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USING SOCIAL NETWORK ANALYSIS TO INVESTIGATE THE RELATIONSHIP
BETWEEN SCHOOL-BASED TEAM COMMUNICATION NETWORKS AND
IMPLEMENTATION OF POSITIVE BEHAVIOR SUPPORT SYSTEMS

A Dissertation Presented

By

SHANNON K. BARRY

Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree of

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College of Education

USING SOCIAL NETWORK ANALYSIS TO INVESTIGATE THE RELATIONSHIP
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DEDICATION

To my loving parents, Jane and Richard, who have shown me the importance of compassion towards others and the profound strength of the human connection.

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As reflected in this dissertation, the knowledge and success of one individual cannot be attributed to just one or a few persons or events. I have interacted and formed relationships with numerous people over my life as a graduate student, and each one has shared with me some piece of advice, knowledge, or expertise to make me a stronger researcher, student, educator, and person. To then acknowledge just a few people would not appropriately or accurately reflect the significance of the extensive network of people that has supported me in the process to have success in my graduate program, complete this dissertation, and earn my doctorate. Therefore, I would like to thank everyone I have ever met, talked to, worked with, and learned from in my educational and professional career. The insight and support provided to me are invaluable and I will be forever grateful to have been part of such an incredible group of seasoned, respected, and intelligent people. It is impossible to name everyone in this network, but special recognition must be given to a select few "stars":

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ABSTRACT

USING SOCIAL NETWORK ANALYSIS TO INVESTIGATE THE RELATIONSHIP
BETWEEN SCHOOL-BASED TEAM COMMUNICATION NETWORKS AND
IMPLEMENTATION OF POSITIVE BEHAVIOR SUPPORT SYSTEMS

MAY 2015

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The purpose of this study was to examine the relationship between school-based team communication networks and implementation of school-wide reform efforts and initiatives, namely Positive Behavioral Interventions and Supports (PBIS). The study employed social network analysis (SNA) to determine if a relationship was present between the structure and properties of the team communication network and the level of implementation of PBIS, the position and properties of the PBIS leadership team and the level of implementation of PBIS implementation, and the quality of internal process for collaboration of the PBIS leadership team and PBIS implementation. It was predicted that schools in which teachers and staff have opportunities to communicate with their colleagues within and across teams have a network conducive to access of social capital and diffusion of innovation, supporting the school-wide implementation of reform efforts. Team network data were collected from eight elementary schools actively implementing PBIS and were analyzed at the network and ego-level using social network analyses. Network analyses were correlated with reports of PBIS implementation, as measured by

the Self-Assessment Survey (SAS). Internal process for collaboration was assessed using the Teacher Collaboration Assessment Survey (TCAS) and correlated with the SAS. Moderate findings were present between network properties indicating the number of nodes, edges, and density of the network and PBIS implementation. A moderate relationship was also found between the degree centrality, betweenness centrality, and eigenvector centrality of the PBIS leadership team and the level of PBIS implementation. Statistically significant and strong correlations were reported for the quality of internal process for collaboration in PBIS leadership teams and PBIS implementation. The study concludes with a discussion of the implications of the findings for policy, professional practice, and future research on implementation of school-wide reform efforts, particularly from a social network and diffusion of innovations perspective.

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CHAPTER 1

INTRODUCTION

Schools across the nation are faced with the incredible task of best educating all children. Policies at the national, state, and local level urge educational leaders to implement practices to ensure immediate and long-lasting improvements in student achievement in the areas of academics, social-emotional health, and behavior. While these practices are essential for producing positive outcomes for students, practices are not enough – there must be a vehicle or structure through which best practices can spread throughout the school organization. The social context, or the relational foundation in which school staff are situated is as important, if not more important, to consider when attempting implementing large-scale change efforts, particularly in the area of social, emotional health and behavior. A school system in which educators develop relationships and interact with their colleagues – i.e., form a network - is conducive for quality changes in instructional practice, and consequently, increased student achievement. More specifically, implementation of school wide reform efforts is predicated on all members of the school’s investment in and adoption of their associated practices. Changes in instructional practice and adoption of new approaches to teaching are dependent upon school staff members’ social interaction and connection. When school staff interact and connect, they are able to exchange knowledge and share information, leading to school-wide changes in instructional practices, ideally aimed to improve student outcomes.

Social Networks

The structural dimension, or the overall *network* of relationships, is the vehicle to facilitate information sharing and the exchange of knowledge among individuals in an

organization (Leana & Pil, 2006). A social network approach, or social network analysis (SNA; Butts, 2003; de Nooy, Mrvar, & Batagelj, 2005; Prell, 2011; Wasserman & Faust, 1994) reveals the underlying network structures that are important in understanding resource exchanges between individuals and groups within an organization (Cross, Borgatti, & Parker, 2001; Song, Nerur, & Teng, 2007). It serves as a high leverage approach to study how and what school networks support or impede the large-scale diffusion of innovations (Rogers, 2003) and reform efforts. By considering the professional interactions that school staff members have, stakeholders and researchers gain a solid picture of a school's capacity to support large-scale expertise and implementation.

The social network approach is predicated on a relational way of thinking in which individuals and groups are seen as structured, embedded, and active social networks. It is unlike more traditional forms of social science research in which individuals are considered independent and astructural, and whose distinguishing attributes (e.g. gender, race, age, social class, etc.) are treated with causal or correlational power (Daly, 2010; Papachristos, 2011). Therefore, an individual or group's placement in the network highly influences and is influenced by the happenings of the network. Theoretically, individuals or groups placed in advantageous (i.e. far-reaching and accessible) locations in the network are more likely to access and create knowledge, change behavior, and enact new or highly supported instructional practices. Further, networks with connected members are more likely to support transfer of knowledge and thus, implementation of new or supported instructional practices.

Diffusion of Innovation

Diffusion of innovation theory is concerned with social networks, communication channels, and inter-professional relationships, and how they influence the spread of new ideas, knowledge, and practices across social systems (Rogers, 2003). Diffusion of innovation theory posits that social relationships support and impede contagion, that is, the quality, depth, type, and rate of innovation spread throughout a network of actors. Depending on the strength and attributes of an organization's network, a positive innovation may be adopted, never adopted, discontinued, or a network could spread negative information about an innovation (Rogers, 2003).

Diffusion of innovation is elemental to the consideration of implementing school-wide reform efforts, as they include new ideas, knowledge, and practices – i.e. innovations. As they are school-wide efforts, the intent would be for every educator, in every setting, to implement each associated routine and practice. The routines and practices associated with the innovations are only effective when at least 80% of staff buy-in and consistently apply the elements to their practice (Sugai & Horner, 2006; Merrell & Buchanan, 2006; Stein, Hoagwood, & Cohn, 2002). In order for each staff member to implement its practices, he/she must be exposed to and aware of the decisions made related to implementation.

Teams, serving as the primary vehicles for implementation of school-wide practices (Pinchot & Pinchot, 1993; Gajda & Koliba, 2008; Woodland & Hutton, 2012), allow for the diffusion of innovation to occur and create a *teaming network* conducive to supporting changes to instructional practice systemically (McIntosh et al., 2013, Barnard, 1950; DuFour & Eaker, 1998; Senge et al., 2000; Gajda & Koliba, 2008;). Teams

provide established and formal venues in which teachers and staff interact on an ongoing basis to move forward the work of the school. Team members connect to “solve problems, share ideas, set standards, and build tools” (Snyder, Wenger, & de Sousa Briggs, 2003, p. 17), all aimed at improving instructional practice and overall school capacity.

Teams that maintain a high quality internal process for collaboration, in which they follow a cycle of inquiry of dialogue, decision-making, action, and evaluation of practices related to student learning and instructional practice builds the capacity of school staff members to make significant, positive changes in their instructional practice and produce significant increases in student achievement (Darling-Hammond, Aness, & Ort, 2002; Gajda & Koliba, 2007; Goodlad, Mantle-Bromley, & Goodlad, 2004; Hiebert, 1999; US Dept. of Education, 2001; Wasley et al., 2000; Zito, 2011; City, Elmore, Fiarman, & Teitel, 2009; Stevens & Kahne, 2006; Dufour & Eaker, 1998, Dufour, Dufour, & Eaker, 2005; Pounder, 1998). High quality teams create a high quality system, or network, in which all members of the school collaborate in a way that is conducive for diffusion of innovation to occur. Teams also provide ongoing social interaction and relationship-building in a structured, formal way. Diffusion of innovation relies upon a well-functioning social system (network) to support widespread flow of information and knowledge exchange. When the teaming network is structured for widespread transfer, it is more likely for diffusion of innovation to occur and for school-wide reform efforts to be implemented universally and as intended.

School-wide Implementation of Reform Efforts and Social Capital

Diffusion of innovation involves the transfer of knowledge and spread of

information across a well-structured network. Information and knowledge exchange leads to widespread professional learning and expertise, which then leads to school-wide implementation of reform efforts. Professional learning and building of expertise occurs between and among educational actors who co-construct, make sense of, and implement reform through a social process of interaction, as explained by social capital theory (Degenne & Forsé, 1999; Portes, 1998; Scott, 2000).

Social capital theory posits that social structure, or the web of relationships among individuals, offers opportunities and constraints for the exchange of resources. Resources may include strategies, information, practices, decisions, approaches, or prior knowledge. Individuals may tap into the resources that are available in the social structure in which they are embedded and leverage these resources to achieve individual or organizational goals (Nahapiet & Ghoshal, 1998). In schools, teachers and staff members who are connected via teams and thus have access to peers and colleagues and their resources, learn from one another, creating collective and personal knowledge, and furthering professional learning and internal expertise. The social capital of peers supports the behavior, functioning, and quality of the collective group as the group is consistent and equitable in regards to its level of knowledge and receipt of quality resources. It also supports individual and collective knowledge of all those within the school. Social capital is integral to systematic implementation of reform, as the school is structurally supportive of social interaction and thus professional learning, universal implementation is more likely to occur.

School-wide Reform Efforts Aimed to Address Student Behavior

As stated previously, schools are responsible for providing quality instruction to

students that support long-lasting achievement in the areas of academics, social-emotional health, and behavior. School-wide reform efforts then must aim for positive outcomes in all areas by ensuring that teachers and staff have consistent relational access to their colleagues through quality teaming. A team network in which teachers and staff consistently work together to improve their instructional practices, is conducive to diffusion of innovation and social capital, and thus implementation of school-wide reform efforts.

Although schools are tasked with addressing all facets of student outcomes, a major focus in schools is in social-emotional health and behavior, as the pervasiveness of social, emotional, and behavioral problems that children face across the United States is vast. One in five children in the United States experience some type of mental health related problem and 1 in 10 has a diagnosable disorder, such as anxiety, depression, conduct disorder, and attention deficit hyperactivity disorder (ADHD) (Costello and Angold, 2000). At any given time between the ages of 9 and 16, one out of six children will develop an emotional or behavioral disorder, with many of them developing comorbid disorders (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003). Nearly 22% of students enrolled in public education have behavioral problems severe enough to necessitate mental health services (Hoagwood and Erwin, 1997). These numbers are likely an underestimation of the true prevalence of mental health related issues, given that they do not include a substantial number of individuals who manifest subclinical or undiagnosed disorders (Mash & Dozois, 2002). In fact, the rate of disruptive problem behaviors related to such issues is escalating (U.S. Surgeon General, 2000). The single most common request for assistance from teachers is related to behavior and classroom

management (Elam, Rose, & Gallup, 1999), as 87% of teachers report their classes include students with behavioral challenges (Gates Foundation, 2012). Such behavioral challenges may then turn into problems that increase in cost and severity and decrease in chance of remediation over time (Sprague & Walker, 2005).

The expression of social, emotional, and behavior problems in schools affects teacher instruction, classroom environment, and student learning. Students with social, emotional, behavioral disorders or challenges, generally, are noncompliant, fail to follow social routines or norms or are socially withdrawn, display aversive interpersonal behaviors (e.g. lying, yelling, excessive motor activity), are inattentive and off-task, and are physically aggressive (Breen & Altepeter, 1990). Such behaviors compromise the learning environment whereby academic activities are interrupted, instructional time is taken away, curriculum content is not covered, teacher authority is undermined, and most importantly, there are decreased opportunities to learn (McIntosh, Horner, Chard, Boland, & Good, 2006; Sprague, et al., 2001). Teachers report spending an average of 36 minutes per day dealing with student misbehavior, which translates to about 10% of their day (Cains & Brown, 1996; Gates Foundation, 2012; Wang, 1985). When added up across time, that time taken away from instruction to deal with behavioral incidents is large, thus impacting students' opportunities to optimally access the curriculum and instruction. Further, high rates of behavioral incidents are associated with a negative school climate, a breakdown of teacher-student relationships, and a decline in academic achievement (DeBriere & Wehby, 1993; Shores, Jack, Gunter, Ellis, Sugai & Horner, 1999; Sulzer-Azaroff & Mayer, 1994; Tolan & Guerra, 1994), thus inhibiting both academic and social-emotional-behavioral growth. In comparison, lower rates of behavioral problems

and a positive school climate are associated with positive youth development, effective risk prevention and health promotion, better student learning and academic achievement, increased graduation rates, and teacher retention (Center for Social and Emotional Education, 2010).

Facilitating positive social behavior and preventing negative, antisocial behavior leads to enhanced academic achievement and improved social-behavioral and mental health outcomes for students. Students are less likely to develop mental health and behavior problems that otherwise would increase in severity over time when introduced early to a comprehensive and sustained social-behavioral prevention system in school (Ford & Lerner, 1992).

Given their potential impact, there is a clear need to address the expression of social-emotional and behavioral challenges that students and educators are facing and that are taking away from a focus on academic and social achievement. To do so, educators must look at the ways in which school-wide reform efforts that address social-emotional health and behavior and prevent future problems are best implemented in their schools.

Positive Behavioral Interventions and Supports (PBIS)

A well-supported and commonly utilized school-wide reform effort (innovation) for prevention and intervention of social-emotional health and behavior is Positive Behavioral Interventions and Supports (PBIS; Sugai & Horner, 2002; Lewis & Sugai, 1999), which aims to prevent disruptive behavior and social-emotional challenges, and enhance the school's organizational climate by creating and sustaining a comprehensive system of social-behavioral support (Bradshaw et al., 2008; Horner & Sugai, 2006). PBIS

is a prevention-oriented framework focused on creating environments that reflect safety, social competence, and healthy school climates. PBIS is a multi-tiered approach focusing on student social, emotional, and behavioral learning. It is guided by the following principles: 1) develop a continuum of scientifically based behavior and academic interventions and supports; 2) use data to make decisions and solve problems; 3) arrange the environment to prevent the development and occurrence of problem behavior; 4) teach and encourage prosocial skills and behaviors; 5) implement evidence-based behavioral practices with fidelity and accountability, and 6) screen universally and monitor student performance & progress continuously (OSEP Center for PBIS, 2009). PBIS is not a packaged curriculum, rather relies on a continuum of behaviorally-oriented practices, measurement tools and data gathering that informs decision-making regarding service delivery, and *organizational systems and structures* that support the implementation of practices and ongoing use of data (Horner, Sugai, Todd, & Lewis-Palmer, 2005; Sugai & Horner, 2006).

The PBIS leadership team is a key element of PBIS systems. The PBIS leadership team is a cohesive, integrated, and representative collection of individuals who lead the systems change and implementation process of PBIS. It is responsible for the coordination of training, coaching, and evaluation activities related to PBIS, and make ongoing data-based decisions regarding systemic efforts to support behavior (OSEP, 2004). The quality of the PBIS leadership team is a major factor in its initial implementation and longevity (McIntosh, et al., 2013; Doolittle, 2006).

