of social networks and through it individuals can share social capital resources (Coleman, 1988; Granovetter, 1982). The natures of the ties can be characterized in terms of frequency of interaction, proximity and mutual confiding, and reciprocity of services to individuals in the network (Granovetter, 1982; Hansen, 1999). It is through ties to others in the network that one is able to gain access to particular knowledge, resources and services (Penuel et al., 2009; Small, Jacobs, & Massengill, 2008). Weak ties are defined as acquaintances and strong ties are close friends (Granovetter, 1982). Weak ties are indicators of non-redundant knowledge and may encourage new ideas and innovation because individuals interact with others outside of their immediate network and this leads to new knowledge. Strong ties support the transfer of complex knowledge and coordinated problem solving because it is easier among people with similar backgrounds and expertise (Granovetter, 1982; Hansen, 1999; Reagans & McEvily, 2003; Uzzi and Lancaster, 2003). In educational settings, ties reflect closeness to colleagues and can be developed through both professional and personal interactions. Teachers tend to interact with just a few fellow teachers and turn to teachers for assistance who share common beliefs about teaching (Bidwell & Yasumoto, 1999). It is through these ties that different types of social capital resources and expertise such as curriculum, teaching strategies and technical skills, can be accessed (Penuel et al., 2009).

The concept of tie span is another aspect of the structure of ties. These are the informal tie structures that are comprised of subgroups that span social and organizational boundaries and allow individuals to access information and expertise that are outside of their immediate social group (Frank, et al., 2004, Granovetter, 1982). A wide network range of relationships that span many knowledge pools can increase complex knowledge transfer to a variety of audiences (Reagans & McEvily, 2003). For example, when teachers are implementing a new mathematics reform, the probability of the success of the new mathematics instruction will be stronger if teachers have ties with those that reach beyond their functional area. Tie structure in social networks influences outcomes related to systemic reform implementation including problem solving, transfer of complex knowledge and diffusion of innovations (Frank, et al., 2004; Reagans & McEvily, 2003).

**Trust.** Another element of social capital that constitutes a resource for individuals in their social group is trust. Social trust concerns the confidence that people have in the reliability and integrity of individuals. Bryk and Schneider (2002) identify relational trust as being based on individuals having relationships with one another, understanding one's role obligations and then expecting that others will fulfill their role obligations. Trust decreases when others do not act in ways that are consistent with the rest of the group. One fulfills obligations not just because it is the "right thing to do" but they also must do it in a way that is respectful and is perceived by others to be doing it for the right reasons. Relational trust allows for increased social innovation and more effective decision making. There are four criteria of relational trust: integrity, competence, respect, and personal regard for others. A serious lack of one of these considerations may undermine the trust in the relationship. Relational trust can be a catalyst for change since everyone trusts each other to work for the common good; it facilitates problem solving; it helps individuals understand role obligations and it advances an ethical imperative to present programs that are in the best interests of students (Bryk & Schneider, 2002).

Social trust is associated with a predisposition towards cooperation and the confidence that individuals have in one another, in leadership and in the social group as a whole. In

organizations with a high degree of trust, there is less likely to be conflict. The implementation of reforms may be influenced as much by the trust between a school and the district office as trust among teachers and administrators within a school (Smylie & Evans, 2006). Trust creates an environment that allows teachers to experiment and be creative, to develop more effective instructional practices; trust allows faculties to work together as a professional community to solve problems as a collective; trust allows teachers to work together but to also know that they have autonomy and support for their individual efforts; and trust influences the development of strong personal attachments to the organization and beliefs in its mission (Bryk & Schneider, 2002). Social trust is important as a resource for school improvement because it facilitates conversations about instructional reform among educators. This allows teachers and administrators to develop a shared understanding about the reforms and craft instructional strategies (Spillane & Thompson, 1997).

**Access to Expertise.** Social capital facilitates the exchange of resources and expertise that teachers need to enact curricular reforms. Resources can be both material and human and support the implementation of reform. However, although material resources may be necessary, it is whom one collaborates with or gets help from that matters. Individuals provide resources to the network through the expertise and abilities that they provide (Adler & Kwon, 2002; Coburn & Russell, 2008; Penuel et al., 2009). Although access to expertise can vary based on the ability of individuals in a social group, implementation efforts cannot proceed without individuals being identified as knowledgeable of instructional improvement. Penuel (2009) found that teachers who received help from colleagues who were already implementing the reform were significantly more likely to change their instructional practices. In recent educational studies, researchers have identified positive implementation of a reform as a reflection of access to expertise (Coburn & Russell, 2008; Frank et al., 2004; Penuel et al., 2009).

**Content of Interaction.** Coburn and Russell (2008) refer to the content of interaction as “the substance of conversations in which actors in a social network engage” (p. 207). They identify two dimensions of interactions that matter for reform implementation: congruence and depth. Prior research has found that the content of talk must be congruent with reform for it to be successful; if the talk is not congruent, teachers’ strong networks may actually impede the reform. Thus, not all social interactions are positive for professional learning or reform implementation (Coburn & Russell, 2008; Portes, 1998; Smylie & Evans, 2006).

The depth of interaction is also important to learning from others. Research has looked at the ways teachers share information about reform efforts and then disseminate the new ideas (Frank et al., 2004; Reagans & McEvily, 2003; Uzzi & Lancaster, 2003). In addition to sharing information, teachers need to learn new ideas in areas such as curriculum and teaching strategies to implement the reform (Cohen & Hill, 2001). Through their participation in the informal networks and communities of practice, individuals share information and develop common understandings (Thompson, Sykes, Skrla, 2004). Depth of interaction is an important aspect of social networks because it provides opportunities for teachers to learn through their social interactions.

To date, there is little research on how social interactions between the district and schools develop these four dimensions of social capital. My study will address how networks between schools and the district office can foster social capital and influence the implementation success of a systemic reform effort. I argue that the adoption and implementation of Algebra for All was

affected by the trust that stakeholders held for each other; implementation was influenced by social ties and one's place in the network; resources were needed to implement the reform; and teacher interactions influenced reform.

The following chapter, Chapter 2, details the research design and methodology used in this study to determine how relationships between the district office and high school sites influenced the implementation of Algebra for All. In Chapter 3, I provide data about the district, its schools and the individuals that I interviewed. Chapter 4 is devoted to findings from my study. I close with a discussion of implications in Chapter 5.



## **CHAPTER 2: RESEARCH DESIGN AND METHODOLOGY**

I used a cross case study to understand how relationships between the district office and high school sites influence the implementation of mathematics reform. My cross case study is of four school sites in a district that was implementing Algebra for All, a reform where all students are placed in an algebra class or higher when they enter high school. A case study approach is recommended by Yin (2009) when one needs to conduct “an empirical inquiry about contemporary phenomenon (e.g., “a case”), set within its real-world context – especially when the boundaries between phenomenon and context are not clearly evident” (Yin, 2009, p.5). A cross case study analysis is also important because it allows for a deeper understanding and explanation through an examination of similarities and differences across cases. Cross case studies also allows a researcher to look for themes that cut across cases. Through interviews and observations of site and district staffs, I compared how their social relationships influenced the implementation of Algebra for All at each of the school sites.

### **Why Algebra for All?**

Research has suggested that the course that a student enrolls in may influence the future classes they take, especially if the course is a prerequisite for a higher level sequence of study (Gamoran & Hannigan, 2000; Oaks, 1985). When looking specifically at mathematics education, increased access to more advanced and rigorous math classes can have a significant positive effect on student achievement. This has resulted in the research having a sharper focus on specific courses such as algebra and course sequences such as Algebra I followed by Algebra II (Bitter & O’Day, 2010; Chazan, 2008; College Board, 2000; Gamoran & Hannigan, 2000; Lleras, 2008; Spielhagen, 2011). Schools have responded to this literature by developing programs, such as Algebra for All, to provide opportunities for all students to learn and achieve core mathematic skills and be successful in the advanced math courses that they will need to matriculate to college. In Algebra for All initiatives, all students begin high school enrolled in algebra or a higher level math class in ninth grade. The reform moves algebra from being an elective to an essential course that all students must take.

Historically, algebra was thought to be a difficult subject and was only for students with special abilities (Chazan, 2008; Kilpatrick & Izsak, 2008). But this attitude has changed and mathematics is now considered no longer just for a few selected students but for all students. Some educators view algebra as the new literacy requirement, similar to what reading and writing were in the industrial age and feel that the successful completion of algebra has the greatest impact on future school and career opportunities (Moses & Cobb, 2001; Taylor, 1990). Taking Algebra can allow students education and career opportunities while not taking it may limit their options for further education. Alan Schoenfeld, at The Algebra Initiative Colloquium in 1995, described algebra as “an academic passport for passage into virtually every avenue of the job market and every street of schooling” (Schoenfeld, 1995, p.11). Research has identified algebra as a required course for students to advance to higher level mathematics and science courses (Gamoran & Hannigan, 2000). It is as Robert Moses, who headed the Algebra Project, called it, “the new civil right” (Moses & Cobb, 2001). The completion of algebra is an equity issue because it allows students to advance to higher level math and science courses and further related careers. For students to succeed in the technological world of today, they must have mathematical and science literacy (Moses & Cobb, 2001; Strong & Cobb, 2000). In fact, the College Board Equity 2000 Report (2000) found evidence that students who take algebra

advanced to college at a higher rate than those who did not. “Although the study of Algebra is a milestone and not a goalpost, it remains the most clearly identified gatekeeper to advanced study” (Spielhagen, 2011, p.80).

The identification of mathematics literacy as critical to student achievement and college matriculation has influenced school districts to enroll all students in algebra so that they will have equitable opportunities (Gamoran & Hannigan, 2000; Spielhagen, 2011). However, it has begun to be recognized that for students to be able to participate in higher level rigorous courses they must take algebra at the beginning of their high school education, if not sooner. Students who do not take Algebra until their junior or senior years do not advance at the same rate to college and actually find it very difficult to pursue a college education (College Board Equity Report 2000, 2000; Gamoran & Hannigan, 2000). Because of this research, various reports such as the National Mathematics Advisory Panel (2008) and College Board Equity 2000 Report (2000) have recommended that all students have access to algebra by grade nine at the minimum. Districts have responded to the recommendations and have adopted Algebra for All. Furthermore, Gamoran & Hannigan (2000) found that the leadership role that the district office assumes and the resources it provides to implement the policy are critically important for the reform to be implemented successfully.

I selected to study the reform Algebra for All for three reasons. First, policy makers and educators have come to recognize that algebra is a gatekeeper course for both college preparation and preparation for the world of work. Many states, including California, have made algebra a graduation requirement for all high school students. Algebra is also being used increasingly by districts as a lever to enhance academic achievement for all students and increase the likelihood that they will enroll in and complete college. My second reason for selecting the reform is that in the last few years many districts have begun to adopt the initiative of having all students that are entering high school take algebra in 9<sup>th</sup> grade so that they will have time to take additional math courses that will assist them to become college ready. The push for all students to begin 9<sup>th</sup> grade in algebra 1 or higher is usually driven by the district office and requires all schools to implement the reform. Third, as districts implement Algebra for All, teachers face the difficult challenge of teaching a rigorous course to a classroom of students who may have a wide disparity of proficiency levels in mathematics. To address this need, districts must provide resources and coordinate high quality professional development that is centered on appropriate instructional strategies and curriculum differentiation to support the success of all students in algebra.

### **Site Selection**

I used purposive sampling to select a school district and schools that are well positioned to investigate the connection between social capital and reform implementation. My criterion was to identify districts that were suburban districts and had high schools. I selected these types of districts and schools because they are not the geographic areas and levels that have been studied historically in relation to the district office’s role in systemic reform. Most studies have been of urban districts and the focus has been primarily on elementary schools (Darling-Hammond, et al., 2003; David & Shields, 2001; Elmore & Burney, 1997; Hightower, 2002; Marsh et al., 2005; McLaughlin & Talbert, 2003; Snipes, et al., 2002; Spillane, 1996; Togneri & Anderson, 2003). Even Coburn and Russell’s (2008) study of district policy and social capital, a similar area of my investigation, was conducted at elementary schools in two large urban districts. High schools have also been a neglected area of research because of their challenge to

researchers due to their departmentalization and course specific curriculum. My second set of criteria was that the Algebra for All program had to be implemented at all high schools in the district for all 9<sup>th</sup> graders. An important premise of the reform Algebra for All is that all students entering the school must be placed in an algebra class or higher (Gamoran & Hannigan, 2000). In addition, I wanted to select a district that has a memory of the adoption of the reform and the process that the district and schools went through during implementation. School personnel that had experienced the implementation needed to still be at the district office and school sites. I was concerned that if the reform has been implemented too many years ago it would be difficult to collect social capital information as it related to the mathematics reform data. Therefore, I wanted to select a district that had adopted the program within the last five years. Finally, I preferred to identify districts that had at least four high schools so that there was an increased possibility that the schools may have had different experiences with the implementation of the Algebra for All reform initiative.