Previous research has indicated that implementation of PBIS is associated with a reduction in office discipline referrals (Taylor-Greene et al., 1997) and suspensions

(Horner, Sugai, Todd, & Lewis-Palmer, 2005), and improvements in academic performance (Nelson, Martella, & Marchand-Martella, 2002). Without universally strong implementation in all settings (classroom, cafeteria, bus, playground, hallway), practices are less likely to benefit students, leading to diminished social-behavioral achievement for students. The implementation of PBIS, like any large-scale innovation, takes on a systems approach, in which the collective actions of individuals within the school predict how the school operates (Lewis, Barrett, Sugai, & Horner, 2010). All individuals within the school have a common goal and consistently use the universally known routines and practices (Horner, 2003). As PBIS is a systemic effort, it includes the effective and efficient selection and implementation of practices by school personnel (e.g., teachers, school psychologists, administrators). These practices include the development of policies and guiding principles, operating routines, resource supports, and administrative leadership. With such systems in place, internal behavioral expertise and capacity are developed, and data-based decision making is emphasized to improve the selection, adoption, outcomes, and durability of practices (Sugai, Horner, & Lewis, 2009).

While relying on “experts” to deliver training and provide on-going technical assistance is a long-standing model within education (Guskey, 2000), school-wide reform depends on building “expertise” across all educators within a school (Lewis et al., 2010), suggesting that professional learning and development will have to be embedded into the jobs and daily functions of the educators. In this sense, the capacity for schools to support professional learning and knowledge exchange through social interaction and communication is a major consideration in the implementation of far-reaching behavior support systems, such as PBIS.

In order to support professional learning and knowledge exchange, the social network in which teachers and staff are embedded must be structured to diffuse the innovation (i.e. PBIS) and provide access to social capital (i.e. resources, practices, decisions, knowledge of PBIS). Implementation relies on diffusion of related practices to all those within the network. Therefore, the successful implementation of PBIS is dependent upon a network whose structures and properties are conducive to diffusion of innovation.

Statement of the Problem

Implementation/diffusion of PBIS entails the transmission of practices across all those individuals who will be expected to use them (i.e. administrators, teachers, school staff). The introduction, commitment and use (i.e. implementation/diffusion) of an innovation such as PBIS is supported through high quality, ongoing, job embedded professional interaction and learning for school staff. Systems and structures in which school staff members work together in and across teams is a key component of school improvement and the attainment of educational goals and outcomes (Croft, Croft, Cogshall, Dolan, Powers, & Killion, 2010; Dufour, 2011; Dufour & Eaker, 1998; Gajda & Koliba, 2008; Hattie, 2009; Hord, 2004; Leana, 2011; Little, 2003; Pounder, 1998). The diffusion of an innovation such as PBIS depends upon a connected network of administrators, teachers, and school staff following a cycle of inquiry (Woodland & Hutton, 2012; Gajda & Koliba, 2008) and communicating within and across teams (Rogers, 1963; Sugai & Horner, 2006). A network of administrators, teachers, and staff working with their colleagues structured to support diffusion of innovation is likely to be associated with strong school-wide implementation of instructional practices and

consequently, positive student outcomes. Conversely, network of teams structured to constrain diffusion of innovation, thus inhibiting student outcomes is likely to be associated with poor implementation.

In summary, structured teacher teaming networks is associated with improving the quality of instructional practice in K-12 education. Practices aimed supporting positive student outcomes are most likely to succeed and be sustained in schools in which teachers work in teams and communicate with one another consistently and at a high quality (McIntosh et al., 2013, Dolittle, 2006; Gajda & Koliba, 2008; Woodland & Hutton, 2012). To ensure successful implementation and longevity of school-wide practices, leaders and researchers must assess schools' capacity of their teaming networks to support the diffusion of best practice and instructional innovation. By analyzing the structure and attributes of school teaming networks, educators can then improve children's school environments to better address their needs.

Purpose of the Study

The primary purpose of this study was to closely examine the relationship between the structure of school teaming networks and the implementation of PBIS. First, this study attempted to identify which network properties supported or constrained diffusion of PBIS by determining the relationship between the teacher teaming network structure and PBIS implementation. It was hypothesized that there would be a relationship between implementation of PBIS and the structure and properties of the teacher teaming network, and that a moderately connected and far-reaching network in which each team was connected to at least one other supported diffusion of PBIS. Conversely, a disconnected, highly centralized network in which teams were isolated or

frequently inaccessible, constrained diffusion of innovation, and thus implementation of PBIS.

This study also aimed to determine how the accessibility and influence of the PBIS leadership team over the teaming network supported and constrained diffusion of PBIS. To do so, it sought to examine the relationship between the structural position and properties the PBIS leadership team within the network and PBIS implementation. Position is the PBIS leadership team's influence and power over the network and accessibility to other teams within the network, indicating its capacity to enact or support diffusion of PBIS to the rest of the network. Properties are measures of its connections to other teams, role in the transfer of information, central location, and accessibility to other teams within the network. PBIS leadership teams in highly central and influential positions and properties within the network would support diffusion of PBIS practices, and thus implementation PBIS. PBIS leadership teams with positions on the periphery and who had properties indicating inaccessibility to or lack of influence over other teams within the network constrain diffusion of PBIS.

A third purpose of the study was to examine the PBIS leadership team's internal process for collaboration and its relation to PBIS implementation. It was hypothesized that there would be a positive relationship between PBIS implementation and PBIS leadership team's internal process, indicating the internal process for collaboration does support PBIS implementation.

An additional purpose of this study was to pilot the social network approach in the evaluation of PBIS implementation and sustainability. Literature surrounding PBIS implementation is emerging; and this study attempted to add an additional lens to

understanding schools' capacity to implement PBIS school-wide. Furthermore, a large body of research has pointed to social networks as valuable foci in education reform and innovation research, but none to date has used the social network approach in research on behavior support implementation in schools, especially PBIS. Thus, this study sought to add a social-emotional and behavioral support perspective to the SNA literature base.

Research Questions

1. To what extent are the structure and properties of a school's team communication network related to the level of PBIS implementation?
2. To what extent does the structural position and properties of the PBIS leadership team relate to the level of PBIS implementation?
3. To what extent does the quality of the internal process for collaboration of the PBIS leadership team relate to the level of PBIS implementation?

More specifically,

- What is the level of PBIS implementation at each school?
- What are the properties of the team network for each school? How do they correlate with measures of implementation?
 - How many discrete, formal teams exist within the schools? How many connections exist between teams?
 - Where are the stars, bridges, bottlenecks, and cliques in the network?
 - What are the density, average path length, and centralization of the network?
- What is the position of the PBIS leadership team within the team network?
 - Is the PBIS team a star, bottleneck, isolate, part of a clique in the network?

- What are the degree, betweenness, eigenvector, and closeness centralities of the PBIS leadership team within the team network? How do they correlate with measures of PBIS implementation?
- What is the quality of the internal process for collaboration of the PBIS leadership teams? To what extent do they follow a cycle of inquiry? How does it correlate with measures of PBIS implementation?

In conclusion, this study will aim to use SNA to examine how the structure, properties, and quality of the teaming network supports or constrain the diffusion of innovation, and uses PBIS as the model school-wide innovation. A more detailed explanation of theoretical underpinnings and previous research informing this study are further discussed in the upcoming review of literature.

CHAPTER 2

REVIEW OF THE LITERATURE

Introduction

The purpose of this study was to investigate the relationship between the structure and properties of school-based team networks, team quality of internal process for collaboration, and the implementation level of positive behavior support systems. Consideration of this topic requires a well-formed knowledge of a wide range of theoretical orientations and background in numerous perspectives. While on their own, the theories and perspectives are often presented as distinct, they in fact share many common themes and messages aimed to explain how and why things happen within organizations, and in this case, why and how PBIS happens within and across a school system. As such, the following literature review will primarily describe the theoretical models that most appropriately informed this study's purpose and methodology of data collection and analysis.

The most prominent theoretical framework that undergirds this study is that of social network analysis (SNA; Butts, 2003; de Nooy, Mrvar, & Batagelj, 2005; Prell, 2011; Wasserman & Faust, 1994). SNA is a theoretical and methodological approach to describing and examining the structures and effects of social relationships. As stated earlier, SNA is different from traditional attribute-based methodological approaches in that it addresses the profound implications of the configuration of social systems (i.e. networks) on access to information, resources, and the flow of ideas, practices, and routines. SNA is used to explain the "diffusion of innovations" which is theory that explicates how and why new ideas spread between actors in networked organizations.

And SNA is used to examine “social capital theory”, which explains the resources and knowledge that are leveraged from social relationships and are existent and accessible within networks. Both diffusion of innovation theory and social capital theory emphasize the great importance of social interaction and relationships between individuals. In this study, SNA, diffusion of innovation, and social capital theories guided the theory that quality teaming networks structured to support diffusion of innovation and social capital would support implementation of school-wide reform efforts.

Educational Reform

Federal policies and programs such as the No Child Left Behind Act (NCLB) and Race to the Top have put the pressure on schools to engage in reform efforts to bring about improvement in student outcomes (Finnigan & Daly, 2012). School leaders are expected to make major changes in their schools (Deal, Purinton, & Waetjen, 2009). Efforts aimed to address, reform, and refine educational practice in schools have been introduced through a variety of means. Educational leaders, policy-makers, and researchers have provided a range of documented fixes, which have often been technical, and include prescribed or mandated policies, structures, and processes for change (Moolenaar & Daly, 2012). Numerous suggestions, invitations, mandates and legislations have been delivered in hopes of changing behaviors, attitudes, knowledge, and understanding of school leaders, teachers, and staff (Hall & Hord, 2011).

The process in which to enact these mandates and practices within schools is not a simple task. And while these technical fixes are necessary for large-scale change in schools, they are embedded within a larger social system, which must also be considered. As schools are organizations of people, there exists a social system, in which teachers,

staff, parents, and students interact and communicate consistently and form relationships with one another. These interpersonal ties matter because they transmit behavior, attitudes, information, and goods (de Nooy, Mrvar, & Batagelj, 2005; Moolenaar & Daly, 2012). The social system, or structure or patterns of relationships, is often referred to as a *network*. For the purposes of this study, the network of school staff (i.e. teachers, administrators, counselors, support staff) is one of interest when considering how changes in instructional practice are implemented and sustained. The educator network and process of social interaction and relationship-building provides an important context for the work of the school to be completed and progress to be made in improving educational outcomes. Therefore, it is important to consider network capacity to support widespread change and implementation of new ideas and practices within schools. The success of school-wide reform efforts depends on a network conducive to support them.

Social Network Analysis (SNA)

SNA is a methodological approach that enables the examination of relationships (Moolenaar, 2012; Coburn & Russell, 2008; Penuel et al., 2009). SNA enables researchers to more accurately understand and appreciate how the social network supports or constrains the implementation of school improvement initiatives. Social network analysts theorize that the patterns of social relationships among individuals offer a valuable unit of investigation to explain behavior, beliefs, and knowledge. In schools, it is the assumption that the relational structure (or social network) of the school staff is of importance and serves as a platform for capacity building and diffusion of practice via communication, collaboration, and interaction (Moolenaar & Daly, 2012).

(refers to an approach to studying social relationships, their structuring, and their quality. It involves theoretical concepts, methods, and analytic techniques to uncover the social relations that tie individuals and groups together, the structure of those relations, and how relations and their structures influence or are influenced by behavior, attitudes, beliefs, and knowledge. The SNA approach posits that relations between individuals (called actors) create systems called social networks, and that much of culture and nature seem to be structured as networks. Actors are tied together due to a shared relation or relations, which are defined as the linkages between entities (Borgatti, Everett, & Johnson, 2013). Relations can be consistent as *states*, such as social roles, cognitions, or similarities; or discrete *events*, such as shared membership or attendance in a social interaction (Borgatti, Everett, & Johnson, 2013).

Social networks are alive, ever-changing, and ever-evolving based on the relations between its members (Samet, n.d.). A general hypothesis of SNA is that “an actor’s position in a network determines in part the constraints and opportunities that it will encounter, and therefore identifying that position is important for predicting outcomes such as performance, behavior, or beliefs” (Borgatti, Everett, & Johnson, 2013, p. 1). Social network analysts also hypothesize that “what happens to a group of actors is in part a function of the structure of connections among them” (Borgatti, Everett, & Johnson, 2013, p. 1). Social network analysts treat the social network in which individuals are included as the primary unit of analysis and investigation. Individuals are considered to be interdependent, who do not behave independently from each other, but rather gain capital from others based on the pathways of which they have access (Deal, Purinton, & Waetjen, 2009). Individuals’ behavior, beliefs, and performance are then

dependent upon the social network's capacity to provide them. SNA is a method that focuses upon the relationships between individuals in a given context, rather than a method that views individuals as independent and autonomous units. A particular advantage of SNA is its ability to examine both social structures *and* individual attributes simultaneously. Therefore, SNA has the capacity to account for structural regularities but also individual attributes, and it is well suited for investigating the complex relations that exist within schools (Lusher, Robins, & Kremer, 2010).

In a social network, the relationship does not just refer to a social network as members who “socialize with” or who are their friends. Social is a general term describing an inter-personal interaction or relation. Certainly, friendship is a type of social network relation, but there are many others, such as trust, advice, communication, collaboration, and even negative relations such as conflicts or bullying (Deal, Purinton, & Waetjen, 2009; Prell, 2011; Lusher, Robins, & Kremer, 2014). SNA is concerned with examining a specific relation between network members, because this will provide detailed information about the ways in which particular types of relations operate within a group or organization. In addition, individual-level attributes (such as age, years teaching, gender, role/title, focus, process of team) can be incorporated into a social network investigation to see how such attributes are associated with social relations within the school (de Nooy, Mrvar, & Batagelj, 2005; Deal, Purinton, & Waetjen, 2009; Daly et al., 2010). In this study, the main network of interest is the team communication network: the patterns of relationships between teachers and school staff created by their membership to carefully created teams in the school. Theoretically, social interactions and relationships are created within and between teams. That is, teachers and staff who

share membership to a team or teams have the opportunity to interact, communicate, and share ideas within the team(s). Then ideally, each teacher and staff member would have membership to multiple teams, which would then create a relationship between many teams, in which ideas can be communicated from one team to the next. These patterns of communication create an overall team communication network, in which communication is a result of the connections between teams. When teachers and staff members communicate, they can share ideas and information about what is happening within the school and implement change based on their new knowledge (Deal, Purinton, & Waetjen, 2009; Moolenaar, 2012; Moolenaar & Daly, 2012; Daly et al., 2010).

The concept of social networks has its foundations in sociological research with the theoretical work of social theorists such as Ferdinand Tonnies, Emile Durkheim, and Gustave LeBon who are credited with first describing social ties. According to Tonnies (1895/1936), social groups exist as the social ties that link individuals who share common personal or impersonal commonalities. Personal commonalities refer to shared values and beliefs, where impersonal commonalities were instrumental or purposeful (Freeman, 2004). Durkheim (1893/1964) argued that social phenomena arise through the interactions between individuals, and cannot be solely attributed to the properties of individual actors. Society then develops out of cooperation between individuals, rather than a compilation of individual traits. LeBon (1897/1995) studied crowd behavior and structure of social ties. He suggested that when individuals become members of crowds they lose their individual identities by imitating them. He also said that ideas and behaviors diffuse from person to person by a process of contagion (Freeman, 2004).

German sociologist George Simmel is often credited with first attempting to

understand how social phenomena and social laws emerge by explicitly investigating the structure of social interactions. His research attempted to explain and describe large-scale institutions by observing and analyzing the social interactions within society. According to Simmel (1907), a collection of human beings does not become a society objectively. He said, “society arises from the individual and the individual arises out of association” (p. 163). There must be a reciprocal influence between individuals in which one has an effect on another to create an interaction. To study society then, one must study the patterns of interaction. Further, he suggested that it was the nature of *ties* themselves rather than the social groups, that lie at the center of many human behaviors. He believed that the social interaction affects the way that individuals’ personality and belief structures are formed. Simmel’s students continued his work and suggested that society is a “system of relations” and a “network of linkages between men” (Wiese & Mueller, 1931/1941, p. 30 as cited in Freeman, 2004).

In the mid 1900s, the study of social ties and interaction continued with the work of Jacob Moreno, a student of psychiatry from Vienna, who was the first to develop a methodology for studying social ties, and was the first to operationalize the term *social network*. Moreno’s studies focused on Gestalt psychology, which looks at the interplay between perceptions and the larger structures of the human mind. Moreno and his university colleagues argued that the structure of the whole mind mattered more than the individual parts of the mind or individual perceptions, and that individual well being must be linked to a whole structure. Moreno’s foundations in Gestalt psychology then precipitated his interests in how the psychological well-being of individuals was linked to the social relations in which they were embedded (Prell, 2011; Freeman, 2004). Moreno

first introduced *sociometry*, the precursor to modern SNA, in which he created sociograms to visualize social networks.