I initially conducted phone interviews with 15 school districts in northern California that met my criteria. In each of these districts, I interviewed the associate superintendent of instruction or the director of curriculum. In some districts, I was referred to a site principal for additional information. Each interview lasted approximately 20 minutes and the initial critical question was if the district had an Algebra for All program that all high schools participated in and was for all incoming 9<sup>th</sup> graders. If they had such a program, then I asked how long the program had been in operation and how many high schools they had. Seven of the districts had the math program in existence for more than five years. Three of the district did not have an Algebra for All program. With the five remaining districts, I then called back to do a more in depth interviews with the individual who I had interviewed initially. In addition to meeting my selection criterion, I also needed a district that was willing to participate in my study and allow me access to personnel for interviews, observations and documentation review to complete my research. This discussion was part of my second interview.

After further phone interviews and emails, three of the districts were not feasible for research because of reasons that included unwillingness to participate in a research study for an extended length of time or the district office personnel were new to the district. The remaining two districts were viable because they had implemented Algebra for All for their 9<sup>th</sup> grade mathematics curriculum in the last three years, each district had more than two high schools and they were suburban districts. I conducted a third telephone interview with the two districts and explored in greater detail the parameters of my study. I selected one because it was interested in my research and it was willing to participate in the project. The other district was difficult to contact and seemed to be focusing on other reform initiatives at the school sites that would make it problematic for teachers and administration to devote time to my study.

The district I selected is a suburban district on the fringe of an urban district. It has four comprehensive high schools and a continuation high school that together serve approximately 5000 students. The district began implementing Algebra for All three years ago. I chose all four schools to be part of this study because three of the schools have implemented Algebra for All within the three years prior to my study and the fourth was planning to begin the implementation of the program the following year. I did not select the continuation school to be studied because it primarily serves students in grades ten through twelve. The principals at three of the schools had been at their school sites for over 13 years and the principal at another site for seven years. The superintendent and the associate superintendent of instruction had each been in the district

for over 35 years. The longevity of the administrative team in the district ensured a memory of the implementation of the reform.

## **Data Collection**

The data collection consisted of interviews and observations.

### **Interviews**

I interviewed district administration and the principal, department chair and selected mathematics teachers at the four school sites. The initial interview at the district was with the associate superintendent of instruction. It lasted approximately one hour. We discussed the mathematics program in the district and its implementation at each school. At that meeting, he suggested that I meet with three district level staff. They included himself, the district math coordinator and the superintendent. I had originally planned to interview the district's director of curriculum but the district no longer has such a position because of budget cuts. When the director of curriculum retired two years ago, the associate superintendent of instruction, who I interviewed, assumed his duties. He suggested that I interview at the school sites, at a minimum, the principal, the mathematics department chair and at least one 9<sup>th</sup> grade algebra teacher at each school.

The associate superintendent communicated with the principals and department chairs so they were expecting me to contact them. He had told them that I was working on a dissertation study and that their participation was voluntary. I initially contacted the participants by email to set up an interview. All of the principals and teachers agreed to be interviewed.

I conducted full interviews with each participant. I had separate interview protocols for district office staff, school site administrative staff, and school site teacher, which are included in Appendix A, B and C. The focus of the questions was on how social relationships between the district office and school sites have influenced the implementation of Algebra for All. The questions were also structured to determine whether the dimensions of social capital - trust, access to expertise, structure of ties and content of interactions - fostered the development of social capital between the district office and the schools. The interview included demographic questions about the interviewee's length of tenure in the district and work experience.

The interviews took place at the individual's school site, usually in their office or classroom. Each interview lasted approximately one hour. Each interviewee was asked for informed consent to participate in the study after I outlined the purpose and procedures of the study and identified the measures that I was taking to ensure confidentiality of the participating subjects. Each subject agreed to have the interview digitally recorded so that it could be transcribed.

I interviewed the principal and the mathematics department chair in each school and at least one 9<sup>th</sup> grade algebra teacher. The mathematics teachers that I interviewed were identified after being suggested by the site administration and the mathematics department chair. I also interviewed two more people because of a final question that I asked in each interview "Is there anyone else I should interview?" It was suggested at one site that I also interview the vice principal and another math teacher.

After completing each interview or observation, I reviewed my notes and the transcription to identify areas that needed follow up. I then conducted follow-up interviews by telephone or email to get clarification about a response or to ask for additional information. For

example, when I interviewed a principal, I realized that I did not fully understand whose decision it had been to implement Algebra for All at the site. This was an important aspect of the reform implementation that was identified in interviews with the teachers at the site so I needed further clarification.

The interviews were spread out over four months, February-May, 2012, and during that time I met with three district administration personnel, four principals, one vice principal, four department chairs, and four teachers at the school sites. At the district office, I interviewed the superintendent, associate superintendent of instruction and the district math coordinator. The district math coordinator is also a vice principal at a school site. Detailed descriptions of the individuals I interviewed and their school sites are in Chapter 3.

## Observations

I initially observed a district mathematics curriculum council meeting in April, 2012. This council, that met approximately every six weeks, was composed of math department chairs or a representative math teacher from each school, the district math coordinator and the associate superintendent of instruction. All of the council members were present at the two hour after school meeting. The associate superintendent facilitated the meeting and had set the agenda. There was a visiting mathematics coordinator from another district that presented her district high school mathematics program and their algebra support program. After she spoke, the council discussed textbooks for integrated math and the 9<sup>th</sup> grade mathematics placement process.

For my second observation, I attended a math teacher’s meeting in May, 2012 called “The Challenge.” The workshop topic was algebra readiness and it was coordinated by Lincoln Union High School District and its four feeder elementary school districts. It was an after school workshop at the district office that lasted two hours. Approximately 50 teachers attended the event along with district site administrators, the superintendents from each feeder middle school district, and the county superintendent of schools. About 20 teachers and administrators from Lincoln Union High School District participated in the workshop including twelve of the sixteen teachers and administrators that I interviewed. The teachers sat in mixed groups of middle school and high school teachers at round tables and discussed the following question – “What are the minimum skills and capacities students, who are proficient in algebra, need to demonstrate and understand to move to the next level?” The teachers shared the information from the small group discussions with the whole group. It was suggested that a follow up meeting be organized in the next school year.

During each observation, I followed an observation protocol, Appendix D, and took descriptive and reflective notes (Creswell, 2007). I was a non-participant in each of the observations. Table 1 presents the number and type of interviews and observations that I conducted.

Table 1

### *Interviews and Observations Conducted*

Number of Evidence events	Principals	Assistant Principals	Department Chairs/designated teachers	Algebra Teachers	District Staff	Meetings	Total
Interviews	4	1	4	4	3		16
Observations						2	2

## **Data Analysis**

All interviews were taped and transcribed verbatim and the observations were documented with descriptive and reflective notes. I began my data analysis by reading the transcripts of the interviews and my field notes from the observations (Miles & Huberman, 1994). I analyzed the information to identify emerging themes or patterns to develop codes. I then developed a hybrid coding system that included both deductive and inductive coding. I initially identified a provisional “start list” of codes prior to my fieldwork (Miles & Huberman, 1994). These were based on the work of Coburn and Russell (2008). The seven preliminary codes were access to expertise, content of interaction, depth of interaction, trust, tie span, tie strength and frequency of interaction. I expanded the initial list based on the themes and patterns that emerged which demonstrated the connection between social relationships and the implementation of Algebra for All. I then began to code using QSR Nvivo 9 software. I followed an ongoing process of continual reflection about the data, asking analytical questions and writing memos throughout the study. As themes emerged, I coded the data again to verify initial themes and to identify disconcerting evidence. I began to sub code. My sub codes went deeper into the initial themes and quantified the extent of the activity by high and low activity. The coding process was used to generate descriptions of the setting or people as well as themes or categories for analysis (Creswell, 2003).

After the coding was complete, I began a within-case analysis, analyzing how each school’s relationships with the district office influenced the implementation of Algebra for All. Miles and Huberman (1994) suggest reducing data in a systematic way that helps the researcher think about the data in relation to one’s research questions. Matrices are a visual display of two or more dimensions that allows one to further understand data and get answers to the research questions. I created a matrix in which I looked at each of the main themes by school. The information on the matrix was from the evidence that I gathered from the interviews and observations. I then cross-analyzed the data using my research questions as a reference. I used the code frequency data from the Nvivo software and the matrix to compare and contrast the major themes as I began to look for patterns across the district office and the school sites. Emerging themes resulted from the comparison of the schools and provided an opportunity to clarify and support findings.

## **Generalization, Validity and Reliability**

For some research, the purpose is to generalize from a sample to a population so that inferences can be made about some characteristic, attitude or behavior of the population (Creswell, 2003). However, the function of my study is not to identify findings that can be generalized to other reforms or districts. My goal is to contribute to emerging theory on the role of social relationships between the district office and school site personnel interactions in implementing systemic reform. The data that I generate may be used for future research on social capital (Yin, 2009).

Validity is seen as a strength of qualitative research because it is used to determine whether the findings are accurate from the viewpoint of the researcher, participant or the reader of the case study (Creswell, 2003). In this case study of social relationships as they relate to systemic reform, I used multiple sources of evidence to gather information, including, interviews, observations, district demographics and data and reviews of documents. I used the triangulation of three of the sources, interviews, observations and document artifacts to build a

coherent justification for themes. I also established a succession of evidence that built from the case study questions, to the case study protocols, to the data, to the coded data, and ultimately to the case study narrative. The evidence chain allowed me to review the conclusions drawn from the data to support evidence of a connection between social relationships and systemic reform.

External validity allows the researcher to generalize from the “what is” to the “what may be” or “what could be”. I triangulated data from three sources, interviews, observations and document artifacts, to determine if I was producing converging conclusions and thus able to ensure that the results could be used to generalize to a broader theory. I clarified my biases that I brought to the study by self-reflecting on my role as a principal and in my previous role as the director of curriculum for a district and this allowed me to write an open and honest narrative. I also explored negative or discrepant information that ran counter to my themes to ensure credibility of the narrative (Creswell, 2003; Miles & Huberman, 1994).

In qualitative studies, reliability plays a minor role. It can be used to demonstrate that there is consistent data collection, theme development and data analysis when the research is repeated (Creswell, 2003). My study has interview and observation protocols and codes that may be used by others who desire to implement similar research.

### CHAPTER 3: INTRODUCCION TO THE DISTRICT AND THE SCHOOLS

Lincoln Union High School District is a suburban district that is located in Northern California and is adjacent to a large urban district. The district is a high school district only for students in grades 9-12 and serves about 5000 students. It is ethnically diverse and 64% of the students are identified as underrepresented minorities. The student population is 26% Filipino, 28% Hispanic, 18% white, 14% Asian, 4% African American, 2% Pacific Islander and 8% other (two or more ethnicities). In addition, 10 % of the students are identified as English Language Learners (ELLs), which means that students are not proficient in English based on test scores on the California English Language Development Test and the student's academic progress. Thirty-seven percent of the district students are eligible for the National Free and Reduced Lunch Program (NFRLP) indicating that these students' families earn less than the national guidelines for poverty. Table 2 provides an overview of the district demographic data.

Table 2

*Demographics of Lincoln Union High School District 2011*

School	Jackson	Oakville	Taylor	Washington
Enrollment	1196	552	1249	1725
% Free and reduced lunch	57	30	22	38
API	672	792	800	798
% English language learners	24	0	0	10
% Race or ethnicity				
Hispanic	44	24	23	19
White	3	21	49	5
Filipino	32	26	7	38
Asian	6	15	6	26
African American	6	4	3	2
Pacific islander	3	0	2	1
Other	6	10	10	9

The 2010 California Base Academic Performance Index (API) for Lincoln Union High School District was 759. The API is a numerical index that ranges from 200 to 1000 and is calculated from the test score results of students in grades 9-11



who participated in the previous year's statewide standardized tests. California has set 800 as the API target for all schools to meet. The district had a twenty point gain in the past three years. However, one year ago the district was identified as a Program Improvement (PI) district according to the No Child Left Behind (NCLB) adequate yearly progress requirements.

In 2011, 900 9<sup>th</sup> grade students were tested on the California Standards Test (CST) Algebra 1. High school students are tested annually in the spring in the math class that they are enrolled in. The scores for a CST subject test have five levels that range from advanced to far below basic. In 2011, 69% of the 9<sup>th</sup> grade students were enrolled in algebra. The rest of the students were enrolled in geometry classes or higher. Three percent of the 9<sup>th</sup> grade students were advanced on the Algebra 1 CST, 15% proficient, 25% basic, 39% below basic, and 18 % far below basic. Of the 900 students in algebra, 82% scored less than proficient on the CST test. The district's low Algebra CST test scores and its identification as a Program Improvement district influenced the schools to adopt the mathematics reform of Algebra for All.

At the district office, I interviewed Marc, the superintendent, Ray the associate superintendent for instruction and Jason the district mathematics coordinator. Marc had been employed in the district for 39 years. He began his career as an English teacher at Oakville High School. He initially advanced from being a teacher to the vice principal at Oakville and then Washington High Schools. After being in those positions, he was appointed to be the principal of Oakville High School and then Washington High School. He was associate superintendent for one year before he was appointed superintendent, a position he has held for the last 17 years. Marc was a white male in his 60's. His extensive experience in the district had allowed him to have a broad understanding of the district and its needs and he had personal connections with many of the faculty. He will be retiring at the end of this year.

Ray, associate superintendent for instruction, had been employed for 38 years in the district. During this time, Ray had been as a teacher, vice principal, district director of pupil personnel services and associate superintendent. He was a teacher and vice principal at Jackson High School. He then moved to the district office and has been the associate superintendent for the last 4 years. He had worked extensively with the superintendent since he has been in the district office in various capacities for over 15 years. He facilitated the district math curriculum council. His longevity in the district had broadened his understanding of the district and expanded the number of colleagues he has worked with through the years. Ray was also a white male in his 60's.

Jason was the math coordinator for the district but he was also vice principal at Oakville High School. He taught math for 9 years at Oakville High School before he became an administrator 4 years ago. He is a white male in his late 30's. Jason was a strong advocate for the College Preparatory Math (CPM) alternative mathematics program that was developed through University of California at Davis and he was instrumental in introducing it to Oakville High School six years ago.

Jason had been the district math coordinator for two years. As district math coordinator, he organized the district mathematics curriculum council meetings with the associate superintendent. Marc and Ray acknowledged Jason for his math expertise and consulted with him about changes to the district math program.

## **School Sites**

### **Jackson High School**

Jackson High School is the third largest high school in the district and the most diverse. The school has 1196 students; 85% of them are identified as non-white. The major group of students is Hispanic, 44%, and 32% are Filipino, 6%, African American, 6%, Asian, 3% Pacific Islander, 3% white and 6% other. It serves 57% of the students through the National Free and Reduced Lunch program (NFRLP) and has the biggest program in the district. Jackson also ranks number one in the district for English Language Learners (ELLs). Twenty-four percent of the students are ELLs and this percentage is 14 percentage points higher than any other school in the district. The school is the closest one in the district that is located adjacent to a large urban school district.

The API for Jackson High School is 672 and they had a gain of 22 points in three years. Four years ago, Jackson was identified as a NCLB Program Improvement school in the district and it is the only designated school in the district. To address the poor performance of the school, Jackson became a Smaller Learning Community (SLC) school 3 years ago. The school had four houses and the students remained in their house for a minimum of 2 years with the same team of teachers. The SLC model affected the math program because math teachers met with their house cross-discipline teachers rather than as a team of math teachers. The school does not have a math department and as a result there was not a math department chair. In 2011, Jackson had the lowest CST Algebra 1 test scores in the district. 73% of the 9<sup>th</sup> graders were enrolled in algebra and of those students, 92% of them scored basic, below basic or far below basic on the test. Only 6% scored proficient and 2% scored advanced.

A year after adopting the SLC model, the school implemented the Algebra for All reform. The principal said that the decision to adopt the reform was made by the district office to increase student achievement at the school. As evidenced by the CST Algebra 1 scores, the school continued to struggle with mathematics achievement. Because of the large number of ELLs in Jackson High School, sheltered algebra classes are offered and professional development was provided for the sheltered math teachers through WestEd, an out of district professional development provider.

At Jackson High School, I interviewed three individuals: Kurt, the principal, Mitch, the department chair and Nathan, an algebra teacher. Kurt was in his first year as principal of Jackson High School. He had been in the district for 10 years as an administrator. He had been a vice principal at Jackson for three years and was a

principal at the continuation school before coming back to Jackson to be the principal. Kurt had previously worked with Ray, associate superintendent of instruction, when Ray was a vice principal at Jackson. Kurt was a white male in his late 30's.

Mitch was the designated math teacher who was selected to attend district meetings since the SLC model does not support department chair positions. He was the representative at the district meetings and was appointed by the principal because no other math teacher wanted to attend the meetings. Mitch previously worked at another school in the district and had only been at Jackson for two years. He taught sheltered algebra to English Language Learners and attended WestEd professional development workshops that supported instructional strategies for teaching algebra to English Language Learners. Mitch was in his late 20's and white.

Nathan was a math teacher who had been at Jackson High School for 22 years. This was the only school he had taught at and was at Jackson when it became a SLC school and adopted Algebra for All. During the year of the study, he taught algebra and represented his school at district supported professional development workshops to develop a pacing guide and common assessments for algebra. Nathan previously worked with the superintendent, and the associate superintendent of instruction was the vice principal at Jackson when he started teaching. He was also at Jackson when Kurt, the principal, was the vice principal. At that time, they coached basketball together. Nathan was in his 50's and is white.

### **Oakville High School**

Oakville High School is the smallest high school in the district with 552 students. The major groups of students are 26% Filipino, 24% Hispanic, 21% White, 15% Asian, 4% African American and 10% other. It serves 30% of the students through the National Free and Reduced Lunch program (NFRLP) and the school does not have an English Language Learner program.

The API for Oakville High School was 792 and they had a gain of 24 points in three years prior to the start of the study. They ranked third in the district for their 2011 API but were within 8 points of the highest ranking district school. Approximately, 60% of the 9<sup>th</sup> grade students are enrolled in algebra and the remaining were in geometry and above classes. In 2011, 21% of the students scored proficient or advanced on the Algebra CST, 27% scored basic, 34% below basic and 18% far below basic

In 1991, Oakville adopted the Small but Necessary School reform initiative. They closed down as a comprehensive high school and re-opened as a restructured small school. Oakville chose this reform because they believed that smaller high schools create environments that encourage effective teaching and learning by using more student-centered instructional pedagogies. As the faculty continued to reorganize the school, they adopted the CPM (College Preparatory Mathematics) curriculum. CPM is a problem solving curriculum that encourages student study teams and weaves math concepts and project based learning throughout all math

courses. Oakville is the only high school in the district that teaches CPM. Two years later, in 2008, the school adopted Algebra for All; Oakville has operated this program for the longest time in the district.

At Oakville, I interviewed the principal and two math teachers. One teacher attended the district math council meetings. The design of the school did not support department chairs so he was selected by his peers to represent them. I previously interviewed the vice principal, Jason, who had a special assignment of being the district's math coordinator.

Kathy had been the principal at Oakville for 5 years. She had been at the school since 1995. She started as a teacher and then was a vice principal for 2 years before becoming principal. She was at Oakville when it was re-structured as a small but necessary school, when it adopted CPM, and then adopted Algebra for All. She was a teacher at the school when the superintendent was a principal at Oakville. Kathy worked very closely with Jason. Kathy is white and was in her 40's.

Kevin is a math teacher who had been at Oakville for 10 years. Oakville does not have department chairs but they have "learning area representatives." Kevin was the school representative for the math area so he attended the district math curriculum council meetings with Jason. Kevin enjoyed going to the meetings but he deferred to Jason for decisions related to the math department. Kevin did not teach algebra so he suggested, as did Kathy, that I interview Ed, an algebra teacher. Kevin is Asian and was in his 30's.

Ed had been a math teacher for 11 years and taught at Oakville for 8 years. He taught algebra and formerly taught algebra A, a pre-algebra course, until the school move to only offering algebra or higher courses 4 years ago. He also began the CPM program with Jason, the vice principal. He represented Oakville at the district workshops that developed the algebra pacing guide and common assessment. Ed is a Filipino male who was in his 30's when the study was conducted.

## **Taylor High School**

Taylor High School, with 1249 students, serves a coast side community in the district. At the time of the study, it was the second largest high school in the district and had the smallest non-white population in the district: 49% of the students were white, 23% Hispanic, 7%, Filipino, 6% Asian, 3% African American, 2% Pacific Islander and 10% other. Twenty-two percent of the students are on the NFRLP Lunch program, the smallest number in the district. The school did not have an English Language Learner educational program.

In 2011, Taylor High School had an API of 800, ranking it the highest school in the district. They experienced a growth of 46 points from 2009 to 2011, the highest increase in the district over the three year period. The year of the study, Taylor had just completed its first year of adopting the Algebra for All reform and its enrollments in algebra had risen from the year before. In 2010, 58% of the 9<sup>th</sup> grade students were in algebra. In 2011, 72% of the 9<sup>th</sup> graders were enrolled and all

entering 9<sup>th</sup> grade students were not placed in any math class below algebra. The school's proficiency and advanced scores also rose from 7% in 2010 to 24% in 2011. Students in 2011 scored the following on the Algebra I CST: 6% advanced, 18% proficient, 23% basic, 31% below basic and 22% far below basic.

Taylor High School taught a traditional mathematics curriculum. The year before the study, the math department invited an individual from the Jackson County Office of Education to come on site to work with the math department for three days and analyze their mathematics curriculum. At that time, he encouraged the school and the principal to place all 9<sup>th</sup> graders in an algebra class or above. The principal had adopted Algebra for All in the previous year and began implementation during the year of this study.

I interviewed the principal, a department chair, and an algebra teacher at Taylor. Ted, the principal, had been at Taylor for 18 years. During his tenure at the school, he had been a teacher, dean and a vice principal before assuming the principal position 4 years prior to the study. He decided to eliminate pre-algebra classes last year because he felt that the school's test scores did not reflect the capabilities of the students. He was concerned about his math department because he felt that only a few teachers support innovative instruction. Ted is white and was in his mid-fifties. He had just been selected to be the new superintendent.

Helen was the department chair at the school. She had worked at the school for 8 years and taught algebra I and algebra II. Helen had been the department chair for 3 years and she was elected to the position by her peers. She is a Filipino female and was in her 30's.

Larry was an algebra teacher who had taught at Taylor for 4 years. He formerly taught in another local school and had been teaching for 29 years. Larry helped organize professional development activities at Taylor because he had previously attended professional development workshops that had been presented by a coordinator from the Jackson County Office of Education and was very positive about the content. Larry worked closely with Ted, the principal, but he did not interact with most peers in his department. He had run for the department chair position at the same time as Helen but he was not elected. Larry is a Hispanic male who was in his 50's.

## **Washington High School**

Washington High School is the largest school in the district with 1725 students. The ethnic make-up of the student body is 38% Filipino, 26% Asian, 19% Hispanic, 5% white and 2% African American, 1% Pacific Islander and 9% other. 38% of the students are served by the NFRLP program and 10% of the students are English Language Learners.

The API for Washington was 798, only two points lower than Taylor. At the time of the study, the school's API had risen twenty points over three years. A review of their 2011 Algebra I CST scores indicates that 31% of their 9<sup>th</sup> graders

scored proficient or advanced on the test and this is the highest percentage when compared to other schools in the district. The students scored 4% advanced, 27% proficient, 24% basic, 30% below basic and 15% far below basic. However, although the upper scores are strong they have fallen 5% in one year and the school's scores for below basic and far below basic have risen 5% in that same year.

The year of the study was a transitional year for Washington as they began eliminating both algebra A and B, pre-algebra courses, for all students including English Learners and moved to placing all 9<sup>th</sup> grade students into algebra or a higher level mathematics course. This was the second year of a major change for Washington because the prior year they eliminated lower level geometry A and B courses. The school taught a traditional math curriculum and they offered sheltered algebra for English Language Learners. The school was designed so that the math teachers were located throughout the school and did not teach in close proximity to each other.

I interviewed four people at Washington: the principal, vice principal, department chair, and another math teacher. The principal, Ben, had been at the school for 7 years. He was a vice principal for 4 years and then principal for three. Ben is Filipino and Chinese and was in his 40's.