SNA continued to grow in the mid twentieth century, precipitated by the work of Moreno's sociometry and other scholars. By the 1950s, scholars at that time began to introduce a number of new approaches to objectively understanding social relations, and make more meaningful conclusions about networks, beyond that what sociograms could provide. Graph theory, a sub-field of mathematics, was then integrated into studying networks, which makes use of notation, visual graphs, and theorems (de Nooy, Mrvar, & Batagelj, 2005; Prell, 2011). SNA then emerged as a more precise, objective, and rigorous mathematical approach to the study of relational ties.

While SNA has its foundations first in sociological research, it has since developed through its very essence, the collaborations and linkages between topics pertinent to numerous areas of social science research, including psychology, anthropology, sociology, public health, and political science. Its development is ongoing and the result of a long history and work of scholars, theorists, and mathematicians. Today, social network analysts continue to create sociograms to demonstrate the visual structure of a network and perform complex statistical models using graph theory aimed to provide an objective understanding of the social ties within groups.

The use of SNA is not limited to just one or a few disciplines, as a wide range of researchers have utilized it in recent years to describe and investigate the behavior, beliefs, and performance of individuals based on the social structures in which they belonged. As a broad set of techniques, SNA has been used extensively in organizational settings such as business and government (e.g., examining leadership, governance of

environmental resources, advice relations, innovation, information sharing), health-related applications (e.g., HIV networks, mental health support, bullying in schools), politics (alliance formation, social movements), and defense (e.g., terrorist networks) (Lusher & Robins, 2010).

For example, sociologists have studied the social structure of gangs to predict murders using SNA (Papachristos, Braga, & Hureau, 2012). In this study, the authors investigated the relationship between an individual's position in a high-risk social network and the probability of being a victim of a fatal or non-fatal gunshot wound. They found that each person within the network was less than five handshakes away from the victim of a gun homicide or non-fatal shooting. Their findings demonstrated that the closer one is to a gunshot victim, the greater the probability that person will be shot, and each network step away from a gunshot victim decreases one's odds of getting shot by approximately 25 percent (Papachristos, Braga, & Hureau, 2012). This study provides evidence that the relationships individuals have play integral roles in behavior, and therefore, the network in which they are embedded.

Psychologists have also used SNA to study the effects of popularity on depressive symptoms in friendship networks. A longitudinal study collected friendship network data from 376 adolescents and determined who held positions of strong popularity. Data indicated that friendship network popularity was associated with increases in depressive symptoms in females and decreases for males. The authors suggested that the network structure is of importance when considering expression of behavior collectively and individually (Kornienko & Santos, 2014).

Health scientists have used SNA to identify individuals that would be most likely

to be affected by infectious disease and to predict who have good health intervention behaviors. Researchers asked members of an African community to identify their friends. Using measures of nomination frequency (in-degree) and how often one friend was a link between two other sets of friends (betweenness), they concluded that people with more friend nominations were more likely to self-report illness, while the individuals serving as the link between friends were more likely to report good health behaviors. The results suggested that intervention efforts should include consideration of the networked positions of its intended audience, rather than an individual trait such as their health status (Chami, Ahnert, Voors, & Kontoleon, 2014).

Political scientists have employed SNA to investigate lobbying behavior and patterns in government. After interviewing lobbyists about their social connections to other lobbyists and collecting network data of which organizations endorsed certain bills, they concluded that organizations converge on “popular” bills and lobbying organizations influence each other when their lobbying agendas overlap. Results showed that the policy domain is a social community that consists of ongoing relationships, trust, and information sharing. Therefore, the structure of the lobbyist social networks seemed to be related to their policy endorsement behaviors (Scott, 2013).

The studies mentioned above provide a very basic overview of the types of studies that have been conducted using SNA. As noted previously, SNA is not specific to one area of scholarly research or oriented toward one or a few disciplines. The application of SNA across disciplines to explain or describe phenomena is extensive and proven to be informative to each discipline that has employed it. The possibilities of

using SNA are truly limitless and applicable to a wide array of research interests and venues.

Social Network Analysis in Education

The social network approach has recently emerged as a useful approach to understanding the ways in which information is spread and work gets done within organizations, compared to traditional conceptualizations of productivity and knowledge creation. In educational settings, specifically schools, the use of SNA has become an important tool in empirically examining capacity of school networks to educator learning and implementation of instructional practices. SNA is advantageous in the educational setting, as schools can be viewed as a micro-social systems with clear boundaries and opportunities for relationship building (Moolenaar & Daly, 2012; Daly et al., 2010; Deal, Purinton, & Waetjen, 2009; Moolenaar, 2012). While the SNA literature is emerging in the education field, this innovative approach has been applied to describe a range of networks and their relationships with school reform, professional learning, and productivity.

In a study funded by the National Science Foundation, policy analysts sought to see how the choices of teachers about whom to seek out for advice influenced the structure of their network. The school had just introduced a school-wide mathematics initiative and researchers were interested in how the network would change based on who teachers sought out for advice regarding mathematics. Researchers worked with a group of teachers for three years and mapped their social networks. They found that teachers' reasons for seeking others out to discuss mathematics changed dramatically over time (Coburn et al., 2010) and concluded that social arrangements and organizational

structures to support collaboration and communication greatly influence individual choice. They found that the colleagues who had direct ties were more likely to ask for advice from one another. They stated, “tie formation - the foundation of social networks - can be influenced in profound ways by existing organizational norms, structures, and practices” (Coburn et al., 2010, p. 46). They suggested that administrators should concern themselves with systematically understanding and configuring the network in purposeful ways to support relationship building via interaction and communication between their staff.

In their study, Penuel, Sun, Frank, and Gallagher (2012) aimed to investigate how interactions between teachers augment learning from formal professional development. In this longitudinal study with 20 schools, the authors followed teachers undergoing partnership and professional development activities from the National Writing Project. They analyzed advice-giving network data and self-report of writing instruction provided by teachers, and concluded that both professional development and collegial interactions between teachers were associated with changes in writing instructional practices, therefore suggesting the social interactions teachers have matter when implementing changes in practice.

SNA has been used to identify the teachers, staff, and administrators who are change agents, opinion leaders, and individual and group stars, who drive the adoption and spread of innovations. For example, Tuomainen, Palonen, and Hakkarainen (2010) investigated one special education teacher’s activity within his workplace community and his external professional network. Using SNA, the teacher was identified as a “networked expert” who served as a bridge of knowledge resources in the community. Spillane and

Min Kim (2012) used SNA to study formal school leaders' positions in advice seeking and information networks within 30 elementary schools. They found that leaders (both formal and informal) play central roles in the school organization and advice seeking networks, by brokering relations and spreading pertinent information. In a study conducted by Kochan and Teddlie (2005), school leaders used SNA to investigate patterns of teacher collaboration, and identify highly connected individuals and the presence of isolated cliques at the secondary school level. They concluded that effective schools are characterized by a network of highly linked teachers, while lower performing schools are comprised of disconnected cliques and isolates.

SNA has also been used to investigate large-scale school-community efforts at reform. Cross, Dickman, Newman-Gonchar, and Fagan (2009) used SNA to explore, measure and describe the development of intra-agency collaboration as part of a multi-year Safe Schools/Healthy Students initiative involving partnerships among two dozen community agencies. Levels of integration were shown to increase over time and were correlated with other important outcome measures related to student safety and health. Similarly, Coburn, Russell, Kaufman, and Stein (2012) studied how teachers' social networks were related to sustainability of school-wide reform efforts. In this longitudinal study, the researchers asked teachers whom they talked to about mathematics, how often, and why and observed their classroom mathematical practices. They concluded that the social networks with ties, high expertise, and high-depth interaction enabled teachers to sustain instructional practices related to this mathematics reform, even after initial training supports were withdrawn. Their findings suggest, again, that the interactions and relations between school staff have importance to instructional practice and overall

school performance. Hawe and Ghali (2008) examined the implementation of a school-wide health promotion program using SNA. Their work revealed that SNA could provide useful information about the structure of the school and to whom to introduce programming, predicting that the individuals with the most ties within the school would be the ones to facilitate the information and introduction of the program most efficiently and effectively. Daly, et. al, (2010) employed mixed methods to examine social networks and teacher work perceptions in an under-performing school district engaged in system-wide reform. They concluded that social networks significantly influence the rate and depth of school reform. Finnigan and Daly (2012) continued this work and investigated whether underperforming schools under sanction exhibited the necessary processes, relationships and school climates to support organizational learning and improvement. They found that schools with sparse ties (and thus weak relationships) and negative school climates inhibited flow of ideas and practices school-wide and district-wide to implement change.

Recently, Woodland, Barry, and Crotts Roohr (2014) used SNA to examine an elementary school network's capacity for instructional innovation, and found that grade level teachers who would be most responsible for introducing instructional changes to their practice were not optimally positioned within the team task network to do so. They were sparsely tied to their colleagues and leaders who would create change and introduce reform efforts. Researchers also showed findings for school leaders; administrators reconfigured their own positions within the network to become less redundant and over-worked, to make diffusion and communication more efficient. Woodland and colleagues

emphasized that SNA has great utility in educational evaluation and can produce meaningful results about network capacity for diffusion of instructional innovation.

Woodland, Whitcomb, and Barry (under review) also utilized SNA to examine the configuration and position of the PBIS Leadership team within two schools' respective networks. Authors reported more advantageous network centrality for diffusion of innovation in schools who reported stronger implementation of PBIS at Tier 1. Their findings suggested that PBIS leadership team configuration and the position of the team in the school's overall communication network together influence the degree to which teachers and school staff accurately articulate their school's core values, teach those core values in the classroom, and implement core PBIS practices across the school community.

Diffusion of Innovation

The diffusion of the innovation, or the spreading of new practices and fixes, is an integral part to the overall change process, and serves as a powerful approach to understanding how efforts of school reform are implemented. Therefore, school leaders and policy makers must aim to best support the diffusion of innovations by considering the capacity of their school networks to do so.

Diffusion of innovation is a theory concerned with social networks, and seeks to explain how information is spread between individuals, and specifically, how, why, and at what rate new ideas are efficiently and effectively adopted across cultures (Rogers, 2003). Diffusion of innovation theory has been studied and applied in a vast array of academic disciplines, including communication and marketing, healthcare and medicine, organizational development and management, education, and anthropology (Moseley,

2004; Rogers, 2003), to help researchers and program developers understand the process through which new ideas and technologies become translated into widespread practice (Murray, 2009).

Diffusion of innovation originated in the 1920s and 1930s in Midwestern United States as agriculture technology was rapidly advancing with rural sociologists, who examined how independent farmers were adopting hybrid seeds, equipment, and techniques. Often considered a seminal study in diffusion research, Ryan and Gross (1943) studied the rate of adoption in hybrid corn seed in two communities in rural Iowa. Because it was new, this hybrid corn was considered an innovation and some farmers decided to adopt it quickly, while others delayed it for years. In their study, Ryan and Gross reviewed the history of adoptions in the two communities by interviewing more than three hundred farmers. Analyses revealed two major points: 1) The adoption process began with a small number of farmers who adopted hybrid corn soon after it was released. From these farmers, the innovation diffused to other farmers. 2) The most influential source of information on this innovation was neighbors. When farmers saw and interacted with farmers who had adopted hybrid corn, they adopted it too. Basically, these findings implied that if innovative farmers were targeted to adopt innovations, other farmers would soon follow, which would speed up the adoption of new agricultural practices, and emphasized that the interaction between the farmers facilitated adoption (Ryan & Gross, 1943; Hall & Hord, 2011).

In 1962, rural sociology professor Everett Rogers synthesized diffusion studies across the fields and produced diffusion of innovation, a theory of adoption of innovations among individuals and organizations. Based on his review of these studies,

Rogers defined diffusion as the process by which an *innovation* is *communicated* through certain *channels* over time among the members of a *social system* (Rogers, 1962; 1995). The end results of diffusion are adoption, implementation, and institutionalization. An individual or organization (a) *adopts* an innovation upon the decision to acquire the innovation, (b) *implements* the innovation by putting it into practice and testing it, and (c) *institutionalizes* an innovation by supporting it fully and incorporating it into typical practice routines (Dusenbury & Hansen, 2004; Oldenburg, Sallis, French, & Owen, 1999).

Rogers and other diffusion theorists posit that diffusion of innovation has four main elements: the innovation, communication channels, time, and the social system (1995). In this study, the innovation (PBIS), communication channels (the PBIS leadership team), and the social system (teacher teaming network) were examined in relation to the diffusion of PBIS.

Innovation

An innovation is an idea, practice, or object that is perceived new by an individual or other unit of adoption. The newness of the idea is not just objectively “new” knowledge. Someone may know about the knowledge, but has not yet formed an opinion on it, or made the decision to reject or adopt. Therefore, newness of the innovation can be understood in terms of one’s knowledge of, attitude toward, or decision to adopt it (Rogers, 1995). For the purposes of this study, an innovation is considered a set of instructional practices introduced to school staff and intended for them, as the units of adoption to implement. The innovation of interest in this study is PBIS.

Communication Channels

For diffusion to occur, the process requires 1) the innovation, 2) an individual that has knowledge of that innovation or experience using it, 3) an individual who had not yet had experience, and 4) communication channel between those units or individuals (Rogers, 1995). According to Rogers and other diffusion theorists, the communication channels are the means by which messages get from one individual to another. Communication channels often include mass media such as television, radio, social media, or newspapers, interpersonal relationships, and the face-to-face exchange of information between two or more individuals. The essence of diffusion is the information exchange from one to other(s), and the communication channel allows for that to occur. According to Rogers (1995), the nature of the information exchange relationship between a pair of units determines the conditions under which a source will or will not transmit the innovation to the receiver, and the effect of the transfer. Interpersonal influences can either speed up or slow down the diffusion process (Dearing, 2004). Essentially, diffusion of innovation will not happen unless there is a venue in which they can exchange information (Rogers, 1995). In this study, the communication channels of interest are established/formal teams of teachers within the school.

Social System

The social system is essential to diffusion of innovation. It is defined as a set of interrelated units that are engaged in joint problem solving to accomplish a common goal (Rogers, 1995), and constitutes a boundary for diffusion to occur. The members of the system may be individuals, informal groups, and/or subsystems. They can be distinguished from one another, but cooperate in order to reach a mutual goal. In

education, the system is the school, which is inclusive of all staff aiming to provide quality instruction for their students.

The structure of the social system affects the diffusion of innovation. Structure, defined as the patterns of arrangements of the units of a system, facilitates or impedes the diffusion of innovation. When considering the structure of the social system, it allows one to predict behavior within that system with some degree of accuracy, as its arrangements can determine the extent to which members interact. For the purposes of this study, the communication structure, or the linkages resulting from communication between and among educators within and across educational systems, plays an integral role in diffusing policies and procedures aimed to improve student outcomes.

Communication structures create interactions between all school staff and foster the conversations about the innovations. In turn, structures allow for differentiated flows of information exchange between and across individuals. Structures for the communication of information about new ideas are essential in order to create positive perception of the benefit and favorable attitude toward the innovation being described (England & Stewart, 2007).

Rogers and other diffusion theorists, again, emphasize interaction within the social or communication structure as the facilitator of diffusion. This interaction occurs within a larger social system, also known as a network. The network must be then structured to support communication and interaction. In schools, the structures between educators create a *network* in which information is spread to all those included. The concept of studying the school networks is predicated on the idea that networks either support or constrain diffusion of innovation and then the learning and performance of

teachers and other school staff. Networks must be structured to enable information to be spread to all its members. In schools, educators must be positioned with mechanisms in through which they communicate and work with another consistently. Those individuals or groups who make decisions and have new ideas regarding school practice must be positioned to spread the innovations to those who do not have them. The success of the school is then dependent upon its communication network, to either support or constrain implementation and application of innovative practices aimed to improve student performance.