John had been at Washington for 19 years and had been the department chair for 14 years. He taught the sheltered algebra course and was participating in the WestEd workshops that taught instructional strategies and curriculum for English Language Learners. John suggested that I speak with Mary, the instructional vice principal, since he felt that she had made the decision to adopt Algebra for All at Washington this year. John is a white male, who was in his 50's.

Mary was the vice-principal at Washington. For 16 years, she was a social science teacher at the school and became the instructional vice principal three years prior to the year of the study. She participated in a professional development program at the County Office of Education to obtain her administrative credential. Mary is a white female who was in her 40's.

Mary recommended that I interview Howard, another math teacher and a colleague of hers when she was in the classroom. He had been teaching math at Washington for 11 years and was teaching algebra, geometry and a support math class that year. Howard is an Asian male who was in his 30's.

Appendix E provides a complete list of the interviewees and characteristic information.

## CHAPTER 4: HOW DO RELATIONSHIPS BETWEEN THE DISTRICT OFFICE AND HIGH SCHOOL SITES INFLUENCE THE IMPLEMENTATION OF ALGEBRA FOR ALL?

In this chapter, I analyze the social interactions between the Jackson Union High School district office and its high school sites and discuss how the ties influenced the adoption and implementation of Algebra for All. Social capital theory has shown that individuals use the resources available to them through their position in a network or organization to realize the successful operation of reform efforts (Adler & Kwon, 2002). I examined the four dimensions of social networks: structure of ties, trust, content of interactions and access to resources (Adler & Kwon, 2002; Coburn & Russell, 2008). Here, I argue that while not all stakeholders agreed with the adoption of the reform, social trust enabled the majority to sign on to the reform anyway. To assist in implementing the reform, teachers and schools also drew on their social networks to access resources and expertise.

However, before discussing the findings from the research data, I delineate the four dimensions of social capital that proved important in the study: trust, social ties, content of interactions, and access to expertise. I contend that these dimensions interacted with and shaped the adoption and implementation design of Algebra for All.

- **Trust:** Trust is the confidence that people have in the reliability and integrity of individuals' competence and respect (Bryk & Schneider, 2002).
- **Social Ties:** Social ties have two dimensions: strength and span. The strength of social ties is influenced by the frequency of interactions and the closeness that individuals feel to another colleague. It can be developed through both professional and personal interactions. It is through these ties that different types of social capital resources and expertise such as curriculum, teaching strategies and technical skills, can be accessed (Penuel et al., 2009). Tie span is the extent to which network connections span institutional, organizational or social boundaries (Regeans & McEvily, 2003). It allows one to access information and expertise outside of the immediate social group.
- **Content of Interactions:** Teachers learn through their social interactions. Coburn and Russell (2008) refer to the content of interaction as "the substance of conversations in which actors in a social network engage" (p. 207). Prior research has found that if teacher talk is not congruent with the reform, then teachers with strong networks may actually impede it (Frank et al., 2004; Reagans & McEvily, 2003; Uzzi & Lancaster, 2003).
- **Access to Expertise:** Teachers and administrators need to access resources and expertise to enact curricular reforms. Resources may be both materials and human and both support reform implementation. Individuals provide resources to the networks through the expertise and abilities that they provide (Adler & Kwon, 2002; Coburn & Russell, 2008; Penuel et al., 2009). Recent research has shown that teachers who receive help from colleagues were significantly more likely to change their instructional practices. Positive implementation of a reform has also been identified as a reflection of access to expertise (Coburn & Russell, 2008; Frank et al., 2004; Penuel et al., 2009).

In what follows, I will argue that the individuals at both the district office and the school sites in my focal district showed relational trust and believed that they each would “do what is right” to adopt Algebra for All. This enabled most of them to sign on to the reform even if they had doubts. But adopting a reform only goes so far. School staff needed access to resources to implement the reform, which they accessed via social networks. These social networks, especially those between the school and the district, were rooted in social relationships and the ties that individuals had to their colleagues. Finally, I show that teacher discussions, both formal and informal, that focused on reform implementation, contributed to positive changes to classroom instruction and provided support for the implementation of the reform Algebra for All.

### **Adoption of Algebra for All**

By the time I conducted this study, Algebra for All had been in the district at two schools for three years, for another school it had been a reform for one year and for the fourth, it was being adopted in the coming year. In 2010, one school, Jackson High School, had been identified as a Program Improvement school under No Child Left Behind and then three years later the entire district was placed in Program Improvement. As a result of these actions, the district office encouraged all schools to adopt Algebra for All as a strategy for raising test scores and then being able to exit program improvement status. However, the district gave the schools autonomy to develop a program to implement the reform at their sites that met their needs. Most of the teachers and site administrators had reservations about the reform initiative and implementing Algebra for All for every student. Even the superintendent, Marc, and the associate superintendent, Ray, expressed concern. To quote Ray “Algebra for All is fraught with peril.”

All 16 teachers and administrators that I interviewed had concerns about the implementation of Algebra for All. These concerns ranged from the English proficiency of the students, to teacher collaboration, curriculum pacing, teacher preparation and to the wide variety of abilities in the classrooms. The interviewees expressed these comments:

English Proficiency - Well, to be honest with you, I have concerns about some kids, because we have kids that, they come to us in their junior year from another country, and they can barely read and write, they don't have math skills, and yet we're supposed to get them from 4<sup>th</sup> grade level through algebra in a year? Realistic? Philosophically it's great, but practically speaking... (Marc – Superintendent)

Skill Proficiency - They've [district and school] said, it doesn't matter where the student is, skill wise, they need to take algebra. And if they're not successful, then we judge the schools as being not successful. So I think, I mean, it really is insanity, and then you sit there with these heterogeneous classes, where I've got students who could go at a regular normal Algebra I pace, and then I've got students who are struggling with the most basic concepts, tripping up on all the negative, all the intricacies of just basic math skills, and as hard as you try, you can't move at a pace fast enough for those kids and a pace slow enough for these kids at the same time. (Mitch - Department Chair)

Collaboration - There's nothing in our learning area time that says maybe you guys should get together to... We don't have it set up to say, well, since you guys are teaching Algebra, maybe you guys should sit down and talk about curriculum and structure of the



class. And if it is given time, it's very brief. It needs to be throughout the whole entire year, not this brief stint at the beginning of the year. (Ed – Teacher)

In spite of these concerns, three schools had implemented the reform and the fourth was committed to doing so in the following year. Although most of these teachers and administrators were supportive of the reform, there was still apprehension by some to adopt it. For example, Howard, a math teacher at Washington, commented that teachers were complaining and concerned about the new math program for next year but that they were also talking about how to best serve their students. “Within the department it's been more just griping [about Algebra for All]. But you sort of get to a point that this is how it is. You get to a point where you just accept it and you deal with how your classrooms will be.” At this school, teachers were starting to concentrate on what changes they would need to make in their teaching strategies to support all students being placed in Algebra. Similarly, Kevin, the department chair at Oakville, stated: “I think to a certain point, when they are telling us, we're in Program Improvement, we have to do this, so why not do it sooner.” John, department chair at Washington, voiced a comparable sentiment when he said that “I fight for what I believe in. But I realize when the writing's on the wall. So is it worth me fighting for Algebra A [pre-algebra] to be retained here? At this point, I would say no.” In spite of reservations, teachers were moving forward to adopt Algebra for All.

However, three interviewees, all teachers, were decidedly not supportive of the reform and questioned if the district would support the schools to allow all students to be successful. Unlike their colleagues they did not trust the district. For example, Larry, a math teacher at Taylor, supported the concept but was concerned about the lack of support for collaboration from the district. Helen, the department chair at Taylor, was not supportive of the adoption of Algebra for All because of her concern about the need for math support classes to implement Algebra for All successfully. An algebra support class is an additional class that a student takes to receive added instruction to improve low basic math skills. She said:

“Our concern [math department] is that, if we are going in that direction [Algebra for All], we would want to have more algebra support classes. We know very well that those kids coming from 8<sup>th</sup> grade coming to us as 9<sup>th</sup> graders, there's no way that all of them are really very proficient in algebra.”

Then she told me that she asked Ray about getting more algebra support classes and he told her it was a management issue and it came from the principal. She did not expect to get more classes because as she had indicated when she talked about the principal in her interview, “we don't get enough resources to support these kids.” However, in spite of the lack of resources, Taylor and the math department were adopting the reform.

Finally, Ed, Oakville teacher, was concerned that his school would not get support from the district to continue teaching an alternative math program, CPM, at his school. He participated on the pacing guide and common assessment committees but the new products did not reflect the instructional strategies of the CPM program. He said, “I tried the [district] pacing guide at the beginning of the school year but a lot of that stuff doesn't flow with how the CPM curriculum is structured. CPM is very different.” He hoped that even though the new district curriculum guides did not follow CPM's instructional sequence that the district would still allow Oakville to continue with an alternative mathematics program.

What differed between those who supported Algebra for All in spite of their concerns and those who did not? I argue that it was the degree of trust those individuals had in their district

leaders. The word trust was used frequently by both the district and the school site personnel in their interviews. There was a widespread expectation to “do what is right” and expect others to do the same. The thirteen teachers and administrators trusted that the district would adopt the reform for the right reasons for both teachers and students even though they did not completely support the reform. For example, Kathy, principal at Oakville, said

They’ve [Marc and Ray] been wonderfully, wonderfully supportive. I think part of their role in relationship to Oakville is that they understand and support the alternative nature of our [mathematics] program and curriculum, and they understand it and support it and want it and have helped us to be successful with it.

Kevin, department chair at Oakville, was very direct and said,

I like Ray a lot. I think he’s very straightforward regarding implementing things... I think at this point I’m veteran enough to be able to comfortably voice my opinion. And I’m confident that and I definitely trust them enough that they’ll listen to it, yeah, definitely. But implementing it, I think so much is even out of their hands just because of the funding, whether things are possible in certain ways.

And, Jason, the district math coordinator discussed his relationship with Ray, Associate Superintendent. “I always feel supported by Ray. I think the relationship works pretty good because I have math experience and he has the district administrative experience, and he’s more familiar with what’s going on, with No Child Left Behind, and the policies that we’re trying to implement.”

The trust in the district was also evidenced by a new mathematics placement procedure for incoming 9<sup>th</sup> grade students that Marc, the superintendent, had facilitated with the middle schools. Up until now, each high school had a different method for math placement and there was no consistency across the schools. Under the new proposal, students were being placed based on the recommendations of their middle school math teacher. The new procedure was controversial because the high schools had to accept the placement recommendations of the middle school rather than re-testing students when they came to high school. In a district workshop, that I observed, to introduce the new protocol, fourteen of the people that I interviewed attended the workshop. These teachers and administrators represented all the schools and trusted that Marc and Ray would make revisions to the plan if problematic issues were identified. John, the department chair at Washington, confirmed this expectation when he said that he was told by Ray that if the placement was not consistent with the student’s STAR scores then the student would be re-assigned to a different math class based on the scores. This would be the teacher’s “safety net” to ensure proper placement. John trusted that his site administration and district office staff would make these changes and his comments reflected the feelings of the other district teachers.

Those that did not support Algebra for All also did not trust the district. For example, Larry, teacher at Taylor, complained about the district pacing and common assessment restructuring activities, noting how the district didn’t follow through—a key indicator of lack of trust:

They [district office] tried to implement for Algebra I what we called pacing guides. They didn’t do it, though. They intend to do it, they mention, we are going to do it, we

are going to have pacing guides and common assessments for the beginning of the school year. Didn't have it. So we were waiting.

He told me that he was not invited to be on the district pacing committee and he spoke very disparagingly of the process. "They are teaching a lot of things that are not Algebra I. They are spending two months in that pacing guide on pre-algebra. I know our students need that. But that is not Algebra I. They are not teaching the Algebra I standards." I specifically asked him if he supported the pacing guides and he said "No."

Helen's lack of support for the reform was reflected in her negative view of the support that she received from the district for professional development. "I would just get funding from the district, but it's not coming from the district saying, oh, this is the support that you need, this is the professional development that you need, then go there. It's not there; I need to find it on my own."

The third teacher, Ed, believed in Algebra for All but he had concerns about the reform in relation to continuing the math program that was taught at his school, CPM. He saw the district pacing and curriculum guides as not supporting CPM instruction. CPM uses instructional strategies that are different from traditional mathematics teaching so the guides did not follow the CPM pacing. He discussed the development of the guides by the district office as "they [district office] get pressure from the outside, and they pressure us, and there's no follow up. The appropriate thing to ask would be how did everybody do? Where is everybody at in the next six weeks? We put out this pacing guide, let's come together and see where everybody's at." He said that this "didn't happen" so there was no follow-up to discuss the inappropriateness of the district guides for CPM instruction. He acknowledged "the whole idea behind the pacing was that for students to transfer from one school to another, there wasn't this whole repetition of work for them, and that they were actually, they would be on board for whatever school they had to transfer from." But this scenario was not possible at Oakville because of the difference with CPM pacing. This was why he was concerned about the district maintaining CPM instruction at his school.

These three teachers questioned the district's support for the reform and their mistrust was mirrored in their feelings towards the district office and the resources they provided to school site staff.

### **Why School Administrators and Teachers Trusted the District**

There are at least two reasons why most school staff interviewed, appeared to trust the district on the Algebra for All reform. First, they did not blame them for the unpopular policy. They felt that the top-down district decision was ultimately driven by the state and federal governments. School staff sensed that the district had to adopt the reform because of No Child Left Behind and the fact that the district and a school were in Program Improvement. All department chairs and administrators that I interviewed for the study reported that the district was "caught in the middle" and had to make curricular changes to receive federal and state funding. For example, John, department chair from Washington, commented that he believed that state and federal policy determined district decisions and teachers have little say in making those decisions. The districts adopt reforms and "it is the job of the site to implement the policy." Another department chair, Kevin commented "I'm not sure what is out of our hands versus what is not but I always feel like OK, the decision is the decision so I have to do my part."

Second, allowing some school site autonomy in implementation served to build trust. The administrators were very glad that the district was allowing them to adopt the reform in a manner that met the needs of the students at their schools. Kathy was allowed to keep an alternative math program at Oakville, Washington could abandon the courses that did not fit their new math pathway, Jackson had adopted the program within a smaller learning community framework and Taylor could implement the reform as appropriate for their site. Each school selected their own approach to implementing the reform.

### **Trust in the Central Office**

Trust appeared to be bidirectional. Not only did most teachers and administrators trust the district leaders, district leaders appeared to trust teachers and administrators. The district administration trusted the site math teachers to enact the reform to ensure success for all students. They felt that they had the expertise and were the ones that should make the decisions as to when and how to adopt Algebra for All. This was why Marc and Ray did not believe in telling the schools what to do – they supported reform implementation that was driven by the school sites. Marc said:

See, here's, one of the philosophies of the district, and it goes back to the board, and it's been there for a long time, is that if the schools have some choice, that they are going to better carry out and have more investment in carrying out whatever that mandate is.

Ray said:

I don't like telling these guys what to do. I don't think that works. I have never been one to tell them what to do. I mean I tell them what to do because of Program Improvement. Got to do this, got to do that. But there are a lot of options and I like to let them pick their own option that fits their school best. I think telling them from the top down, I don't know that that works real well.

Marc and Ray believed that the schools would do what was needed for their learners to be successful. They trusted the schools and their abilities to adopt the reform, Algebra for All in a way that followed the guidelines of the reform but met the needs of their students.

Relational trust served to moderate concerns and uncertainty that normally accompanies reform. Thus, even though nearly everyone involved had concerns about Algebra for All, those that trusted the district were supportive of the reform. This finding supported Bryk's research that when trust is strong, change is more likely to be broadly diffused across the organization (Bryk & Schneider, 2002).

### **Implementation of Algebra for All**

It is one thing to be supportive or agree to adopt a reform. It's another to be able to implement it in a school or classroom. Here, I argue that implementation was influenced by access to resources, including expertise. I also show that the presence of incongruent talk did not prevent teachers' implementation, contrary to prior research. Finally, I discuss why teachers' networks were configured the way they were and how they affected the content of interactions.

### **Resources**

Teachers and schools drew on their networks for resources and expertise to assist in implementing the reform. Principals played a key role in accessing resources for teachers, acting as boundary spanners between the district office and their school site. Wenger (1998) and other sociocultural learning theorists define important individuals who are in supporting relationships and operate as brokers or boundary spanners. Honig (2006) used this theory in an educational context to research the role of central office administrators as boundary spanners between the school sites and the district central office. She identified their boundary spanner role with school sites as being supportive rather than regulatory and that through this role the administrators were able to develop ties to inform policy. The principals in my study used their position in the network to obtain resources to help advance Algebra for All at their school sites and to connect the schools to outside organizations that would provide new information and expertise.

Every administrator, in their interview, said that they looked to the district office for resources to support them in implementing the reform. Kurt made a comment that he felt that relationships were crucial to getting access to funds for site implementation of the reform - "I think that relationships are important in terms of getting access to money." He also said that the "district office is small and that they have an open door policy" so it was easy to talk with them about any needs and concerns he had. Kathy saw the district as providing her resources for her site to teach an alternative math program, CPM, to implement Algebra for All. Ted said he went to the district to discuss math issues with Ray and Marc when he was considering adopting Algebra for All. He was looking to them both for support and resources. Ben, Washington's principal, was the exception. He supported the reform but he was not a boundary spanner. He said that he would support the district initiatives and do what was needed to implement them. However, he deferred to Mary, his vice principal, to execute the Algebra for All reform. She was the boundary spanner and even said that she was taking the "heavy criticism and wrath" from staff about moving to Algebra for All but she said that when she calls Ray "he's behind her all the way." The site administrators saw an important aspect of their role in the reform was to broker resources from the district to support their teachers to successfully implement the reform. These resources ranged from material resources such as textbooks and computers to outside professional development programs such as WestEd and the County Office of Education to district professional development that included developing algebra pacing guides and common assessments.

The department chairs also acted as boundary spanners as well, but only if they had strong connections with the district office. John, who has been a department chair at Washington for over 15 years, had a good relationship with Ray through the district department chair meetings - "I've always had a really good working relationship with the associate superintendent of instruction [Ray]." He also felt comfortable speaking with Marc and asking for support because he has been in the district for the entire time that John had been teaching in the district. Howard, one of his math teachers, said that John was responsible for getting resources to help teachers. He commented that John would say "I agree with you and I will talk to them [administration and district office] about it and then maybe we can work something out." His comment echoed what John had told me when he said that he had just ordered document cameras for his teachers with funding from Ray. Two new department chairs, Mitch at Jackson, and Kevin at Oakville, both said the Ray would help them when they needed assistance. The department chairs had recently selected teachers to participate on the committees that were writing the district algebra curriculum, pacing guides, and common assessments. Kevin said "so the main thing that I have been relaying back to my teachers is that were supposed to come up

with a common assessment, not within a school but for all schools in the district.” He selected Ed to represent his school on the district committee. The department chairs were brokering with the district to provide curriculum resources for their algebra teachers.

By contrast, one department chair, did not know Ray very well and was uncertain about interacting with the district office. I observed her at a district department chair meeting and she did not participate in the discussions. She sat back and let other department chairs talk. Even when Ray asked how the schools wanted to implement the new algebra placement policy, she did not share her opinion. She told me later that she felt uncomfortable speaking in the meetings even though she had been a department chair for three years. Helen was the only female in the meetings. She also told me that she tended to seek advice on math from Filipino teachers that she interacted with outside of the district. Her interactions with Ray outside of the meetings were infrequent and when she did, her questions to him were very basic –“can I do this?”

Usually the department chair role not only brokers resources for their teachers but they are also a resource for expertise in their content area for their school. However, because the department chairs were elected in the schools by their peers, the department chair of math was not necessarily the person that teachers went to for help with an issue or viewed as the expert in the math department. If one did not vote for the chair, then they did not go to them for mathematics professional development. Larry, Taylor teacher, was an example of this situation. He did not vote for Helen and he had commented that she did not provide leadership. “Every teacher is on their own. And that comes from the leadership in the department. We need it.” Even Marc, superintendent, and Ray, associate superintendent, commented, as did the principals, that they did not always go to the department chairs for expertise on math reform implementation because the position was elected by peers. Marc said that he “does not always feel that they have the most expertise or understanding of the bigger picture.” That is why he sought out other math teachers and administrators to discuss mathematics education. Ted, the principal at Taylor, referred to the peer selected department chair selection process as “a beauty contest” and he did not regard his mathematics department chair, Helen, as a resource. He preferred to interact with teachers that supported his changes at the school. Mary did not even suggest that I talk with her department chair, John, even though he had been in the position for 14 years. She suggested that I interview a teacher that did not teach algebra but was a teacher that she went to discuss math ideas and who had been a friend for many years. Kurt, his principal, and Nathan, a co-math teacher, did not see Mitch as a resource for mathematics content expertise. Mitch was young, new to the school and only was placed in the position because no other veteran teacher wanted it. Ed indicated that he did not have a good relationship with Kevin, his department chair. This was an unexpected finding. Although the department chair would normally be the person that teachers and administrators would turn to for math expertise, in this district that was not true because of the selection process.

Connections to professional development resources—in and out of the district—were important for implementation. Ray organized professional development at the district level. He coordinated district committees to write a common algebra curriculum, pacing guides and common assessments. Nathan, Marc, John and Kevin said that the guides were important as they implemented Algebra for All. They provided a roadmap for teachers to follow and they helped to ensure that all students were receiving the same curriculum. Sheltered algebra teachers attended WestEd training. Ray chose WestEd to provide the training because “The professional development presentations are absolutely solid. Their things are useable. It isn’t all pie in the sky rhetoric. It’s down to earth, reasonable, useful stuff.” Both Mitch and John who attended

the WestEd training referred to the high quality of the training and the excellent resources that they received.

However, the role of the district math coordinator, a district resource, did not play an important role in implementation, according to teachers and school leaders. District administration wanted to provide the schools and staff with a district math resource person to support the implementation of Algebra for All. Jason was selected by the associate superintendent to be the math coordinator for the district. He was a vice principal at Oakville and was a former math teacher at that site. He taught CPM math and his school was the only one in the district that taught CPM for their mathematics program. Thus, teachers and administrators did not see him as a mathematics expert and actually were inclined to dismiss his math expertise because he taught CPM. Although, CPM is a highly respected math program, the rest of the district schools and staff did not view the program as providing quality mathematics instruction. All of the schools commented about him being the district math coordinator but when I probed, only one teacher, Kevin, who was from the same school as Jason, looked to him for expertise and help with math. The teachers who interacted with him from the math curriculum council, department chairs, only saw him as a person who hosted the council meetings. Most of the teachers that I interviewed said that Ray, the associate superintendent, set the agendas and facilitated the meetings. Jason was seen as a participant on the council who had no additional power or influence. Mitch, the department chair from Jackson High School said that “Jason hosts the meetings but Ray’s usually the one presiding over them.” Even Jason admitted, “Generally the agendas are built by Ray and sent down. I think technically I’m the facilitator, but a lot of the topics, especially in the last couple of years, are kind of Ray centered.” When I mentioned Jason’s name in the conversations with two teachers that I interviewed, Howard and Larry, who were not department chairs, they said that were not familiar with his role as district math coordinator. They knew him as a school site administrator. Although, Jason was the district math coordinator, his math content expertise was not leveraged by most of the staff because of his ties to CPM instruction. This district resource was not needed by the schools to implement Algebra for All.

Resources within the district were important. However, people and organizations outside the district were also sources of support for implementation and one’s position in the network influenced the need to move beyond the site to seek professional development. All department chairs and district leaders recognized the need for common curriculum and assessments, differentiated instructional strategies and resources to ensure success for all algebra students. For that reason, they sought assistance from outside sources. For example, Helen continued to attend the County Office of Education training so that she could support her teachers with new mathematics curriculum and assessments. John and Mitch attended workshops taught by WestEd to learn instructional strategies to teach Algebra to English Learners. They felt that the information and the training they received was excellent. Taylor was the only school that brought in an outside source, County Office of Education, for mathematics professional development at the school. Ted had brought them in for Algebra because he wanted his math teachers to review the math program at Taylor and he did not think that that they would initiate the discussion without being facilitated by an outside entity.