Rogers outlined the essential elements of diffusion, and emphasized the importance of interaction and relationships between individuals. Clearly then, the interactions between and among educators have significant influence on what happens within a school. Educators who have access to their colleagues through communication channels and social networks have opportunities to communicate with one another, make meaning of information received and transferred, create new knowledge or expand upon learned knowledge, and apply it to their instructional practice, ideally to improve the outcomes of their students. Consequently, diffusion occurs, and change at the system-level is equitable, consistent, and universal.

Social Capital Theory

Social capital refers to the value found within social networks as well as the value one gains access to through social networks (Prell, 2011). More generally, social capital has been understood as the actual and potential resources existing in the personal relationships and linkages among members of a group or organization (Bourdieu, 1986; Leana & Pil, 2006; Nahapiet & Ghoshal, 1998). The term first appeared in community

studies, where it was used to describe networks of strong, overlapping personal relationships that developed over time within city neighborhoods. These relationships formed the basis for cooperation, trust, and collective action, serving a critical role in ensuring the survival and proper functioning of such neighborhoods (Nahapiet & Ghoshal, 1998), implying that the capital produced via the network of community members provided them with skills and vital information to stay productive as a community.

Research on social capital from a social network perspective tends to focus on how the structure of the social network relate to various outcome measures, and endorses the idea that the networks serve valuable resources for the management of social happenings (Prell 2011; Nahapiet & Ghoshal, 1995). For example, Leana and Pil indicated that the structural dimension, or the overall network of relationships, is able to facilitate information sharing and the exchange of knowledge among individuals (2006). More specifically, the relational dimension accessible through the network is able to foster enhanced levels of trust among individuals, which in turn encourages an environment of collaboration. The cognitive dimension, which develops over time as individuals interact with one another as part of the group, enables the group to develop a shared vision and common goals (Leana & Pil, 2006; Zito, 2011).

Social capital is also quite prominent in diffusion of innovation. Given the emphasis and importance on communication channels and social systems, the innovation may be carried across the network, not through formal lectures or training, but through positive social interaction. The social capital, which is accessible and created through these social interactions, is then diffused across the system. Individuals within the

network possess a certain knowledge that is then transferred to others, allowing for continued diffusion of the innovation, given a well-structured network.

Teams as Vehicles for Diffusion of Innovation and Access to Social Capital

Groups, teams, and committees of people who engage in inter-professional collaboration are “the basic building blocks of an intelligent organization” (Pinchot & Pinchot, 1993, p. 66). Because teams are the predominant unit for decision making and getting things done in any organization (Barnard, 1950; DuFour & Eaker, 1998; Senge et al., 2000; Gajda & Koliba, 2008), they serve as the best mechanisms for communication, access to social capital between and amongst school staff members, and diffusion of innovation. Communication can and does happen spontaneously between teachers and actors in any given network, for example through friendships or informal gatherings or commonalities (Deal, Purinton, & Waetjen, 2009). However, teams, i.e. connections between people created by design, form an established network structure and increase the likelihood that educators will collaborate and communicate consistently about what is happening within the school (Gajda & Koliba, 2008; Dufour & Eaker, 1998; Woodland, Barry, & Crotts, 2014). Educators who share membership within and between teams have access to their colleagues and are best positioned to diffuse information across the network.

Optimal school reform is more likely when the team communication network is structured to support diffusion of innovation, and when the collaborative process of the teams within the network is of high quality (Gajda & Koliba, 2008; Woodland & Hutton, 2012; Woodland, Barry & Crotts Rohr, 2014). High quality teacher teaming is empirically linked with increases in teacher knowledge and skills, instructional quality,

and student learning (Garet, Porter, Desimone, Birman, & Yoon, 2010; Goddard, Goddard, and Tschannen-Moran, 2007). Effective teacher teams engage in a process focused on improving students' achievement and solving problems (Woodland & Hutton, 2012; Gajda & Koliba, 2008; Hiebert, 1999). One model of an effective team process is DDAE (Gajda & Koliba, 2008; Woodland & Hutton, 2012), in which teams follow a cycle of inquiry towards problem solving and improving practice. More specifically, a well functioning team may include teachers solving problems of instructional practice through a continuous cycle of *dialogue*, *decision-making*, *action-taking*, and *evaluation* (DDAE). The process of DDAE around shared problems of instructional practice builds the capacity of teachers to make significant, positive changes in their instructional practice and produce significant increases in student achievement (Darling-Hammond, Aness, & Ort, 2002; Gajda & Koliba, 2007; Goodlad, Mantle-Bromley, & Goodlad, 2004; Hiebert, 1999; US Dept. of Education, 2001; Wasley et al., 2000; Zito, 2011; City, Elmore, Fiarman, & Teitel, 2009; Stevens & Kahne, 2006; Dufour & Eaker, 1998, Dufour, Dufour, & Eaker, 2005; Pounder, 1998).

Dialogue

Highly functioning teacher teams will engage in collective dialogue about student learning, the effects of instruction on student achievement, and how to provide an appropriate level of challenge and support to every student (Woodland & Hutton, 2012). Lower functioning teacher teams may discuss more administrative issues such as grouping and placement, scheduling, materials, and curriculum alignment (Pappano, 2007). Effective dialogue includes member attendance, balanced and shared participation of members, a set agenda and summary of meetings, organized facilitation, procedures

for disagreements, and a consistent focus on student achievement and instructional practice (Woodland & Hutton, 2012).

Decision Making

The most important decisions that teachers can make are those that deal with the quality and merit of their individual and collective instructional practices and their effects on student learning (Little, 1990; Valli & Buese, 2007). Sharing curriculum ideas, swapping strategies, choosing textbooks, or crafting discipline procedures are not enough to improve practice and increase student learning (Gajda & Koliba, 2008; Woodland & Hutton, 2012). Teachers at all levels must uncover and determine relative differences in instructional quality and make decisions about what and how to improve practice through group consensus, transparency, a process, and focus on relevant topics (Woodland & Hutton, 2012).

Action

By itself, a decision, or a plan to act, does not produce results (Woodland & Hutton, 2012). If teachers do not take actions as a result of their team decisions, the cycle of inquiry ceases to move forward and continuous improvement falters (Gajda & Koliba, 2008). Actions must be directly related to the improvement of practice and entail a degree of sophistication through documentation of actions, equity, and coordination (Woodland & Hutton, 2012). Without action of the team's members, progress towards implementation or change is halted, and process towards improvement is less likely to progress. Team members must follow through on their decisions to ensure continuous progress toward instructional goals.

Evaluation

Evaluation of decisions and actions is a crucial component of a fully developed teacher team process of cycle of inquiry (Woodland & Hutton, 2012). Educators must continually assess their effectiveness using data (i.e. tangible evidence that students are acquiring essential knowledge, skills, and dispositions and practices and policies are in place; Earl & Katz, 2006; Goldring and Berends, 2009, Stiggins, 2005; Dufour et al., 2005). The extent to which the actions of a teacher team and changes made to practice have merit or worth is determined through evaluation and action research: the systematic collection, analysis, and use of data (Patton, 2012; Gay, et al., 2005). Teachers in high functioning teams will systematically collect and analyze data whereas less effective teacher teams tend to rely on opinion, memory, and disjointed observation.

In summary, social relationships are created through interpersonal interaction, whether they be communication, attendance, attitudes, or just exposure. Inter-personal interaction can be done by design via the formal team structure. Social capital is cultivated and accessed via interaction, and the benefits of the social interaction are greater when a network is structured to support further interaction and consequently, diffusion of capital (e.g. knowledge, beliefs). Theoretically, when ideas and knowledge are diffused across a network of individuals, they are more likely to adopt and implement these ideas into current knowledge base. Ideally, adoption and implementation of ideas and knowledge regarding best practice will then change their behavior and beliefs. In the educational setting, this may translate into changing instructional practices, ideally designed to improve and enhance academic, social, emotional, and behavioral student outcomes.

Prevention of Social-Emotional-Behavioral Problems

Of all institutions, schools play the largest role in intervening with the social, emotional, and behavioral problems that face youth (Koppelman, 2004; Mayer, 1995; Sprague & Walker, 2006; Sugai & Horner, 1994; Walker et al., 1996). However, the ways in which schools have traditionally addressed behavioral concerns has been problematic. Historically, traditional approaches have relied on restrictive, reactive, and punitive approaches to managing and changing student behaviors. Schools often have inconsistent rules and behavioral expectations and inconsistent and punitive management practices (Lewis, 2006). The use of reprimands, penalties, loss of privileges, detention, suspension, corporal punishment, and expulsion, with the exclusion of proactive and positive approaches does not bring long-term change in behavior (Colvin, Kame'enui, & Sugai, 1993; Sprague & Walker, 2006). Indirect intervention approaches, such as counseling, used in isolation are ineffective and actually increase the incidence of antisocial behavior (Sprague et al., 2001). Zero tolerance policies fail to give students the opportunity to learn and practice social skills and self-management skills (Bear, 2010; Colvin, Kame'enui & Sugai, 1994). In fact, exclusive use of punishment leads to increases in aggression, truancy, vandalism, harassment, dropping out, and other problem behavior (Lewis & Sugai, 1999; Mayer, 1995; Mayer & Sulzar-Azaroff, 1991; Skiba & Peterson, 1999; Sprague et al., 2001). In response to the lack of empirical support for reactive and punitive behavior management, schools have been urged to look toward a more systematic proactive approach to address behavior. Sugai and Horner (2009) state, "the reauthorizations of the Individuals with Disabilities Educational Act (1997, 2004) increased attention to the use of scientifically based behavioral interventions and

supports, in particular to prevent the development of problem behaviors and to address the educational needs of students with serious behavior challenges.” (p. 226-227).

Schools also have access to large numbers of children and are settings uniquely and ideally positioned to proactively provide early efforts aimed at preventing problems and promoting positive social, emotional, and behavioral outcomes for children. Researchers have found that prevention programs can both reduce mental disorders and problem behaviors and promote youth competence (Greenberg et al., 2004; Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011). Evidence-based prevention efforts, when implemented early in a student’s development, improve the outcome of the student both behaviorally and academically, and in doing so improves the overall health and functioning of the school.

In schools, prevention oriented reforms have become widely known as Response to Intervention (RtI), Multi-Tiered Systems of Support (MTSS), Positive Behavioral Interventions and Support (PBIS), etc. Conceptually, these models are adapted from public health models, and typically include a framework for offering a population of individuals universal, selective and indicated intervention support (Merrell & Buchanan, 2006; Strein, Hoagwood, & Cohn, 2002). Universal support (Tier 1) is offered preventatively and consistently to all individuals, which often consists of the core academic and social curriculum and instructional delivery practices that are offered to all students. Selective support (Tier 2) is more intensive than universal support and is offered to those who are not entirely responsive to what is provided universally. This support is targeted and may include curricula or interventions offered to small groups of students. Finally, indicated support (Tier 3) is intensive and individualized. In schools,

this may include specialized instruction in very specific domains. In essence, decisions made within tiered support frameworks are those that adjust the intensity and nature of support depending on assessment of students' needs and responsiveness (Adelman & Taylor, 2006). Research in schools, that have taken a preventive orientation to mental health and behavior following a multi-tiered model of supports, reported associated improved academic outcomes for students, a stronger connection to school among students, a more positive school climate, reduced school violence and peer victimization, and increased organizational health (Bandura, & Zimbardo, 2000; Bear, 2010; Bradshaw, Koth, Thornton, & Leaf, 2009; Caprara, Barbaranelli, Pastorelli, Luiselli, Putnam, Handler, and Feinberg, 2005; Domitrovich, Bradshaw, Greenberg, Embry, Poduska, & Ialongo, 2010; Horner et al., 2009; Metzler et al., 2001; Zins, Bloodworth et al., 2004).

Positive Behavior Interventions and Supports (PBIS)

One commonly used system-wide framework for improving student outcomes is PBIS. It is a prevention-oriented framework focused on creating environments that reflect safety, social competence, and healthy school climates and has been adopted by nearly 20,000 schools in the United States (Horner, 2013). Research also suggests that implementation of PBIS supports academic performance (Algozzine, Putnam, & Horner, 2010; Luiselli, Putnam, Handler, & Fienberg, 2005; McIntosh, Chard, Boland & Horner, 2006; McIntosh, Horner, et al., 2006; Metzler, Biglan, Rusby, & Sprague, 2001; Musscot et al., 2008; Bradshaw, Koth, Thornton, & Leaf, 2009; Horner et al., 2009) and reductions in problem behavior (Colvin et al., 1993; Horner et al., 2009; Nelson, 1996; Nelson, Hurley, Synhorst, & Epstein, 2008; Nelson, Martella, & Galand, 1998; Nelson, Martella, & Marchand-Martella, 2002; Safran & Oswald, 2003) and out-of-school

suspensions (Bradshaw, Mitchell, & Leaf, 2009; Horner et al., 2009).

The conceptual model of PBIS is a collaboration of (a) principles of applied behavior analysis, (b) the multi-tiered prevention logic from community health (Walker et al., 1996), (c) rigorous use of universal screening and progress monitoring (Fairbanks, Sugai, Guardino, & Lathrop, 2007; Fuchs & Fuchs, 1986; Shinn, Walker & Stoner, 2002), (d) integration of behavioral and education practices for improving behavior and learning (Algozzine & Algozzine, 2009; McIntosh, Horner, Chard, Boland, & Good, 2006), and (e) the implementation technology needed to apply effective practices at large scales (Fixsen et al., 2005).

PBIS is a multi-tiered approach focusing on student social, emotional, and behavioral learning. It is guided by the following principles: 1) develop a continuum of scientifically based behavior and academic interventions and supports; 2) use data to make decisions and solve problems; 3) arrange the environment to prevent the development and occurrence of problem behavior; 4) teach and encourage prosocial skills and behaviors; 5) implement evidence-based behavioral practices with fidelity and accountability, and 6) screen universally and monitor student performance & progress continuously (OSEP Center for PBIS, 2009).

PBIS is not a packaged curriculum, strategy, package, or product (Colvin, 2010, Sugai & Horner, 2006). Rather, it is a framework in which essential features interact as a system, which includes continuum of behaviorally-oriented practices, measurement tools and data gathering that informs decision-making regarding service delivery, and organizational systems and structures that support the implementation of practices and ongoing use of data (Horner, Sugai, Todd, & Lewis-Palmer, 2005; Sugai & Horner,

2006). Universal practices associated with a PBIS model include clearly defining, teaching, and acknowledging behavioral expectations and engaging in consistent strategies for discouraging undesirable behavior across all school settings. These practices are created by school staff and are able to be seen across all school settings (classrooms, cafeteria, hallway, bus, playground, etc.). All members of the school community including staff, parents, and students define and know the expectations. They work collaboratively to teach and acknowledge the same expected behaviors and prevent undesired behaviors in clear and consistent ways (Sugai & Horner, 2006).

Measurement of how well school staff are implementing PBIS practices and how students are responding to these practices is critical (Sugai & Horner, 2006). Ongoing assessment provides school leaders and stakeholders with information necessary for validating decisions, identifying areas of success and targeting areas of need, making decisions, and provide a general picture of the progress of an innovation. Data reveal strengths and weaknesses and provide direction (Learning Point, 2004). Prior to answering questions related to the outcomes of social-behavioral learning, it is essential to assess if practices that enable student learning have actually been implemented. A critical feature of high quality implementation is evidence of the extent to which critical features of PBIS are being or have been implemented as intended (Algozzine et al., 2010). A range of measures allows schools to assess the extent and quality of implementation of PBIS practices school wide. These measures reveal if all practices are apparent in all settings and to what extent. Together, these data produce a comprehensive report of overall PBIS implementation. Measures include, but are not limited to: the Team Implementation Checklist (TIC; Sugai, Horner, Lewis-Palmer, & Rossetto Dickey,

2011), Benchmarks of Quality (BoQ; Kincaid, Childs, & George, 2010), Self-Assessment Survey (SAS; Lewis & Sugai, 1999; Sugai, Tood, & Horner, 2000; 2009), School-wide Evaluation Tool (SET; Todd, Lewis-Palmer, Horner, Sugai, Sampson, & Phillips, 2012), and Tiered Fidelity Inventory (TFI; Algozzine et al., 2014).