Those with greater links outside the school had stronger individual understanding of the reform. Those who interacted with the district on a consistent basis such as through the district council meetings, district sponsored professional development or attended outside workshops such as WestEd, tended to understand the need for the reform. Helen, the department chair, said

that the training was very good – “I feel refreshed with all this information. Not everything you can learn from the textbook. So they have the new strategies for which are helpful when I deal with different kinds of students.” Mitch, a teacher from Jackson and John, teacher at Washington attended the WestEd workshops. Mitch commented that “we’ve [other sheltered math teachers] been going to meetings and working on how to make interactive, engaging lesson plans that develop the vocabulary they’re going to need and uses some of the basic algebra skills.” District professional development also encouraged greater understanding of reform and the need to look at the algebra curriculum. Jason called the district professional development a “district learning area.” He said that Ray brings the CST test scores and they talk about them. “I mean I think it’s really helpful to see and talk about the scores district wide and it makes it pretty clear that there are still things that are not working.” At Oakville, the school that has implemented Algebra for All longest, Kevin said that “there wasn’t much talking about Algebra for All anymore because that’s been processed already, so recently it’s on aligning our algebra curriculum and developing a common algebra curriculum at the school and then district wide.” Through the outside organizations, the teachers that participated in the workshops garnered new knowledge that supported the reform.

However, sources of support and expertise from the district and outside resources were not always leveraged due to a lack of ties internally in the schools. People got new information and ideas, but sometimes kept it to themselves or shared it only with a small group. There was not widespread dissemination of the new strategies and learnings. John and Mitch said it was difficult to disseminate the information from the WestEd workshops on algebra and ELL because they were the only algebra teachers for English Learners at their sites. Mitch commented “there’s no organizing focus where it’s like today, all the sheltered algebra teachers are going to get together.” John stated that the instructional strategies could be used for all students and he did share them informally with a few of his fellow colleagues. When I asked him if he shared them at the department meetings he said “no” because he was the only sheltered algebra teacher. Similarly, Larry, at Taylor did not know about the results of the common assessment committee work because the department chair did not share the information with him. This was a result of the poor relationship that he had with his department chair. Ed did not have a close relationship with Kevin and felt that he did not get very much information about the district activities. This situation may be a reflection of the fact the department meetings were infrequent so there was not a formal venue to share the new ideas. Some teachers did share the information informally. For example, Nathan, at Jackson, said that it was his responsibility to share the information from the pacing and common assessment workshops with the other algebra teachers because there was not a math department at Jackson; he just spoke with the teachers individually. However, this was not widespread.

### **Content of Interactions**

Prior research suggested that congruence and depth of interactions were important for reform implementation (Coburn & Russell, 2008; Frank et al., 2004; Reagans & McEvily, 2003; Uzzi & Lancaster, 2003). However, in my study, this was not the case. At the school sites, department meeting discussions often concentrated more on why students could not succeed in algebra. Department chairs said that they carried the conversations that they had at the district council meetings on curriculum and instruction from the district to the school sites but at the school site meetings the focus of the conversations tended to be on complaining about how some students were not succeeding in algebra. John, Helen, Kevin and Mitch all said that teachers



talked negatively about the reform rather than discussing how to change instructional practice so that all students could be successful in Algebra. Even the teachers mentioned that the department meetings did not focus on reform. Howard, Washington teacher, said, “within the department, we talk about it [Algebra for All] and it’s just more griping.” Larry, Taylor teacher, commented that “I would say that out of ten meetings, maybe one or two have been talking about student performance and how they do in class. The other meetings have been to complain about why are we teaching algebra to those kids that don’t know it.”

However, the lack of reform focused discussions at the formal department meetings was mitigated by informal conversations between colleagues. These conversations often happened without pre-planning and at informal sites such as in classrooms, during lunch, in passing and at the copier. It was during these occasions that the teachers discussed instructional strategies, curriculum, and assessment and received support to enact the reform. Helen who was teaching algebra this year commented that she talks with people she feels are like her and said that “they have a lot of experience [teaching algebra] so whatever challenges they have they share with me.” She also said that as a result of talking informally with her colleagues “I would modify my curriculum, my lesson, my pacing guide.” John talked about getting together with two of his fellow algebra teachers after school got out “to develop meaningful curriculum so that we are not grabbing worksheets out of textbooks or flying by the seat of our pants!” Nathan, the math teacher from Jackson, who attended the district workshops said he shared what he learned with his fellow teachers, especially the new teachers. He shared the information when they sought him out for other help with curricular ideas and classroom management. He said, “we don’t have department chairs anymore so young teachers come and ask you if they can come and observe your class and see what you are teaching. We share ideas from the district mandated meetings and we’ve been able to come up with curricular ideas of what would be good for our kids.” Howard stated “usually it’s like, we meet each other in the faculty room and we’re just photocopying, we’re just standing around and we’re asking how things are going in the math classes.” He said that the math department can “talk to each other and share ideas.” Ed at Oakville said that algebra teachers had discussions about content such as “maybe this problem’s best for direct instruction and maybe this part’s best for group instruction” or if he was a day ahead he would share feedback on a lesson with a teacher before they taught the lesson.

Even administrators commented about informal implementation discussions. Mary, vice principal at Washington, said that in preparation for the implementation of Algebra for All this year, she was talking with the “silent majority” in the math department. “We talk about rigor, we look at data.” Thus, the informal teacher discussions that focused on instruction and curriculum for teaching Algebra for All, sustained the implementation of the initiative. These activities are supported by the research that shows that through their participation in the informal networks, individuals share information, develop common understandings and inform reform efforts (Daly & Finnigan, 2009; Thompson, Sykes, Skrla, 2004).

Finally, it became apparent that the teacher discussion had more depth in formal professional development than in workshops run by the district. There were more thoughtful content discussions in the outside vendor workshops. The nature of the professional development was more thoughtful – sheltered Algebra and curriculum and assessment in math education. Workshop facilitators had more expertise and the workshops were not single events but were of longer intensity. Mitch, teacher at Jackson commented, “[WestEd] So for example they’ll have examples, simple activities, like think pair share or something, which will

incorporate some of the basic math that you need, that's going to push you, it's like a warm up but it's more interactive, that's going to propel you into what you're going to be doing."

### **The Nature of Teachers' Social Networks**

Previously, I have shown that relations of trust influenced whether teachers and school leaders were supportive of Algebra for All and that access to resources was important for implementation. This raises the question: why do some people have relations of trust and access to resources and others do not? In other words, what accounts for the configuration of teachers' and school leaders' social networks? I argue that there are four explanations: 1) prior personal and professional relationships; 2) similar educational values; 3) proximity and homophily (the principal that people are more likely to make contact with others that are similar to them (Coburn, Mata, & Choi, 2013); and 4) perceptions of expertise.

First, trust appears to be the result of long personal and professional histories that many in the district had with the superintendent and assistant superintendent. The superintendent and associate superintendent had been in the district for 39 and 38 years each. Only three of the 16 individuals that I interviewed had been in the district less than 8 years. In fact, the majority of the persons that I spoke with had been in the district over 18 years. Most everyone had interacted with one another in the district at one time because of their extensive tenure in the district. Nathan, at Jackson, talked with a fellow teacher who he had known for a long time – 'we started here at the same time, I've seen his mother pass away, he's seen the birth of my three kids, it's like having another family member in your school.'" Ed mentioned that spoke he with Jason because they had started at Oakville together and were the initiators of the CPM program – "so for the first year it was just me and Jason." Kurt, the principal at Jackson, said he talked with two math teachers that he knew from before when he was a vice principal at Jackson because he felt that as a first year principal he needed to go to people he could trust. "I knew Mr. B and Mr. P. because they were here when I was previously here as a VP. And that's part of the reason that I went to them." Marc and Ray frequently talked because they have known each other for 38 years. Marc said "I value his [Ray's] opinions and Ray said "Marc and I started together. We've never worked in any other district – 38 years. I can talk to him."

Second, people went to others who they saw as having similar values regarding educational philosophy and mathematics education. For example, Larry, at Taylor, said he spoke with a fellow math teacher because he had the same philosophy about math as Larry and both were addressing health issues. Because of these connections, they shared resources and developed common assessments. He did not do this with other teachers in the department and in fact commented that the other teachers were lazy and they didn't want to change their instructional strategies to support Algebra for All. John, at Washington, said that he talked to fellow colleagues who had the same beliefs that he did. Mary, at Washington, talked with teachers that were supporting her move to the new reform and were teachers that she knew "would stand behind her." Ted, Taylor's principal, talked with Larry, a math teacher, because he has supported him in adopting Algebra for All and "we both share the same values."

Third, proximity and homophily mattered for teachers. Teachers were influenced most by fellow teachers who had classrooms located in close proximity to them, by teachers who taught what they did and were like them (homophily). Each of the teachers that I interviewed when asked who they went to for support for implementing Algebra for All identified math teachers in their department. Usually, these teachers were in adjacent or nearby classrooms. Larry commented that he spoke with a teacher whose "room is just a couple of feet from here. I talk to

him a lot. We're collaborating for algebra, sharing tests, curriculum and other things." Helen spoke with teachers who were her age, taught the same subject level, and were usually Filipina (homophily).

Finally, some people went to others that they saw as being experts. This was especially true for school administrators. For example, Ben, the principal at Washington, went to John, his math department chair, or Mary, his vice principal, when he needed to get information about math because they had the expertise and they were "out there" in the school so they understood what was needed. Kathy, the principal at Oakville, talked with Jason, her vice principal, because of his expertise as a previous math teacher. She stated that "I do not make any changes related to math without talking to Jason about it." Ray and Marc also indicated that they identified teachers in the district to talk with about the Algebra for All reform based on respect, subject matter expertise and previous relationships.

### **Summary of Findings**

This study found that the social networks between the district office and the school sites influenced the adoption and implementation of Algebra for All. I used the dimensions of social capital – trust, social ties, content and depth of interaction and access to expertise – and social network theory to frame the discussion of my findings.

People in the schools had apprehensions about adopting the reform Algebra for All. They were concerned about the student's English proficiency, their skill levels, and the lack of collaboration time to prepare for implementing the reform. However, in spite of these concerns most of the individuals supported the reform. The reason that they supported the reform was because they trusted the district. Trust was enabled because teachers and administrators did not blame the district for adopting the reform. Trust was further enabled because the district granted schools some autonomy to implement the reform. In addition, the trust was bidirectional. District staff trusted the schools to enact the reform to support success for all students. Relational trust was important in generating agreement that Algebra for All needed to happen in the schools. It moderated concerns and uncertainty that was accompanying the reform and encouraged change across the district.

As they did in adoption, teachers and schools drew on the assets of social capital and their networks for resources and expertise to assist in implementing Algebra for All. Principals played a key role and acted as boundary spanners to broker resources for their schools. Department chairs also operated as brokers as well. However, department chairs were not looked to for math expertise at the sites because of their selection process. The district coordinated resources for the schools but the district math coordinator was not viewed as a source of mathematics expertise for the school sites.

People and organizations outside of the district were also sources of support. However, those individuals that had greater links outside the school site had a stronger individual understanding of the reform., These sources of support and expertise from the district and outside resources were not always leveraged due to a lack of ties internally in the school. People attended the outside trainings but often did not share the new information with fellow teachers at their schools. Their reasons for not disseminating the information included the fact that they were the only sheltered math teacher, poor relationships with their department chairs, and infrequent venues to share the information.

The teachers did not have congruent and deep discussions about the reform effort but this did not impede implementation. Conversations that focused on reform implementation were

infrequent in site department meetings. However, when colleagues met informally their exchanges targeted algebra syllabus and instructional methods. Through their interactions in the informal networks, teachers were able to share curriculum and develop common strategies for implementing Algebra for All.

The nature of teacher networks influenced the implementation of the reform. Teacher's networks were influenced by longevity of personal and professional ties within the district. Teachers sought out colleagues who had similar values and educational philosophies. They were also influenced by other teachers who taught in close proximity, taught the same subject or were like them. Finally, teacher and especially administrators sought out teachers in the networks for expertise.

Trust influenced the adoption of Algebra for All and social interactions between the district office and the school sites influenced the implementation and sustainability of Algebra for All. The nature of social networks and the dimensions of trust, social ties, teacher interactions and access to expertise, fostered the development of social capital among the schools and the district office. Chapter 5 will outline the important implications of these findings.

## Chapter 5: Implications of Findings

The purpose of this study was to examine how relations between the district office and school sites influenced the implementation of a reform. I chose the reform Algebra for All because of its importance as a gate keeper course to post-secondary education. It was also a reform that districts were implementing to increase student achievement. In my study, I showed how the four dimensions of social networks, structure of ties, trust, teacher interactions and access to resources were used to carry out a reform initiative. My findings showed:

- (1) the individuals at both the district office and the school sites showed relational trust and believed that they each would “do what is right” to adopt Algebra for All even if they had doubts;
- (2) resources and expertise were needed to implement the reform and principals and department chairs acted as brokers;
- (3) informal networks at the school sites supported implementation of Algebra for All; and
- (4) the nature of teachers’ social networks that supported the reform were defined by prior personal and professional relationships, similar educational values, proximity and homophily and perceptions of expertise.

### Limitations

There are several limitations to this study case study. This was an exploratory case that analyzed the role of social networks in implementing reform. However, a major limitation is that it is a case study of only one district so it is difficult to generalize findings. It is necessary to determine if these findings occur in additional district contexts with larger district offices and more schools. If more districts were added to the study, it would have allowed me to gather added information about how social networks between the district office and schools sites influenced mathematics reform. An even larger study could have been conducted if urban and rural districts throughout California had been part of the sampling. Moreover, this is a small district with four schools so it is difficult to make strong claims about the data. I acknowledge the need for a large scale empirical study that could substantiate findings in larger and more diverse districts.

The timing of this study was from January through June of one school year. If I had lengthened the study to at least a full school year, I could have conducted interviews with more teachers and observed additional district mathematics curriculum council meetings. I would have been able to interview the participants at the beginning of the year and at the end to allow for a greater understanding of how social relationships influence systemic reform over a longer period of time and throughout a school year. I also only interviewed a limited number of individuals and by doing so I may have under-represented the social connections between the district office and the school sites. More interviews and observations would have provided a broader study of the part social capital plays in implementing new initiatives in districts.

Each school in the district had a different culture, staff, and students and this impacted how individuals viewed the implementation of the reform. This study attempted to select the same job profession at each school site to interview; however, because the conditions that they worked under were different, the findings cannot be generalized to all other individuals in similar positions.

Finally, I was not able to observe classrooms so I did not have evidence of actual implementation of Algebra for All. I could only discuss whether the school staffs were implementing the reform or not based on interviews. I could not verify their comments with classroom observations nor could I confirm the quality of implementation. An extended study would have allowed me to include classroom observations in my data and validate reform implementation.

### **Implications for Research**

The federal accountability programs including No Child Left Behind initiative have pressured districts to show annual student achievement. To meet the mandates, schools are selecting initiatives such as Algebra for All to support all students to learn at high levels. Current research has shown that social networks encourage reform implementation (Coburn & Russell, 2008; Daly and Finnigan, 2009; Penuel et al., 2009). Therefore to meet the state and federal policies, district offices and schools may need to develop collaborative relationships that support district wide change and innovation.

This study contributes to recent literature by examining how social interactions in a district supported reform implementation. To study reforms, most of the existing research has focused on large urban districts and primarily elementary schools (Elmore & Burney, 1997; Hightower, 2002; Snipes et al., 2002; Togneri & Anderson, 2003). My study expanded the evidence on reform implementation because my case district was a suburban district and was composed of four high schools. I found that while some processes identified in urban districts were also present in a suburban one (e.g. the importance of access to expertise), others were not (e.g. importance of congruence of talk). My study also identified an important phenomenon that may not be present in urban districts, given the extensive personnel turnover: the intensity and importance of prior personal and professional relations. In this study, many teachers, school leaders, and district leaders had extensive histories with one another. They had known each other sometimes a decade or more. They had worked for and with one another in other capacities. These prior relationships built a high level of trust—so high, in fact, that people were willing to trust each other enough to move forward with a reform about which they had grave concerns. Future research should investigate whether trust operates in this way in other smaller districts with similar longstanding relationships.

Although previous research has identified congruence and depth of interactions as important dimensions for reform implementation, they were not factors in my study (Coburn & Russell, 2008; Frank et al., 2004; Reagans & McEvily, 2003; Uzzi & Lancaster, 2003). The conversations about reform occurred during informal interactions and were with people that the individuals had positive relationships. The trust in these interactions appeared to moderate the lack of congruence and depth and allow them to move forward with implementation in spite of concerns about the reform. This finding adds to further research by raising the questions about when and under what conditions is congruent talk a factor and when it is not. The teachers in my study did not have congruent conversations in their department meetings and in fact they talked negatively about the reform. But yet when they met informally at lunch, at the copier, or in each other's classrooms with people they trusted, the talk turned to discussions about curriculum and instructional strategies for implementing Algebra for All. Further research on reforms could focus specifically on examining when and under what settings congruent talk influences reform implementation. A longitudinal study would also be helpful to determine if the talk becomes more congruent with time and if it moves from informal places to more formal settings such as

department meetings. It further raises the question of do teachers need time and a setting to vent frustrations about new reforms at the same time that they are moving forward to implement the reform.

My study found that the nature of teachers' social networks was influenced by similar values and proximity and homophily. Bidwell and Yasumoto's (1997) research found that teachers tend to interact with just a few fellow teachers and turn to teachers for assistance who share common beliefs about teaching. Coburn's (2013) recent research on social networks found that teachers interact with those individuals who are close by or similar to them. My study supported the findings from both of these research studies. A question that emerges is if these factors change over time. Comparable educational values are a strong dimension of why teachers seek out others and that factor may not be influenced by time. However, proximity and homophily may be aspects that change. Further longitudinal research would allow one to study social networks to determine if over time teachers move away from the only seeking out teachers who are close by them or similar to them for support and expertise and use other factors to find the assistance they need for reform implementation.

Reform literature frequently mentions access to resources as needed for successful implementation (Coburn & Russell, 2008; Massell, 2000; Penuel, et. al., 2009; Snipes, et. al., 2002). My study also supported this common general finding. But when one examined the findings data in this study, it became apparent that there was a resource area, district and site personnel expertise, that did not matter for implementation. Although, the district mathematics' coordinator was selected by superintendent and associate superintendent to provide resources and expertise to the site math teachers, he was not perceived by them to be an expert. At the sites, the department chairs were also not the school's resource for math expertise. A further study by Small (2009) researched how organizations access resources and found that the individual availability of resources is dependent on what the organization provides. In my study, the district office as the organization, provided resource expertise both across the district and at the sites but the people were not utilized by the math teachers. They found alternate ways to access expertise to implement the reform. Further analysis found that the teachers did not access the district provided expertise because they did not trust the people who were in the skilled positions. It raises a question - Is trust in the expert required before accessing skilled support that is provided by an organization? Additional research should look at this connection between trust and access to expert resources.

Most research studies on social capital have measured only one dimension. For example Bryk and Schneider, 2002, looked at trust; Frank et.al, 2004, studied teacher expertise; and Reagans and McEvily, 2003 researched tie structure. My study contributes to prior studies that examined multiple measures of social capital (Adler & Kwon, 2002; Coburn & Russell, 2008). Four dimensions of social capital - trust, social, access to expertise and resources and congruence and depth of interactions - were examined in my focal district. However, I only found trust, access to expertise and resources and social ties mattered for reform implementation. Although, congruence and depth of interactions were not supported by my findings, the nature of teachers' social networks affected content interactions. Therefore, future research may want to attend to this additional finding and expand research on content of interactions.

Teachers in high schools are usually part of a subject area department or program division. In my study, I looked them as all part of the math department. However, when looking at social network theory, it is possible to see that teacher networks can span multiple sub groups. Their networks can include individuals both in the school and outside the school and across

disciplines. In addition, these networks are dynamic and changing (Daly et al, 2010). This suggests that if a teacher's network is dynamic then so is their access to resources and expertise. Therefore, since networks can change, research is needed to understand how the dynamics of network structures impact network dimensions and in turn influence reform implementation. Longer longitudinal studies are needed to contribute research to the changing aspects of social network theory.

### **Implications for Practice**

The focus of this study was not to create a list of recommendations for programs or best practices for reform implementation. The implications for practice are issues that districts and schools may wish to consider if they use social capital to support reform adoption and implementation. It is the district leaders that will determine if the findings are useful and relevant. I offer five areas based on the findings of this study that districts may want to consider in the context of reform initiatives.

A very important finding from this research was that relational trust supported adoption and implementation of the reform even in the face of concerns about the reform. There was bidirectional trust by the school sites and the district that each would do what was necessary to enact the reform and develop an instructional program that supported achievement for all students. This finding supported Bryk's (2002) research that when trust is strong, change is more likely to be broadly diffused across the organization. However, my findings found two other aspects of trust that affected reform implementation. The first was that school sites supported reforms if they were given the autonomy to implement the reform in ways that supported the needs of the school's students. The second was that trust in the district office decreased if they did not follow through on their commitments. District office and school sites need to trust each other and "do what is right" to implement reforms but they also need to understand that giving schools autonomy increases trust and lack of follow through decreases it.

Another aspect of trust that leaders need to consider is the process of team building. Organizational change literature suggests that it is better to involve employees in the process of change. This helps build trust in the process and commitment. If trust is such an important part of reform implementation and change, then districts need consider how to build it within their schools. Educators may want to study their planning process for reform implementation and identify ways for teachers to be involved as they build trust and commitment to the new initiative.

This study contributes to practice by finding that principals and department chairs act as boundary spanners to broker resources and expertise with the district office. My study supported Honig's (2006) research of examining the boundary spanner role that allowed administrators to develop ties to inform policy. The principals in my study used their position in the network to obtain resources to help advance Algebra for All at their school sites and to connect the schools to outside organizations that would provide new information and expertise. However, an area of concern in my study was that teachers who attended outside professional development did not leverage those resources to other teachers in their schools. The new learning often stayed with the teacher who attended the professional development or with a small group of the teacher's colleagues. In practice, it is important that principals not only broker resources but find ways to develop ties within the school setting that allows for the dissemination of the outside resources.

My study contributed to other research that has found social capital to be important in implementing reforms (Coburn & Russell, 2008; Daly & Finnigan, 2009; Pennul et.al., 2009).



With the recent state and federal adoption of Common Core Standards for instruction, districts will be implementing new initiatives to support the standards. Therefore, districts and school sites should consider developing social capital and supporting teacher social networks to support the reform adoption. Developing social capital may represent a potentially powerful approach to systemic improvement that may be more effective in increasing student learning than changes in structure or policy approaches to reform. The results of this study may help educators build a new conception of how districts and schools can work together and communicate with each other to implement a reform effort successfully.

The nature of teachers' social networks impacted reform implementation in my focal district and it was informal networks that allowed teachers to adopt new learning and instructional strategies. This finding contributed to the recent research by Daly and Finnigan (2009) that informal social relations support reform efforts. This study identified four aspects of networks were important 1) prior personal and professional relationships; 2) similar educational values; 3) proximity and homophily; and 4) perceptions of expertise. In practice, principals should understand the aspects of teacher social networks that are operating in their own school so that they can understand their influence on reform implementation in the school. There is also a possibility though, that the aspects may not support reform. School administrators will then need to look at how they can decrease the capacity of the dimensions. In general, principals should be more attuned to the informal social networks operating in their school and their impact on school instruction.

Finally, it is often easier to adopt a reform than to implement it. My study showed that one of the reasons the district and schools adopted Algebra for All was in response to being identified as a low performing district by federal and state mandates. The district and schools felt they had to adopt the reform if they were to exit Program Improvement status. However, implementation is much more difficult to enact than adoption. It takes more time and effort to put the reform into action. In my focal district, it took four years for all schools to implement Algebra for All. School administration should consider building capacity for new reform implementation and look to the role of social networks and the development of social capital to address the difficult task.

### **Areas of Future Research**

This study supported other research that shows that social networks can influence reform significantly and that social capital is important to adoption and implementation of reform efforts. Further research could examine in greater detail the roles that individuals in both the district office and school sites play in developing social networks and increasing social capital.

Another aspect of network theory, that has the potential for further study, is to look at how district offices and school sites can use social network theory to build communication bridges that transfer knowledge and resources to foster reform implementation.

New research has begun to look at if a district can maintain sustainability of a reform if a resource support is removed (Coburn, et.al., 2013). In today's world of unstable funding and the introduction of Common Core Standards this may become an issue. However, the new research is suggesting that although resources may change, teacher social networks may be one way to maintain sustainability. This is an important area for future research.

All districts are challenged to improve student achievement and instructional practice. Therefore, studying the role of social networks and social capital is important in understanding

how to successfully implement reform initiatives and provide programs that allow all students to be successful.

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## **Appendix A: District Office Staff Interview Protocol**

Time of Interview:

Date:

Place:

Interviewer:

Interviewee:

Position of Interviewee:

Preliminary Coding:

AE – access to expertise

TP – tie span

CI – content of interaction

TS – tie strength

DI – depth of interaction

FI – frequency of interaction

TR – trust

Give a brief overview of the study and ask for permission to record.

Questions:

1. What services and support have you provided to schools to encourage the implementation of “Algebra for All”?

Probe:

- district workshops;
- on-site professional development;
- study groups;
- coaching;
- conversations with colleagues



2. What specific services have you given to School A? School B?
  
3. How often have you visited School A (School B) to assist in the implementation of Algebra for All?" What did you do at the school each time? Who did you talk to/work with each time?
  