Measures of implementation, generally, assess the extent to which the essential features necessary for PBIS are in place within a school. They include the establishment of a functioning PBIS leadership team, staff commitment, leadership support, procedures for dealing with discipline, development of expectations and rules, establishment of a reward/acknowledgement system, systems and procedures for teaching expectations/rules, data entry and analysis plans and routines, and a plan for continued implementation and evaluation (Sugai et al., 2010). When PBIS is implemented, these essential features are in place through observation, documentation, application to classroom management and instructional practice, and embedded within normal school functioning. Adequate implementation is generally observed as 70 to 80 percent or higher, depending on the measure of implementation, which implies that intensive coaching and training are no longer necessary. Any score below 70 to 80 percent shows low implementation, and may indicate additional targeted support is needed to see essential features of PBIS in place (Sugai, 2006; Cohen, Kincaid, Elfner Childs, 2007; McIntosh et al., 2011; Kincaid, Childs, Blase, & Wallace, 2007).

In addition to measuring the implementation of PBIS efforts, it is critical that school professionals consistently collect outcome data. These data are considered indicators of the defined valued outcomes and may focus on academic achievement, school climate, school discipline and/or social-emotional health. Often, office disciplinary

referrals (ODRs) are a source of data used to describe the overall behavioral climate of a school and can be used to evaluate the extent to which a school-wide, universal intervention such as PBIS is effective. ODRs have been correlated with important outcomes such as student behavior, student perceptions of school climate, school and classroom safety/orderliness (Irvin, Tobin, Sprague, Sugai, & Vincent, 2004). ODRs have been previously defined as “an event in which (a) a student engaged in a behavior that violated a rule/social norm in the school, (b) a problem behavior was observed by a member of the school staff, and (c) the event resulted in a consequence delivered by administrative staff who produced a permanent (written) product defining the whole event” (Sugai, Sprague, Horner, & Walker, 200, p. 96). When ODR data are consistently collected, managed, and analyzed, they can be helpful in illuminating school professionals’ understanding of the overall behavioral functioning of their school. These data rely on a shared understanding among staff for which behaviors should be managed in the classroom versus those that need to be handled by an administrator.

PBIS Systems

School staff members need to have structures and mechanisms available that support their work related to PBIS. Structures and mechanisms are the foundation for implementation and provide consistency and expectations in practice. Together, they create the whole framework (Sugai, 2006). School leadership provides the catalyst and creates the conditions for diffusion of innovation and the successful implementation of school reform (Leithwood, Harris, & Hopkins, 2008). A key variable in the successful implementation of any school-wide initiative is the identification or establishment of a leadership team responsible for facilitating the innovation (Marzano, Waters, McNulty,

2005) and having authority over the innovation (Horner et al., 2012). The establishment of a PBIS leadership team is an essential component in the planning and delivery of PBIS-related professional development, building capacity to enact PBIS practices, using data to make decisions, and communicating and diffusing the initiative school-wide. Careful development of the leadership team is defined as an essential process for achieving high fidelity and high sustainability of PBIS (Horner et al., 2012).

An effective PBIS Leadership Team is recommended to consist of a group of individuals that is representative of the school. For example, in addition to an administrator, grade level teachers, special educators, a behavioral specialist, paraprofessionals, parents, and even students may be considered “representative” stakeholders. The collective knowledge, skills, and access to resources created by the team members are necessary for setting a vision for implementation, developing and carrying out a plan to fulfill that vision, and providing the necessary professional development and support to staff (Coffey & Horner, 2012). Stakeholder representation is also important “to ensure careful and thorough consideration of the implications of proposed decisions for groups impacted by the team’s decisions, and may have a positive impact on educators’ buy-in to adopted practices” (Broxterman & Whalen, 2013). A broad team base is considered essential to ensuring a manageable workload for team members, which in turn helps to maintain morale and motivation (Taylor et al., 1999). Schools that sustainably implement school-wide practices are those in which leadership teams are representative and carve out time to meet at least monthly to use student data and/or process data to problem-solve, to target further professional development needs, and to identify information that needs to be communicated school-wide (McIntosh et al.,

2013).

Practices with a team-based approach to implementation are more likely to achieve adequate fidelity of implementation and see improved outcomes (Fixsen, Blase, Duda, Naoom, & Van Dyke, 2010). Effective leadership team meetings tend to be those in which participant roles are clearly defined and the meeting itself is organized. For example, Newton, Todd, Algozzine, Horner, and Algozzine (2009) suggest that PBIS leadership team meetings have an assigned facilitator, recorder, data analyst, and active members. Having a defined process for what happens before, during, and after meetings is critical, as is having a clear agenda that makes room for previous discussion points, current problem-solving, and action steps. Algozzine et al. (2009) have created a model that enables teams to effectively use time to engage in data-oriented problem-solving. Schools engaging in Team-Initiated Problem-Solving (TIPS) meetings are those that effectively collect and manage PBIS implementation and outcome data, regularly use those data to generate precise problem statements, set measurable goals for behavioral improvement, explore and implement evidence-based interventions based on analysis of data, monitor the fidelity with which interventions are implemented, and evaluate the effectiveness of interventions in an ongoing way. Research suggests that the TIPS model has increased the organization and thoroughness of team meetings, and additionally has improved teams' use of data-based decision-making (Newton, Algozzine, Algozzine, Horner, & Todd, 2011; Todd et al, 2011).

PBIS Implementation

The implementation of PBIS, like any large-scale innovation, takes on a systems approach, in which the collective actions of individuals within the school predict how the

school operates (Lewis, Barrett, Sugai, & Horner, 2010; Colvin, 2010). All individuals within the school have a common goal and consistently use the universally known routines and practices (Horner, 2003). As PBIS is a systemic effort, it includes the effective and efficient selection and implementation of practices by school personnel (e.g., teachers, school psychologists, administrators). Systems include the development of policies and guiding principles, operating routines, resource supports, and administrative leadership. With such systems in place, internal behavioral expertise and capacity are developed, and data-based decision making is emphasized to improve the selection, adoption, outcomes, and durability of practices (OSEP, 2004). While relying on “experts” to deliver training and provide on-going technical assistance is a long-standing model within education (Guskey, 2000), school-wide reform depends on building “expertise” across all educators within a school (Lewis et al., 2010), suggesting that professional learning and development will have to be embedded into the jobs and daily functions of the educators. This can be done through a well-formed communication network. In this sense, the capacity for schools’ networks to support ongoing high leverage professional learning through diffusion of the innovation is a major consideration in the implementation of far-reaching behavior support systems, such as PBIS.

Literature regarding the implementation of PBIS suggests it takes three to five years to implement PBIS, and it occurs in six stages, allowing for the innovation of PBIS to diffuse across the school network (Fixen et al. 2005; Fixen, 2011). Although these phases are not necessarily linear, they provide a framework to follow and help to direct school leaders’ decision-making and activities in the process towards implementation. In the Exploration/Adoption stage, users make the decision to commit to adopting the

program and policies and supporting the successful implementation of PBIS. They will consider if it will meet a need in their school, align with the school's culture and established practices, and have the capacity and support of school staff, administrators, and district leadership. Fixsen et al. (2005) note that training does not start in this stage because it is a time only for decision-making. Implementation continues only after key stakeholders have had the time to examine current status, consider options, and determine the feasibility and value of a new approach to how things are done within their school (Horner et al., 2012).

Upon the end of the first stage, schools then move into the Installation stage, in which they set up an infrastructure and foundation so that successful implementation can take place and be supported. Activities in this phase include establishing a team and its practices and routines, creating systems for data collection, development of diffusion practices and training, and initial decision making of core PBIS practices such as defining and teaching behavioral expectations and consequences. Horner et al (2012) emphasize that a successful installation stage is one where a school identifies how to make the practices fit into the local social, cultural, political, and geographic context. The capacity of the network, specifically, is of utmost examination during this phase. The network must support the diffusion of these practices to become in place across settings and groups of school staff. Disconnected networks in which school staff do not have venues to interact and converse with one another about decisions regarding PBIS impede systematic implementation of PBIS. Conversely, collaborative networks in which school staff have ample focused opportunities of exposure and communication about PBIS

support its implementation and sustainability (Finnigan & Daly, 2012; Woodland, Barry, & Crofts Roohr, 2014).

Then occurs a transition into the Initial Implementation stage, in which school users put practices in place, but try them out on a small-scale. This may include putting PBIS into place in just one setting like the cafeteria, or with one grade level, or certain elements. This stage is important to try out what had been planned and identify any organizational, technical and practical barriers encountered at first try of PBIS (Fixen, 2001; Horner et al., 2012). Initial implementation involves documenting that a practice is possible and produces the outcomes promised. Of major importance for PBIS, however, initial implementation focuses using it not as a time of demonstration, but establishing investment in the school's capacity for training, coaching, evaluation, and development of behavioral expertise (Horner et al., 2012), all with the intent to send the message that the school's network is capable of supporting expansion and sustainability of this major initiative. Any problems within the school's network may be noticed within this phase, and as such, adjustments are made to best support diffusion through communication and relationship-building of staff.

The next stage, according to Fixen and his colleagues (2005; 2011) is Full Implementation. This phase includes expanding PBIS school-wide. The structure and properties of the communication network of the school support the diffusion of PBIS, as all elements are put into place, at all tiers and all settings. Training and coaching procedures are put in place and refined, and capacity to sustain them is established (Fixen et al, 2005; Fixen, 2011; Horner et al., 2012). PBIS leadership team also establish schedules for continuous assessment of implementation and procedures for improvement.

The fifth and sixth stages of implementation are Innovation and Sustainability (Fixen et al., 2005). Because schools are highly dynamic settings (Horner et al., 2012), sustained implementation of PBIS must include active adaptation and continuous improvement (Colvin, 2010). PBIS is not a one time installation, and should be modified based on the needs of the school culture, expectations of the community, and experiences of schools staff tasked with implementing it. Organizational culture, leadership, and staff need to be nurtured and maintained. This translates into continuously training school staff, evaluating practice, configuring the network to support continued diffusion, and collecting implementation fidelity data to best meet the needs of all school community members (Fixen et al., 2005; Fixen, 2011; Horner et al., 2012).

Facilitators of PBIS Implementation and Sustainability

PBIS, like any school-wide practice, requires significant time, effort, and resources to implement. Sometimes PBIS is highly implemented and sustained, while other times it is initially adopted, but quickly weakened or abandoned over time, leading to low levels of implementation (Colvin, 2010). Research suggests that passive strategies, such as guidelines and manuals or training alone are not effective strategies for implementation of PBIS (Schechtman, Schroth, Verme, & Voss, 2003; Schofield, Edwards, & Pearce, 1997; Showers & Joyce, 1996), while ongoing training and coaching, development of systemic routines and practices, and support from the whole school community are associated with stronger reports of implementation (Sugai, 2006; Kincaid et al., 2007; McIntosh et al., 2009; 2011; Horner et al., 2013).

Doolittle (2006) completed a study of 285 schools identifying what critical features of PBIS implementation predicted (a) initial implementation (full

implementation within 3 years) and (b) sustained implementation (full implementation for 5 years). Her results indicated that systems for teaching expectations and use of school-wide data were significant predictors of initial implementation. Effective administrator and school team leadership and an active student reward system were significant predictors of sustained implementation.

Bambara, Nonnemacher, and Kern (2009) completed a qualitative interview study of factors affecting sustainability of individual student support systems within SWPBS. The authors identified five factors critical to sustainability: school culture, building administrator support, time efficiency, capacity building, and stakeholder involvement.

In their study of PBIS implementation, Kincaid, Child, Blase, and Wallace (2007) systematically worked with schools of high PBIS implementation and low implementation to determine the barriers and facilitators of implementation. Barriers included lack of time, high staff turnover, lack of knowledge, and misunderstandings and misperceptions about PBIS. A fit into the school culture and social system, leadership team preparation and representative membership, ongoing training and administrative support, positive student outcomes, and staff buy in served as common facilitators of PBIS implementation (2007).

More recently, McIntosh and colleagues (2013) measured the factors most predictive of sustained implementation of PBIS across schools. The authors had previously developed a model of sustainability, which delineated priority (staff commitment, administrator support, resources, and integration into new and existing efforts), effective teaming and skills, efficiency, and continuous regeneration by way of using data and building capacity as the factors necessary for sustained implementation.

While all factors predicted sustainability within all schools, the two most associated with sustained implementation of PBIS were the functioning of the PBIS leadership team, especially its use of data, and capacity building (2013).

Conclusion

SNA, diffusion of innovation, social capital, and quality of school staff member team process all inform the theoretical foundation of this study, and have been supported and explained in many disciplines and numerous writings. Each one is concerned with relationship building, communication networks, and the influence of social ties on greater learning, productivity, and performance. Given that school-wide efforts such as PBIS has taken on a systemic approach to implementation, it seems appropriate to study their implementation through a social network perspective.

Relationships between school staff members are formed by interactions within and between high functioning teams; these connections between teams form a school's communication network. The quality, attributes and dynamics of the network structure have the capacity to support or impede diffusion of innovations related to school-wide practices. Implementation occurs when the innovation is diffused. Furthermore, PBIS is more likely to be implemented and sustained when there is capacity to support it and a well functioning team leading the charge within the school's larger teaming network. Therefore, when considering implementation, we must consider the innovation itself, the capacity of the network, AND the quality of internal process for collaboration of its teams.

CHAPTER 3

METHODOLOGY

Introduction and Statement of the Problem

Communication networks structured to support implementation of systemic reform are associated with improving the quality of instructional practice in K-12 education. Teams are the predominant unit for decision-making and getting things done in any organization (Barnard, 1950; DuFour & Eaker, 1998; Senge et al., 2000; Gajda & Koliba, 2008), therefore they serve as the primary mechanism for intra-organizational communication. A school's team communication network supports or constrains the spread of knowledge, diffusion of innovation, and adoption of reform. School professionals are faced with the tremendous task of improving the instructional practices that support the healthy social-emotional-behavioral outcomes of children. Practices aimed at supporting and improving student outcomes are most likely to succeed and be sustained in schools in which school staff members are able to communicate and collaborate with one another via a team structure (McIntosh et al., 2013; Croft, et. al, 2010; Dufour, 2011; Dufour & Eaker, 1998; Gajda, 2004; Gajda & Koliba, 2008; Leana, 2011; Little, 2003; Hattie, 2009; Hord, 2004; Pounder, 1998). To ensure successful implementation and longevity of school-wide reform, leaders and researchers must assess schools' capacity of their communication networks to support the diffusion of best practice and instructional innovation (Coburn, Choi, & Mata, 2010; Deal, Purinton, & Waetjen, 2009; Daly, et. al, 2010). Analysis of team communication networks enables educators to make informed decisions about improving children's school environments to better address their needs.

Diffusion of innovation is elemental to the consideration of implementation of school-wide initiatives and reform efforts. Diffusion of innovation theory (Rogers, 1963) posits that when an idea is adopted by a user and applied to his or her practice, it is considered implemented. Therefore, when a new idea has been implemented, diffusion has occurred (Rogers, 1995; Dusenbury & Hansen, 2004; Oldenburg, Sallis, French, & Owen, 1999). For the purpose of this study, implementation is considered a direct indicator of diffusion.

A large body of research has pointed to communication networks as valuable foci in education reform and innovation and systems-level implementation research (Deal, Purinton, & Waetjen, 2009; Daly et al., 2010; Moolenaar, 2012; Moolenaar & Daly, 2012; Penuel et al., 2010). PBIS is a widely used school-wide framework in schools aimed at promoting positive social-emotional-behavioral health by providing systematic behavioral supports for all students (Horner, 2013; Sugai & Horner, 2006). With school-wide efforts, the intent would be for every educator, in every setting, to become aware and adopt practices by way of diffusion and then implement each associated system and practice.

The purpose of this study was to closely examine the relationship between structure of team communication networks and implementation of PBIS. First, this study attempted to identify which network structural positions and properties supported or constrained diffusion of PBIS practices, by determining how network structural properties were related to the level of PBIS implementation. Second, the study aimed to detect which network structural positions and properties of the PBIS leadership team supported and constrained diffusion of PBIS practices, by determining the relationship of

the network structural position and properties of the PBIS leadership team and the level of PBIS implementation. Third, this project sought to identify how the PBIS leadership team's quality of internal process for collaboration supported or constrained diffusion of PBIS, by determining how the PBIS leadership team's internal process for collaboration was related to PBIS implementation.

SNA, the study of relationships and networks, and their influence on individual, group, and system behavior, served as the primary methodological approach to this study. SNA was chosen intentionally as the study's approach and design because allows for making insights into how network structure supports or constrains diffusion of innovations.

Research Questions

The following three research questions, and their sub-questions, were addressed in this correlational, network analysis study:

1. To what extent are the structure and properties of a school's team communication network related to the level of PBIS implementation?
 - a. What is the relationship between general network properties (number of vertices and number of edges) as well as properties indicative of cohesion (density, average path length, and centralization) and percentage of PBIS implementation, as measured by the Self Assessment Survey (SAS)?
 - b. Which network structural properties of the team communication network support or constrain diffusion of PBIS?
2. To what extent does the structural position and properties of the PBIS leadership team relate to the level of PBIS implementation?

- a. What is the relationship between network properties indicative of influence (centrality) and percentage of PBIS implementation, as measured by the SAS?
 - b. Which network structural properties of the PBIS leadership team support or constrain diffusion of PBIS?
3. To what extent does the quality of the internal process for collaboration of the PBIS leadership team relate to the level of PBIS implementation?
- a. What is the relationship between the quality of the PBIS leadership teams' internal process for collaboration, as measured by the Teacher Collaboration Assessment Survey (TCAS) and percentage of PBIS implementation, as measured by the SAS?
 - b. Does the quality of the internal process for collaboration of the PBIS leadership team support or constrain the diffusion of PBIS?

Design and Hypotheses

The purpose of this study was to investigate the relationship between the structure of team communication networks and implementation of PBIS. This was achieved through the analysis of the communication networks of teachers and other school staff members from schools currently implementing PBIS. The study used SNA as its primary methodological and analytic approach and followed a descriptive and correlational design (Gravetter & Wallnau, 2007). A descriptive design allowed for the observation of the school networks within the context of PBIS implementation without any manipulation of variables. A correlational design addressed research questions aimed at determining if there was a relationship between the variables described (network structure and

properties and PBIS implementation). The underlying theoretical model directing data collection and analysis was that structure of communication networks supports or constrains school staff members' access to social capital and overall school capacity for diffusion of innovations.

This study was designed to explore three main questions. First, the study sought to identify properties of the network that would support or constrain diffusion of PBIS. Second, the study aimed to determine structural positions and network properties of the PBIS leadership team that would either support or constrain diffusion of PBIS. Third, it aimed to determine how the quality of the internal process for collaboration of PBIS leadership teams supported or constrained diffusion of PBIS. Given the study's aims and assumptions, hypotheses for this correlational research study were as follows:

(H1): There is a moderate to strong relationship between network properties and PBIS implementation.

(H1a): A moderately connected and far-reaching network in which each team is connected to at least one other support diffusion of PBIS. A disconnected and short-reaching and highly centralized network in which teams are isolated or frequently inaccessible, constrain diffusion of PBIS.

(H1b): Measures of network properties and of network cohesion are moderately related to the level of PBIS implementation.

(H2): There is a moderate to strong relationship between network structural properties of the PBIS leadership team and PBIS implementation.

(H2a): PBIS leadership teams in highly central and influential positions within the network support diffusion of PBIS. PBIS leadership teams with positions on the periphery and who are inaccessible constrain diffusion of PBIS.

(H2b): Measures of centrality are moderately related to the level of PBIS implementation.

(H3): There is a strong, positive relationship between the PBIS leadership team's quality of the internal process for collaboration and PBIS implementation.

(H3a): PBIS leadership teams who show high quality of internal process for collaboration (i.e. engage in a cycle of inquiry) support diffusion of PBIS. PBIS

leadership teams who show poor quality of internal process for collaboration constrain diffusion of PBIS.

(H3b): PBIS leadership team inner process for collaboration is strongly related to the level of PBIS implementation.

Setting and Context

The study was conducted in an urban school district in the Commonwealth of Massachusetts. The district serves over 25,000 students from preschool to grade 12 and consists of 36 elementary schools, 10 middle schools, and 5 high schools. The district includes traditional public school models, charter and magnet schools, and some alternative settings. During the 2013-2014 academic year, 52% of the student body was male and 48% was female. In terms of ethnicity, 20% of students were African American, 2% Asian, 62% Hispanic, 12% White, and 3% Multiracial. Approximately 87% of students received free or reduced price meals (Massachusetts Department of Elementary and Secondary Education [MA DESE], 2014). In terms of school and teacher demographics, 20% were male and 80% were female. 5% of teachers were African American, 1% Asian, 5% Hispanic, 89% White, and 1% Multiracial. 94% of teachers were licensed and considered “highly qualified” (MA DESE, 2014).

The district is one that was identified with “Level 4” status, indicating that the district, overall, was among the lowest performing and least improving based on state accountability measures. The state classifies schools and districts from Level 1 (highest performing) to Level 5 (lowest performing). Of the district’s 55 schools, 23 were at Level 3 status and ten schools were identified as Level 4 status based on state accountability guidelines. Through its district strategic improvement plan, the district sought to improve student performance in these schools by introducing a number of initiatives, including additional learning time per day, improved and additional professional development for

teachers, and the institution of health and wellness support networks to students and families. One major reform effort aimed at improvement of Level 3 and 4 schools in the district was the introduction of PBIS. Implementation of PBIS started in the 2011-2012 school year with 16 schools across all grade levels and followed a cohort model, in which groups of schools started implementation at the same time and received coaching and training together. Each year additional cohorts of schools were added and by 2013-2014, 24 schools district-wide had begun implementation of PBIS.

Recruitment

Prior to initiating the recruitment process, the study was approved by the Institutional Review Board (IRB) of the Human Research Protection Office of the College of Education at the University of Massachusetts Amherst and the IRB of the Assessment, Research, and Accountability Department of the district.

Because the study was aimed to analyze the relationship of the structure of communication networks and implementation of PBIS, the investigator sought only to include those who had been identified as implementing PBIS. In addition, to control for variability in grade level of students, only elementary schools were intended to be part of the sample. Sixteen of the 24 schools implementing PBIS within the district were elementary schools.

After permission to conduct the study was granted from several district leaders and stakeholders of PBIS within the district, schools were recruited for participation by means of an informational email distributed to building administrators (principals and/or assistant principals responsible for oversight of PBIS activities). Per directives from district leadership, emails were not directly sent by the investigator, but rather via the

district behavior specialists who served as the in-district PBIS coaches assigned to support each school and had established relationships with the school administrators. The email explained that the purpose of the study was to investigate the implementation of PBIS and the nature and quality of educator networks, at the school-wide level. The email described the basic procedures of the study, focusing on the commitments of administrators and school staff would make distributing and/or completing short surveys (see Appendix A for a sample of the recruitment email).

From the email correspondence, six school administrators initially agreed for their schools to be to part of the study and in turn, their staff to be participants. A district PBIS coach/behavior specialist invited the investigator to meetings with two additional school administrators, in which the study was presented again, and administrators agreed to participate. A total of eight elementary schools were included in the study.

Sample

A power analysis was conducted using the *G*Power 3* software program (Faul, Erdfelder, Lang, & Buchner, 2007) to determine the number of subjects needed for the study. Given the use of two independent data sets (network and implementation), a power analysis for an independent means t-test was run. With a power of .80, an alpha level of .05, and an expected large effect size, $d=.80$, a total sample size of at least 7 subjects (school networks, PBIS leadership teams) was needed. A large effect size was anticipated based on previous research that found the network-level measures or position are associated with performance, innovation, and success across varied professional settings (Ouimet, 2004; Wang & Zhang, 2012; Clifton, Turkheimer, & Oltmanns, 2009).

The sample included eight schools within the district that had implemented PBIS.

The number of staff within each school are in Table 1. Staff included teachers, administrators, counselors, and support staff.

Table 1

Sample Schools and Staff Members

School	Total Staff Members (n=)
School 1	56
School 2	50
School 3	47
School 4	42
School 5	29
School 6	56
School 7	69
School 8	57

PBIS Implementation

As noted previously, implementation of PBIS followed a cohort model within the district. As such, schools started receiving training and technical support from PBIS in-district and out-of-district coaches at different times, starting in 2011. At the time of the study, each school was still receiving training and technical support. Training was identical and teams received it at the same meetings occurring throughout the school year, at which PBIS coaches were present. Table 2 shows each school's cohort, initial training date, and date of implementation.

Table 2

School Implementation Timeline

School	Cohort	Training Date	Date of Implementation
School 3	1	February 2011	September 2011
School 8	1	February 2011	September 2011
School 1	2	June 2011	September 2011
School 4	2	June 2011	September 2011
School 6	2	June 2011	September 2011
School 2	3	May 2012	September 2012
School 5	3	May 2012	September 2012
School 7	3	May 2012	September 2012

In Table 3, Schools are ordered by level of implementation. 70 percent indicates adequate implementation of the essential features of PBIS. As can be seen in Table 3, School 5 demonstrated the strongest overall implementation with 89 percent and School 1 had the lowest reported implementation with 42 percent.

Table 3

Level of PBIS Implementation (Self-Assessment Survey Results)

School	Percent Implemented
School 5	89
School 8	77
School 2	71
School 6	69
School 3	59
School 7	58
School 4	45
School 1	42

PBIS implementation data were collected through the implementation measure used within the district and available from PBISApps.org: the *PBIS Self-Assessment Survey Version 2.0 (SAS)*; Lewis & Sugai, 1999; Sugai, Tood, & Horner, 2000; 2009). The

SAS is used by school staff for assessment of staff awareness of PBIS practices and perception of the implementation status and improvement priority for across four systems: 1) school-wide, 2) classroom, 3) non-classroom, and 4) individual student systems. It includes a total of 46 items, in which respondents rate whether a particular element is “In Place”, “Partially in Place” or “Not in Place” and at a “High”, “Medium”, or “Low” level of priority. Results then provide a status of implementation and can help to inform an action plan for implementing and sustaining PBIS systems throughout the school. It has demonstrated moderate to high-level technical adequacy and shown valuable for program evaluation and applied research of PBIS (Safran, 2006; Hagan-Burke & Burke, 2005).

The School-Wide System subscale of the SAS, which is comprised of 18 items targeted at: 1) the presence of a team, 2) identifying and teaching expectations, and 3) procedures for addressing behavior was used to determine the level of PBIS implementation. Appendix B includes the School-wide subscale of the SAS.

The SAS was completed online by staff members at each school between March and June 2014. Permission to access SAS data was also obtained between March through June 2014 through communication with school administrators, the in-district PBIS coordinator, and the out-of-district PBIS consultant. Survey completion ranged from 20% to 100% across the eight schools. Table 4 shows response rates of the SAS for each school. Schools with lower response rates may limit the validity and reliability of the SAS and accuracy of PBIS implementation.

Table 4

Self-Assessment Survey Response Rates

School	Response Rate Percentage
School 1	20
School 2	60
School 3	34
School 4	100
School 5	76
School 6	50
School 7	78
School 8	58

Procedures and Measures

Data Collection

Data collection occurred in two phases. Phase one consisted of garnering communication network data and creating an inventory and matrix displaying teams and members. In phase two, the investigator gathered information regarding PBIS leadership team quality of internal process for collaboration.

Phase 1: Team Communication Network Raw Data

Data regarding schools' formal teams were collected to generate an accurate inventory and in order to create a map of the team communication network in each school included in the sample, and to thus analyze its structures and properties as delineated by both research questions one and two. A school formal team is a team, group, or committee of staff members within a school. It is purposefully created and organized by school administrators, tied to school operations or improvement goals, and can typically be identified in organizational charts (Woodland, Barry, & Crofts Roohr, 2014). It is not a group or tie created organically outside the formal structure of the organization, such as

friendships, personal relationships, social groups and clubs, common lunch time, ad-hoc planning, or shared or closely placed workspaces or classrooms.

Data collection for SNA has typically been accomplished through surveys and questionnaires (Scott, 2000; O'Malley & Marsden, 2008; Prell, 2011). Descriptive data about the teams were gathered via a survey of each school's administrator and school staff and made into a matrix identifying teams (columns) and their members (rows).

Team Inventory

The Team Inventory is a researcher-created tool to gather information about schools' teams and team members. It follows approaches delineated by the Collaboration Evaluation and Improvement Framework (CEIF; Woodland & Hutton, 2012) and Teacher Collaboration Improvement Framework (TCIF; Gajda & Koliba, 2008), which have been used by school leaders and researchers to identify teams and communities of practice, and improve their network structures and collaborative practices. The Team Inventory employed in this study was adapted from the suggested instruments included in the CEIF and TCIF. The Team Inventory includes six prompts in which respondents identify: 1) the formal teams or groups within a school, 2) members of the teams/groups, 3) members' titles/roles within the school, 4) when and how often teams meet, as well as their 5) duration, and the 6) purpose/focus of each team. See Appendix C for the Team Inventory. Data about titles of team members, team meeting times and durations, and purposes of the teams were not utilized in this study.

Attached to each recruitment email sent to administrators was the Team Inventory. Administrators returned the completed Team Inventory to the investigator via email or hard copy via interoffice mail, based on the preference of the recipient. They

were completed between February and April 2014.

Staff Member Survey

To confirm the accuracy of the data provided through the Team Inventory, the investigator cross-referenced them with a survey of school staff in which they identified their team memberships. The Staff Member Survey is researcher-created and adapted from the tools and approaches to taking inventory of teams and communities of practices within schools and organizations explicated by the CEIF (Woodland & Hutton, 2012) and TCIF (Gajda & Koliba, 2008). It includes three items, in which school staff identified 1) their names, 2) their primary role within the school, and 3) the teams of which they belonged. Staff member surveys prompted staff to check off teams to which they belonged (teams were provided by the administrators via the Team Inventory), and provided spaces to add those teams or groups not identified by the administrator. Each Staff Member Survey was adapted based on the team names per school, but followed a uniform format. Appendix D includes a template of the Staff Member Survey.

Surveys were distributed by hard copy to individual school staff members and returned through a variety of methods (interoffice mail, participation at a staff meeting, and/or picked up directly from school administrative assistants). School staff members who completed the survey were entered into a raffle entry for a gift card as incentive for participation. Participation in survey completion ranged from 13% to 90% across schools, with an overall completion of 53%. Surveys were administered between March and May 2014. Although overall survey completion was 53%, a response rate of 100% was not necessary for the inventory process because administrators had identified and therefore accounted for all staff members and teams of their respective schools via the Team

Inventory, thus creating a full dataset. It was interesting to note that staff added a mean of 3.38 additional teams (range 2 to 6) that had not been identified by administrators through the Team Inventory, indicating that teachers and staff may have a more accurate understanding of teams within their schools.

School Staff Lists and Matrices

Upon cross-reference of administrator and staff surveys, the investigator then compiled a final spreadsheet of school staff and their team memberships, using staff lists available from school websites and/or documents provided by district leaders. This spreadsheet was then sent via email to administrators for confirmation of valid data. 100% of administrators responded with confirmation that their respective school's data were indeed, accurate. Correspondence regarding review of spreadsheets with administrators occurred between March and May 2014.

The final inventory was then used to create a two-mode matrix as an ©Excel spreadsheet. School staff members were listed in rows and teams were listed as the columns. A '1' in a cell represented membership to a team. The inventory of network raw data is both valid and reliable because 100% of administrators verified the final inventories to be accurate, reflecting no discrepancies revealed during the data collection cross-referencing verification process. Administrators confirmed the addition of the teams added by their teachers and staff in the Staff Member Survey. They account for all teams and staff members within each school.

Phase Two: PBIS Leadership Team Internal Process for Collaboration

The third research question aimed to determine the relationship of PBIS implementation with the internal process of the PBIS leadership team and quality of

collaboration within the PBIS leadership team (i.e. the extent to which they follow a cycle of inquiry).