4. Did you go to anyone for advice, with a question or concern, or just to talk something through about *Algebra for All*? If so, who have you gone to? Who else have you gone to? Anyone else inside or outside of the district? Was there anyone that you spoke with in School A or school B?

For each person mentioned, ask the following set of questions (go through complete set of questions for each person mentioned in turn):

- a. [if not mentioned] What role does that person play? [are they a teacher or administrator? What subject/area? Something else?]
  - b. How frequently have you talked with this person about mathematics?
  - c. What kinds of things did you talk about?  
 probe:
    - particular teaching challenges;
    - problems with specific students;
    - professional development activities;
    - implementation challenges;
    - strategizing about using the curriculum; sharing materials and instructional approaches;
    - creating materials and instructional approaches
    - coordinating instruction with one another
  - d. What advice, information did they offer? Can you give me an example? [to get at content of conversation]
  - e. How did this advice/conversation/talking with this person influence the way that the reform Algebra for All was implemented? Can you give me an example?
- 
5. Why do you go to some people and not others to talk about mathematics instruction?  
 Probe:
    - trust,
    - personal relationship/closeness,
    - attributions of expertise,
    - authority relations (I was required to go to her),
    - anticipation of exchange relationship (I help her so she'll help me)]
    - similar challenges I do (same kids, grade, etc.)

6. What structured opportunities, if any, has the district organized for teachers to meet to talk about the implementation of “Algebra for All?” [probe: whole school meetings, subject level, committees leadership teams, district meetings]
  - Who organized the meetings? [probe: district office personnel? School site personnel?]
  - Who worked together in the meetings? [probe: just school site or district office staff too]
  - When and how often do you meet?
  - What did you do in the meetings? Who facilitated the meetings? Who decided the objectives and outcomes for the meetings?
  - What was the nature of the tasks in the meetings?
  - Who determined if additional meetings/professional development were needed? What was this decision based on?
7. If you needed to make sure that a certain program or activity was implemented to ensure the successful implementation of “Algebra for All,” who would you go to in the district office to make this happen? Have you worked with them before? Why would you go to them? [Probe: trust, expertise, tie strength, placement in the school’s social network, access to outside expertise]
8. If you needed to make sure that a certain program or activity was implemented to ensure the successful implementation of “Algebra for All,” who would you go to at the school site to make this happen? Have you worked with them before? Why would you go to them? [Probe: trust, expertise, tie strength, placement in the school’s social network, access to outside expertise]
9. What do you think was the district objective for implementing “Algebra for All?”
10. Have you gone to anyone outside of the school or district for help [ex. another district teacher, community college staff, or educational foundation]? Why would you go to them? [Probe: trust, expertise, tie strength, placement in the school’s social network, access to outside expertise]
11. Is there anyone else that you think I should be talking to about the implementation of Algebra for All at this school or in the district office? If so, why should I talk with that person(s)?

**Demographics:**

How long have you worked for the district?

What is your position? How long have you been in this position? What other positions have you held?

(Thank the person for participating in this interview. Assure him or her of confidentiality of responses and potential future interviews.)

**Appendix B: School Site Administrative Staff Interview Protocol**

Time of Interview:

Date:

Place:

Interviewer:

Interviewee:

Position of Interviewee:

Preliminary Coding:

AE – access to expertise

TP – tie span

CI – content of interaction

TS – tie strength

DI – depth of interaction

FI – frequency of interaction

TR – trust

Give a brief overview of the study and ask for permission to record.

Questions:

12. What services and support have you provided to your staff to encourage the implementation of “Algebra for All”?

Probe:

- on-site professional development;
- study groups;
- coaching;
- conversations with colleagues

13. What specific services has the district provided to your school to help you implement “Algebra for All”? What has their role been in the implementation process?
  
14. Did you go to anyone for advice, with a question or concern, or just to talk something through about *Algebra for All*? If so, who have you gone to? Who else have you gone to? Did you seek help from anyone in the district office?

For each person mentioned, ask the following set of questions (go through complete set of questions for each person mentioned in turn):

- f. [if not mentioned] What role does that person play? [are they a teacher or administrator? What subject/area? Something else?]
  - g. How frequently have you talked with this person about mathematics?
  - h. What kinds of things did you talk about?
    - probe:
      - particular teaching challenges;
      - problems with specific students;
      - professional development activities;
      - implementation challenges;
      - strategizing about using the curriculum; sharing materials and instructional approaches;
      - creating materials and instructional approaches
      - coordinating instruction with one another
  - i. What advice, information did they offer? Can you give me an example? [to get at content of conversation]
  - j. How did this advice/conversation/talking with this person influence the way that the reform Algebra for All was implemented? Can you give me an example?
- 
15. Did knowing someone personally at the district office make a difference in getting help to implement “Algebra for All”? What or why not? Can you give an example? [to get at how social capital was used]

16. Why do you go to some people and not others to talk about mathematics instruction?

Probe:

- trust,
- personal relationship/closeness,
- attributions of expertise,
- authority relations (I was required to go to her),
- anticipation of exchange relationship (I help her so she’ll help me)]
- similar challenges I do (same kids, grade, etc.)

17. What structured opportunities, if any, has the district organized for teachers to meet to talk about the implementation of “Algebra for All?” [probe: whole school meetings, subject level, committees leadership teams, district meetings]
- Who organized the meetings? [probe: district office personnel? School site personnel?]
  - Who worked together in the meetings? [probe: just school site or district office staff too]
  - When and how often do you meet?
  - What did you do in the meetings? Who facilitated the meetings? Who decided the objectives and outcomes for the meetings?
  - What was the nature of the tasks in the meetings?
  - Who determined if additional meetings/professional development were needed? What was this decision based on?
18. If you needed to make sure that a certain program or activity was implemented to ensure the successful implementation of “Algebra for All,” who would you go to at your school site to make this happen? Have you worked with them before? Why would you go to them? [Probe: trust, expertise, tie strength, placement in the school’s social network, access to outside expertise]
19. Who would you go to at the district office to get help in implementing reform initiatives? Have you worked with them before? Why would you go to them? [Probe: trust, expertise, tie strength, placement in the school’s social network, access to outside expertise]
20. What do you think was the district objective for implementing “Algebra for All?”
21. Have you gone to anyone outside of the school or district for help [ex. another district teacher, community college staff, or educational foundation]? Why would you go to them? [Probe: trust, expertise, tie strength, placement in the school’s social network, access to outside expertise]
22. Is there anyone else that you think I should be talking to about the implementation of Algebra for All at this school or in the district office? If so, why should I talk with that person(s)?

**Demographics:**

How long have you worked for the district? At this school?

What is your position? How long have you been in this position? What other positions have you held?

(Thank the person for participating in this interview. Assure him or her of confidentiality of responses and potential future interviews.)

## Appendix C: School Site Teacher Interview Protocol

Time of Interview:

Date:

Place:

Interviewer:

Interviewee:

Position of Interviewee:

Preliminary Coding:

AE – access to expertise

TP – tie span

CI – content of interaction

TS – tie strength

DI – depth of interaction

FI – frequency of interaction

TR – trust

Give a brief overview of the study and ask for permission to record.

Questions:

23. What services and support has been provided to you provided to you by the school to encourage the implementation of “Algebra for All”?

Probe:

- on-site professional development;
- study groups;
- coaching;
- conversations with colleagues



24. What specific services has the district provided to your school to help you implement “Algebra for All”? What has their role been in the implementation process?
25. Did you go to anyone for advice, with a question or concern, or just to talk something through about *Algebra for All*? If so, who have you gone to? Who else have you gone to? Did you seek help from anyone in the district office?

For each person mentioned, ask the following set of questions (go through complete set of questions for each person mentioned in turn):

- k. [if not mentioned] What role does that person play? [are they a teacher or administrator? What subject/area? Something else?]
- l. How **frequently** have you talked with this person about mathematics?
- m. What kinds of things did you talk about?  
 probe:
- particular teaching challenges;
  - problems with specific students;
  - professional development activities;
  - implementation challenges;
  - strategizing about using the curriculum; sharing materials and instructional approaches;
  - creating materials and instructional approaches
  - coordinating instruction with one another
- n. What advice, information did they offer? Can you give me an example? [to get at content of conversation]
- o. How did this advice/conversation/talking with this person influence the way that the reform Algebra for All was implemented? Can you give me an example?
26. Did knowing someone personally at the district office make a difference in getting help to implement “Algebra for All?” What or why not? Can you give an example? [to get at how social capital was used]

27. Why do you go to some people and not others to talk about mathematics instruction?

Probe:

- trust,
- personal relationship/closeness,
- attributions of expertise,
- authority relations (I was required to go to her),
- anticipation of exchange relationship (I help her so she’ll help me)]
- similar challenges I do (same kids, grade, etc.)

28. What structured opportunities, if any, has the district organized for teachers to meet to talk about the implementation of “Algebra for All?” [probe: whole school meetings, subject level, committees leadership teams, district meetings]
- Who organized the meetings? [probe: district office personnel? School site personnel?]
  - Who worked together in the meetings? [probe: just school site or district office staff too]
  - When and how often do you meet?
  - What did you do in the meetings? Who facilitated the meetings? Who decided the objectives and outcomes for the meetings?
  - What was the nature of the tasks in the meetings?
  - Who determined if additional meetings/professional development were needed? What was this decision based on?
29. If you needed to make sure that a certain program or activity was implemented to ensure the successful implementation of “Algebra for All,” who would you go to at your school site to make this happen? Have you worked with them before? Why would you go to them? [Probe: trust, expertise, tie strength, placement in the school’s social network, access to outside expertise]
30. Who would you go to at the district office to get help in implementing reform initiatives? Have you worked with them before? Why would you go to them? [Probe: trust, expertise, tie strength, placement in the school’s social network, access to outside expertise]
31. What do you think was the district objective for implementing “Algebra for All?”
32. Have you gone to anyone outside of the school or district for help [ex. another district teacher, community college staff, or educational foundation]? Why would you go to them? [Probe: trust, expertise, tie strength, placement in the school’s social network, access to outside expertise]
33. Is there anyone else that you think I should be talking to about the implementation of Algebra for All at this school or in the district office? If so, why should I talk with that person(s)?

**Demographics:**

How long have you worked for the district? At this school?

What is your position? How long have you been in this position? What other positions have you held?

(Thank the person for participating in this interview. Assure him or her of confidentiality of responses and potential future interviews.)

**Appendix D: Observation Protocol**

Time of Interview Observation:

Date:

Place:

Observer:

Observees:

Position(s) of Observees: (Sketch of observation area)

Length of Activity: _____	
Descriptive Notes	Reflective Notes

### Appendix E: Demographics of Interviewees

Name	School	# years in district	Position	Comments
Jason	Oakville HS and District	13 – taught math for 9 years at Oakville	Vice principal	District Math Coordinator
Ray	District Office	38	Associate Superintendent, Instruction	Previous district positions include VP at Jackson HS; Director of People Personnel Services and Director of Special Education
Marc	District Office	39	Superintendent	Previous district positions include teacher at Oakville HS, VP at Oakville HS and Westmoor HS; Principal at Oakville HS and Washington HS; Associate Superintendent Instruction
Ed	Oakville HS	8	Math teacher	Previously taught 3 years in another district
Kurt	Jackson HS	13	Principal	Previous district positions include the principal at Continuation School, VP at Jackson HS
Larry	Taylor HS	3	Math teacher	Previously taught math for 17 years in other schools; recommended to interview by Ted
Mary	Washington HS	19	Vice principal Instruction	Previously was a teacher at Washington HS for 16 yrs.
Ted	Taylor HS	18	Principal	Previously was a

				teacher, Dean, and VP at Taylor HS
Howard	Washington HS	11	Math Teacher	Recommended by Mary to interview
Helen	Taylor HS	8	Math teacher	Department Head
Nathan	Jackson HS	22	Math Teacher	Has worked with Kurt, Ray and Marc
Kathy	Oakville HS	18	Principal	Formerly a teacher and VP at Oakville HS
Ben	Washington HS	7	Principal	Formerly a VP at Washington HS
Mitch	Jackson HS	4	Math teacher	Formerly taught at Westmoor HS; Attends District math curriculum meetings to represent Jackson HS
John	Washington HS	19	Math Teacher	Department Head for 14 years
Kevin	Oakville HS	10	Math Teacher	Represents Oakville HS at District math curriculum meetings