Teacher Collaboration Assessment Survey (TCAS)

The third research question aimed to determine the relationship of PBIS implementation with the internal process of the PBIS leadership team and quality of collaboration within the PBIS leadership team (i.e. the extent to which they follow a cycle of inquiry). Data were collected via self-assessment using the *Teacher Collaboration Assessment Survey (TCAS)*; Woodland & Hutton, 2012; Gajda & Koliba, 2008). The TCAS is included in Appendix E. The TCAS allowed team members to rate their team's internal process, or the extent to which the team followed a cycle of inquiry, which includes the quality of dialogue, decision-making, action-taking, and evaluation that occurs throughout team meetings. The TCAS generated likert scale scores (1-5) for each of the 4 process domains (Dialogue, Decision Making, Action, and Evaluation) and a total score of overall process for collaboration. It is a formative assessment measure that has demonstrated adequate reliability and validity (Crotts, Colvin, Li & Randall; Cook, Foster, and Randall, 2011; Lee & Randall, 2011; Woodland, Kim, & Randall, 2013; Zito, 2011). Analysis of the assessment's internal consistency or inter-item reliability revealed coefficient alphas of at least .930 (Zito, 2011). An assessment of TCAS administration to nearly 600 educators revealed item reliability of separation of the five scales ranged from 0.97 to 1.00 and person reliability of separation from .80 to .90 (Woodland, Kim, & Randall, 2013). In terms of validity, construct, convergent and discriminant validity were demonstrated by the scale scores of the DDAE were more highly correlated with one another (.58 to .83) than other related variables, such as

instructional improvement (.41 to .46), student achievement (.45 to .51), administrative support (.30 to .41). The TCAS' content validity is supported, as it was developed by experts on the topic of teacher collaboration and based on theoretical and empirical knowledge (Woodland, Kim, & Randall, 2013).

Hard copies of the TCAS were given in May and June 2014 to in-school and in-district PBIS coaches, who were responsible for then distributing them to their respective PBIS leadership teams. Each member of the PBIS leadership team at each school completed the TCAS individually during a PBIS leadership team meeting, and returned them to the investigator via interoffice mail. Seven out of eight school PBIS leadership teams completed the TCAS and 100% of PBIS leadership team members at those seven schools completed it. TCAS data were aggregated and analyzed to provide an overall quality of functioning and process for each school's PBIS leadership team (Woodland & Hutton, 2012).

Data Analyses

The primary analytic approach for this study was SNA (Butts, 2003; de Nooy, Mrvar, & Batagelj, 2005; Prell, 2011; Wasserman & Faust, 1994), an approach used to visually and mathematically examine and analyze social relationships. SNA is predicated on a *relational* way of thinking in which individuals and groups are seen as structured, embedded, and active social *networks*. It is different than typical methods of social science research, which operate on a *variable* way of thinking, in which individuals are independent or astructural, and their distinguishing characteristics (e.g. race, gender, socioeconomic status, etc.) take on causal power. Instead, the network analysis approach rejects the independence assumption, and the social web or network in which the

individuals lie becomes the primary unit of investigation and explanation for behavior (Woodland, Barry, & Crofts Roohr, 2014; Papachristos, 2010; Daly et al., 2010).

Findings derived from SNA can be used to 1) describe existing programs, patterns of knowledge transfer, and network attributes, in which networks are treated as dependent variables and/or 2) predict, for example, how information spreads throughout a network or interventions or programs will become integrated throughout a system (Woodland, Barry, & Crofts Roohr, 2014; Papachristos, 2010; Daly et al., 2010). When networks are used for predictive purposes, they serve as independent variables and are informative for determining capacity for diffusion of innovation. As mentioned in Chapter two, social network analysts interested in diffusion of innovations study how an innovation gets communicated through the network, and how individual actors are influenced by the network to adopt or reject a given innovation (Prell, 2011). For the purposes of this study, school networks were treated as independent variables, whose structural properties accelerate or constrain communication, and serve as indicators of its capacity to support diffusion of innovation (i.e. PBIS practices, systems, routines), and thus influence the extent to which PBIS was implemented school-wide. Therefore, social network analyses were used to make inferences regarding the capacity of the team communication network to diffuse PBIS practices throughout the school community. PBIS is typically measured through self-assessment or observational tools that assess the extent to which certain deemed-essential practices or parts of PBIS are in place and observable. SNA add value to these usual assessments by providing a picture of the social context (network) in which these practices are embedded, and the capacity of that network to either support or constrain the continued use of them. Findings derived from SNA can inform adjustments

to be made in order to best enable PBIS practices to be in place and useful.

Network analysts construct sociograms (maps) that show the attributes, properties, and structure of a bounded network (i.e. a complete network such as a work organization or village in which only its members are the ones included). In these maps, individuals (or groups) are represented as the *actors* (also known as *vertices* or *nodes*), which are discrete persons, teams, departments, programs or anything capable of forming relationships with another entity (Daly, 2010; Deal et al., 2009). *Edges* (also referred to as *lines*, *paths*, or *ties*) indicate connections between people in the network (Penuel et al., 2006). Further, statistical analyses are also performed to indicate whole-network structure of connectedness and capacity for diffusion. Actor-level properties were calculated to make conclusions regarding PBIS leadership teams' positional power and influence, and access to the rest of the network. Network-level and actor-level analyses were used to inform the network capacity for diffusion of innovation.

To address the relationship of network structure and properties and PBIS implementation, (Research Question 1), analyses of network sociograms and properties aimed to inform conclusions at whole-network capacity to support diffusion of PBIS innovations and practices. To investigate the extent to which PBIS leadership team properties within the network are related to PBIS implementation, (Research Question 2), network sociogram and property analyses were used to highlight the position of the PBIS leadership team within the greater network, its influence over the network, and thus ability to diffuse PBIS innovations and practices. Using SNA a Team Communication Network (TCN) – one socio-gram depicting the TCN - was created for each school. The TCN is a formal network of connections between teams, groups, or committees, through

which teams communicate with one another, therefore allowing work of the school to be completed, and for diffusion of innovation to take place. Teams within the TCN serve as their own sub-networks, displaying patterns of communication and interaction. The TCN is an adaptation from the Team Task Network (TTN; Woodland, Barry, & Crofts Roohr, 2014), and emphasizes teams' capacity to communicate by means of co-membership between teams. The TCN is purposefully created by school-based personnel, typically administrators, to address the needs and organizational goals of the school. It is not created by friendships or advice-seeking/giving, for example, but rather carefully created to provide school staff members with communication channels to interact, become aware of innovative priorities and practices of the school, and to increase capacity of the diffusion of innovation. The TCN is similar to an organizational chart, as it is derived from the job functions of individuals and their focused goals and tasks. However, it is different from an organizational chart, as it shows how those included within the organization are connected to one another and the extent to which they can interact to complete the work of the school.

All network statistical analyses were calculated from one adjacency (actor by actor) matrix of all team ties (team by team). All data matrices included binary data for which a score of 1 was given when there was a tie between two teams, and a score of 0 when two teams were not tied together. A tie between a team is one or more individual people who belong to both those teams (i.e. dual-memberships between teams).

Network Analyses

To determine the extent to which the network is configured to support or constrain diffusion of PBIS (Research Question 1), each school's whole school TCN was

analyzed. The properties of the PBIS leadership teams within the TCN were analyzed at the ego-level (Research Question 2). The relevant network analyses are outlined below. Network analyses were conducted in R (Urbanek & Bibiko, 2012) using the ‘statnet’ package (Handcock, Hunter, Butts, Goodreau, & Morris, 2007) and UCINET (Borgatti, Everett, & Freeman, 2002).

Descriptive Network Properties

A count of the number of nodes and edges was conducted to provide an analysis of the structure of the school’s TCN. Nodes within the TCN represented teams and edges signified ties between teams. Such descriptive network properties provide an overview of the size and connectedness of a network, which allow to address research question one and determine a sense of each network’s capacity for diffusion.

Visual Analysis

Network sociograms were created to show a picture of each school’s TCN. A visual inspection of the sociograms showed the structure and properties of the networks, and allowed for a preliminary analysis of the cohesion and connectedness of the networks, likelihood and frequency of teams to be connected to one another, and identification of teams as isolates, stars, bottlenecks, bridges, and cliques (definitions of relevant network concepts are included in Appendix F). By visually inspecting the sociograms in relation to research question one, the investigator was able to make inferences about the networks’ capacities for social capital and diffusion, based on network theory. For research question two, a visual inspection of TCN sociograms was performed to identify the network position and properties of the PBIS leadership team. Analyses were then limited to the PBIS Leadership team; the investigator was able to see

exactly where the PBIS leadership teams were within the TCN, make inferences about the team's connectedness to other teams, and position of influence and power within the network, and the leadership team's capacity to diffuse PBIS practices.

Density

Density is a network property that looks at cohesion of a network. Density is the proportion of how many actual ties exist in a network to the potential ties that could exist in the network. The higher the density (i.e. closer to 1), the more cohesive and connected the network. Ideally, the density would be moderate, to allow for efficient flow of information (Wasserman & Faust, 1974; Granovetter, 1973). For the implementation of PBIS, density influences a network's capacity to efficiently diffuse its practices from team to team. The cohesion of the network reveals capacity for staff members to access information across teams and communicate with many colleagues.

Average Path Length

As another measure of network structure in relation to research question one is average path length. Average path length is a means for exploring the quick reachability of a network. Path length is the distance between two actors, or how many steps an actor has to take to get to another actor. The average path length, the mean path length between all actors, was calculated to indicate, overall, how many steps it takes to get from one team to another, on average, in the TCN. Average path length thus reflects how fast information could travel from one node (team) to the other. Theoretically, the more steps it takes for information to travel from one to another, the less likely it is for innovations to diffuse quickly or at all. Therefore, information travels faster in networks with shorter distances, and information is diffused efficiently and farther.

Centralization

Network centralization, an additional property of network structure intended to answer question one, was computed to determine the extent a network is dominated by a single actor or distributed across several actors (Borgatti, Everett, & Johnson, 2013). The higher the centralization (i.e. closer to 1), the more the network is dependent upon on one actor (team). If centralization is too high, all actors rely too heavily on one actor, constraining diffusion because of lack of ties between actors and consequently, lags in communication.

Centrality

To answer research question two, the PBIS leadership teams' actor-level analyses were performed. Centrality was calculated to determine the position of the PBIS leadership team within the TCN. Centrality is a measure of the structural importance of a particular actor to a network (Borgatti, Everett, & Johnson, 2013). Higher centrality scores tend to indicate those actors who are more visible, and active and known throughout the network. Higher centrality suggests more opportunities to influence, access, and diffuse information. Several measures of centrality were calculated to describe the PBIS leadership team's position within the TCN of each school.

Degree centrality

Degree centrality is the number of immediate contacts an actor has within a network. Degree centrality was computed to determine each PBIS leadership team's level of involvement or activity in the network. An actor (e.g. PBIS leadership team) with high degree centrality is one that has many connections and can be considered to be a major channel for diffusion and communication (i.e. works/speaks with many others and

accesses and spreads information quickly). Since a connection is an individual person or persons, it also is an indicator of how many members are on a team, as a connection would also serve as a member on that team, demonstrating the size of the team.

Betweenness centrality

Betweenness centrality is a measure that takes into account how often an actor is situated in the communication network between two other actors. It calculates how many times an actor sits on the shortest path (i.e. *geodesic*) linking two other actors together. Betweenness centrality was calculated to show how much potential control the PBIS leadership team has over the flow of information and influence over whether to withhold or transmit information.

Eigenvector centrality

Eigenvector centrality is the sum of an actor's connections to other actors, weighted by the sum of the degree centralities of the adjacent actors to whom it is connected. This measure takes into account the centrality of actors immediately adjacent to the focal actor. In other words, an actor with high eigenvector centrality is connected to actors that are themselves well connected. Eigenvector centrality was computed to determine the PBIS leadership team's access to and potential influence over information across the network.

Closeness centrality

Closeness centrality is a measure of an actor's independence within the network and potential for mobilizing a network. It is determined by the distance between actors; an actor who has high closeness centrality has the shortest distance to other actors. It was computed to show how quickly the PBIS leadership team was able to reach others and

others to reach the PBIS leadership team without relying on others, thus demonstrating access to the network and influence over diffusion.

Correlational Analyses

Simple correlations were conducted to statistically identify which whole-network and actor-level network properties support or constrain diffusion of innovation.

Correlational analyses were conducted to determine the relationship between the structure of TCNs and PBIS implementation (RQ1), to determine the relationship of the properties (RQ2), and to determine the relationship of PBIS leadership team quality of inner process for collaboration and PBIS implementation (RQ3). Specifically, *Pearson product-moment coefficient of correlation*, commonly expressed as Pearson r , were computed. To answer research question one, scores from the SAS were correlated with network measures of nodes, edges, density, average path length, and centralization of the TCN. For research question two, two correlations were computed: TCAS and degree, betweenness, eigenvector, and closeness centralities of the PBIS leadership team. For research question three, TCAS and SAS scores were correlated. TCAS data have been previously correlated with other measures to “determine what patterns of team process yield the greatest outcomes” (Woodland & Hutton, 2012; Zito, 2011), as have network properties to describe social structures and systems and predict diffusion (Papachristos, 2010). Correlations closer to 1.0 or -1.0 (e.g., .97) indicate a very strong relationship, while those closer to zero (e.g., - 0.02) indicate a very weak relationship, hence reflecting the *direction* of the relationship between two variables (either positive or negative) and the *magnitude* (the relative strength) of the relationship between those variables (Boslaugh & Watters; Coladarci, et al., 2004). Correlations do not imply causation;

therefore these analyses simply revealed the relationship between measures of TCN structural properties and positions, PBIS leadership team internal team process, and PBIS implementation. Together these data enables us to describe and predict the factors that may support or constrain diffusion of innovation.

CHAPTER 4

RESULTS

Introduction

The purpose of this study was to investigate the capacity of the structure and properties of team communication networks, the structural positions and network properties of the PBIS leadership team, and the quality of PBIS leadership team process for collaboration to support diffusion of PBIS practices, routines, and systems. The study took place in eight elementary schools within a large urban school district located in Massachusetts. Research questions aimed to determine the extent to which the structures and properties of the TCN and the position of the PBIS leadership team within the TCN support or constrain the diffusion of PBIS implementation, and the relationship of PBIS leadership teams' quality of process and level of PBIS implementation. A moderate relationship was present between the number of nodes, edges, and density of the Team Communication Network (TCN) and implementation of PBIS, indicating a relationship between the connectedness of the network and the level of PBIS implementation. Moderate correlations were reported in the relationship of the degree centrality, betweenness centrality, and eigenvector centrality of the PBIS leadership team and PBIS implementation. In other words, PBIS leadership teams with central locations in the TCN were associated with higher levels of PBIS implementation. Strong and statistically significant correlations were found between the overall quality of process for collaboration of PBIS leadership teams and implementation of PBIS, suggesting the internal process of the PBIS leadership team supports diffusion of PBIS.

Findings for research question one include: 1) visual analysis of TCN structure, 2) network properties of the TCN, and 3) correlational analyses of SAS data and network properties. Findings for research question two include: 1) visual analysis of the position of the PBIS leadership team within the TCN, 2) network properties of the PBIS leadership team, and 3) correlational analyses between network properties and SAS data. Findings for research question three include: 1) PBIS leadership team's TCAS results, and 2) correlational analyses of TCAS (subscales and overall) and SAS data. Implications of the findings for practice, policy, and research will be discussed in Chapter Five.

Research Question 1: To what extent are the network structure and properties of school team communication networks related to the level of PBIS implementation?

Network Analyses

A series of network analyses were conducted to determine the overall structure and properties of the communication networks of the eight schools. Network analyses were performed on the TCN to observe cohesion of the networks and to make preliminary conclusions regarding capacity for diffusion of innovations across each network based on patterns of structure across highly-implemented schools versus lower-implemented schools.

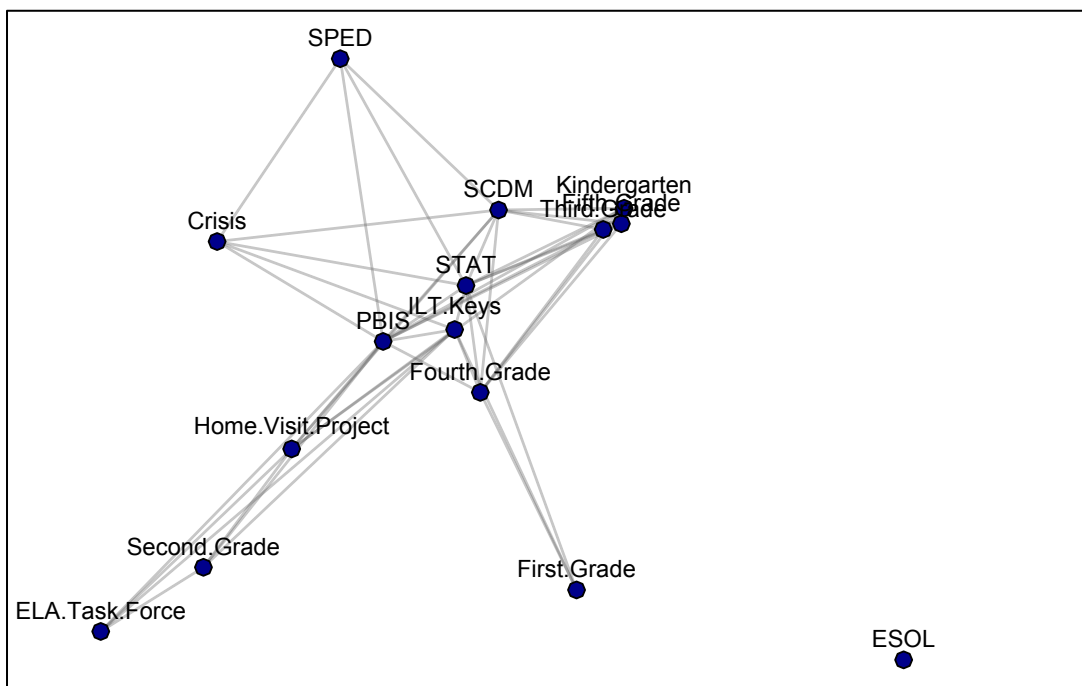
Visual Analyses

Figures 1 to 8 provide visual representations of the structure of the TCN of each school. In each of the sociograms, each node represents a team. The edges (i.e. lines) between nodes indicate ties between teams. That is, when an edge is present between teams, it indicates that one or more of the same people are on both teams. For example, if a line is present between the PBIS and First Grade teams, at least one person on the PBIS

team is also on the First Grade Team. In addition, the length of lines and therefore, placement of the nodes within the sociogram indicate likelihood or frequency of connections. Nodes placed in close proximity to one another with shorter lines connecting them represent teams that have many of the same members and therefore, have stronger overlap in membership compared to those nodes farther away. Neither node size, color, and shape, nor the thickness of line have significance or meaning.

School 1

Figure 1. School 1 Team Communication Network Sociogram

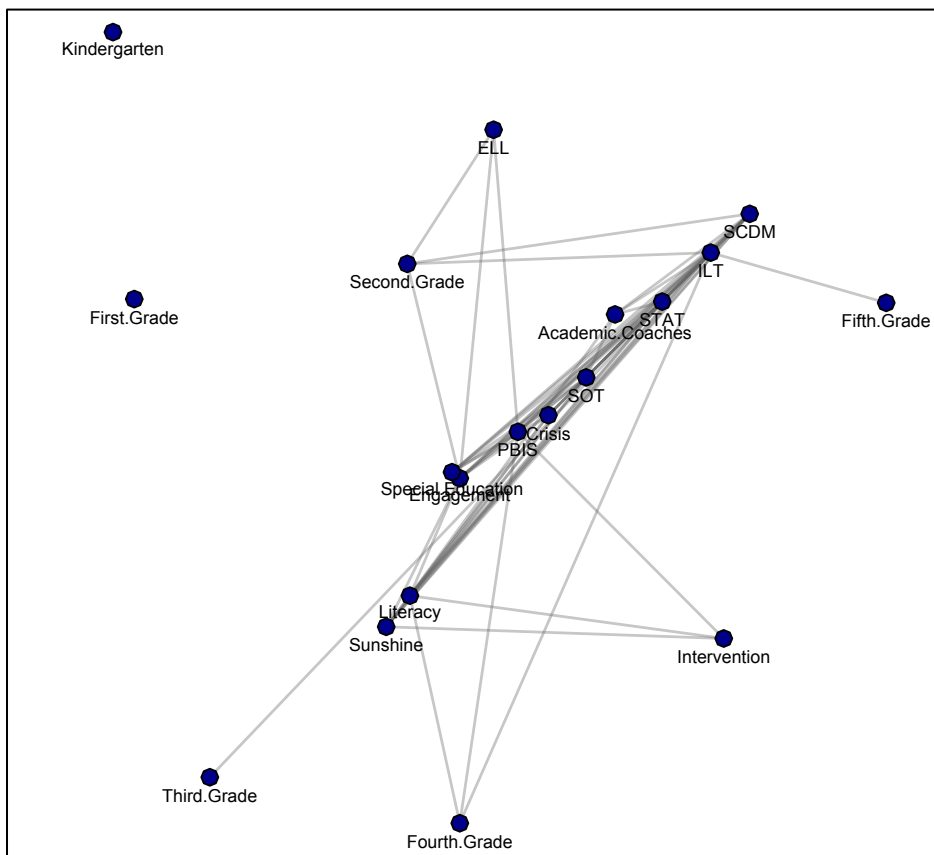


Examination of the TCN structure of School 1 reveals that the network was controlled by three major stars: the Student Teacher Assistance Team (STAT), Instructional Leadership (ILT)/Key, and PBIS Leadership Teams. The School Centered Decision Making (SCDM), Fourth Grade, Crisis, and PBIS Leadership teams served as bridges between the main network and teams on the periphery. The proximity of the Kindergarten, Fifth Grade, and Third Grade team nodes demonstrate frequent overlap in

membership. The length of lines connecting grade level teams to other teams placed them at the periphery of the network and thus farther away from other teams, as well as the ELA, Special Education (SPED), and Crisis Teams. Without any edges connecting it to the network, the English for Speakers of Other Languages (ESOL) team was the isolate.

School 2

Figure 2. School 2 Team Communication Network Sociogram

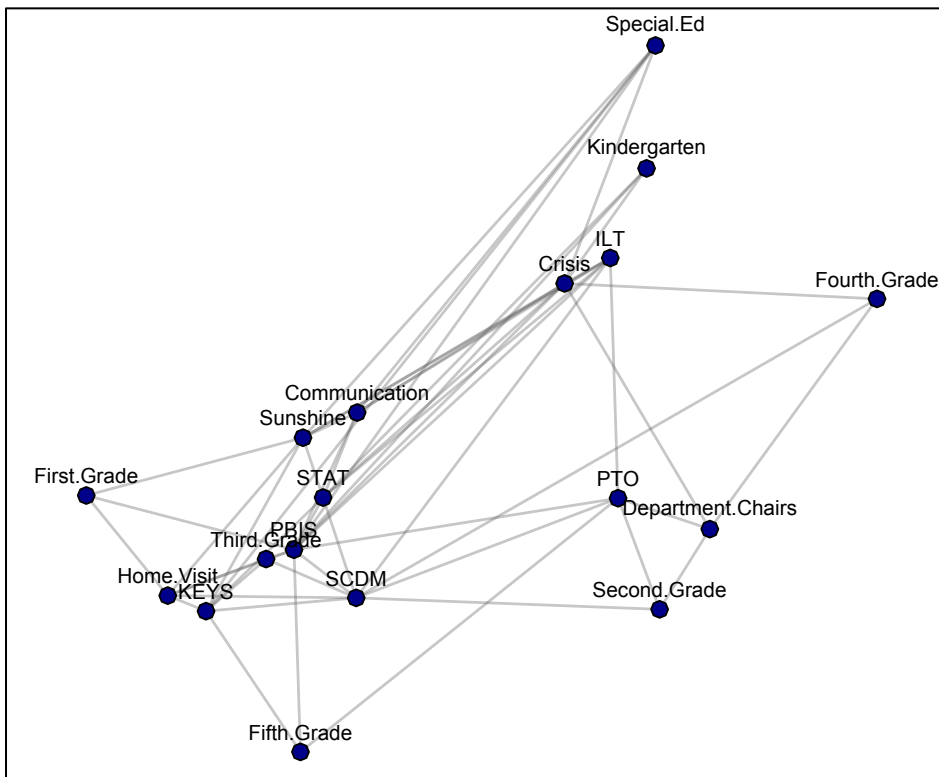


A visual analysis of the School 2 socio-gram reveals that there are many central actors in School 2's TCN. There are many connections and shared membership between eight teams, namely the PBIS Leadership Team, Special Education, Crisis, School Operating Team (SOT), Academic Coaches, STAT, ILT, and SCDM teams, indicating many central actors, based on proximity of those nodes and the length of the edge

connecting them. Said teams also created a clique. Outside of the clique of the main network, examination revealed a generally disconnected network, and sparse overlaps in membership between grade level teams and the ELL and Intervention teams. The Special Education, Engagement, ILT, and SCDM teams serve as bridges between the Second Grade, Fifth Grade, Literacy, and English Language Learners (ELL) teams, while the Kindergarten and First Grade teams are isolates, meaning they have no connections to any other team within the network.

School 3

Figure 3. School 3 Team Communication Network Sociogram

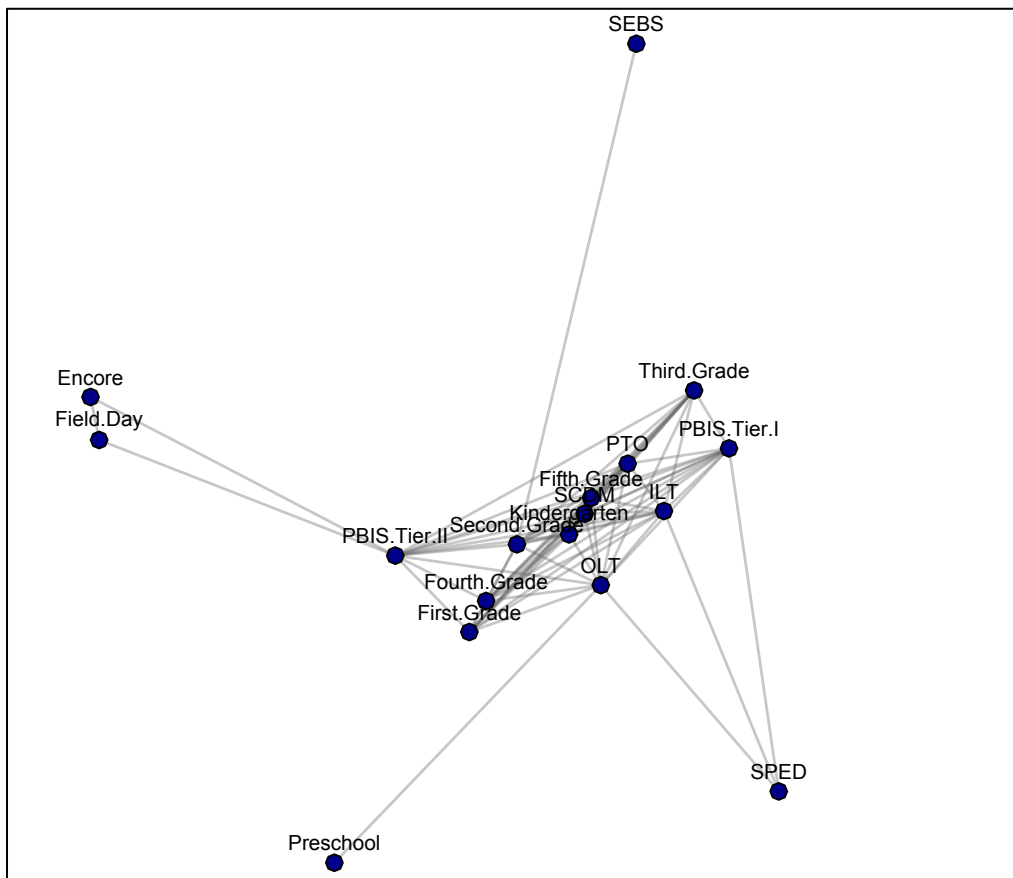


The TCN of School 3 appears moderately connected without any major hub or clear star. However, the PBIS leadership team, STAT, Third Grade, and SCDM teams are centrally located and serve as a clique due to many connections between those teams,

relative to other teams. The SCDM, Communication, and Crisis Teams serve as bridges, and the ILT is a bottleneck because many teams have access to it, but it does not have any lines going out of it to connect it to other parts of the network. Grade level teams tend to be on the periphery of the network, as well as the Department Chairs, Special Education, and Home Visit teams. No isolates are present, meaning every team had access to at least one other team within the network.

School 4

Figure 4. School 4 Team Communication Network Sociogram

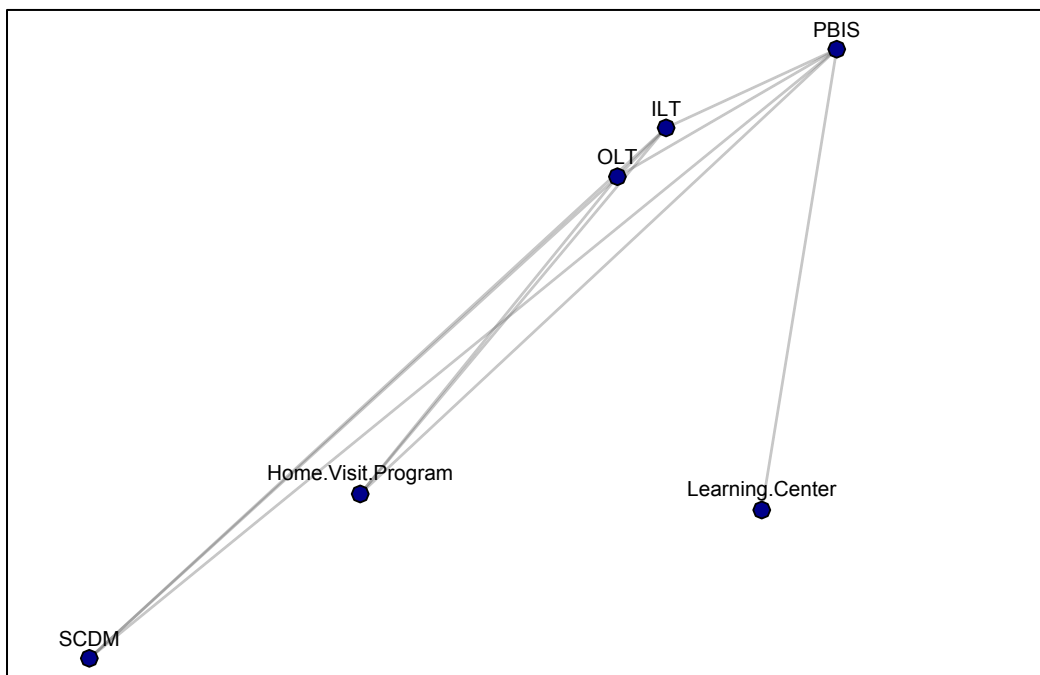


Examination of the TCN indicates a very connected or dense network in which most teams are closely connected. The SCDM, Parent Teacher Organization (PTO), Kindergarten, and Second Grade teams appear to be in control of the network because

they are at the center of the network with many edges going in and out, and therefore serve as the stars. The Fourth Grade, First Grade, OLT, ILT, and PBIS Tier I and II leadership teams are bridges they connect the Encore, SPED, and Field Day teams to the rest of the teams. The SEBS and Preschool Teams, based on the placement of their nodes and length of edges, are not well connected to the network. The SPED, Encore, and Field Day teams are bottlenecks within the TCN, because they are on the periphery of the network and only have lines going into them from one direction. All teams have connections to at least one other team, indicating no isolates within the network.

School 5

Figure 5. School 5 Team Communication Network Sociogram

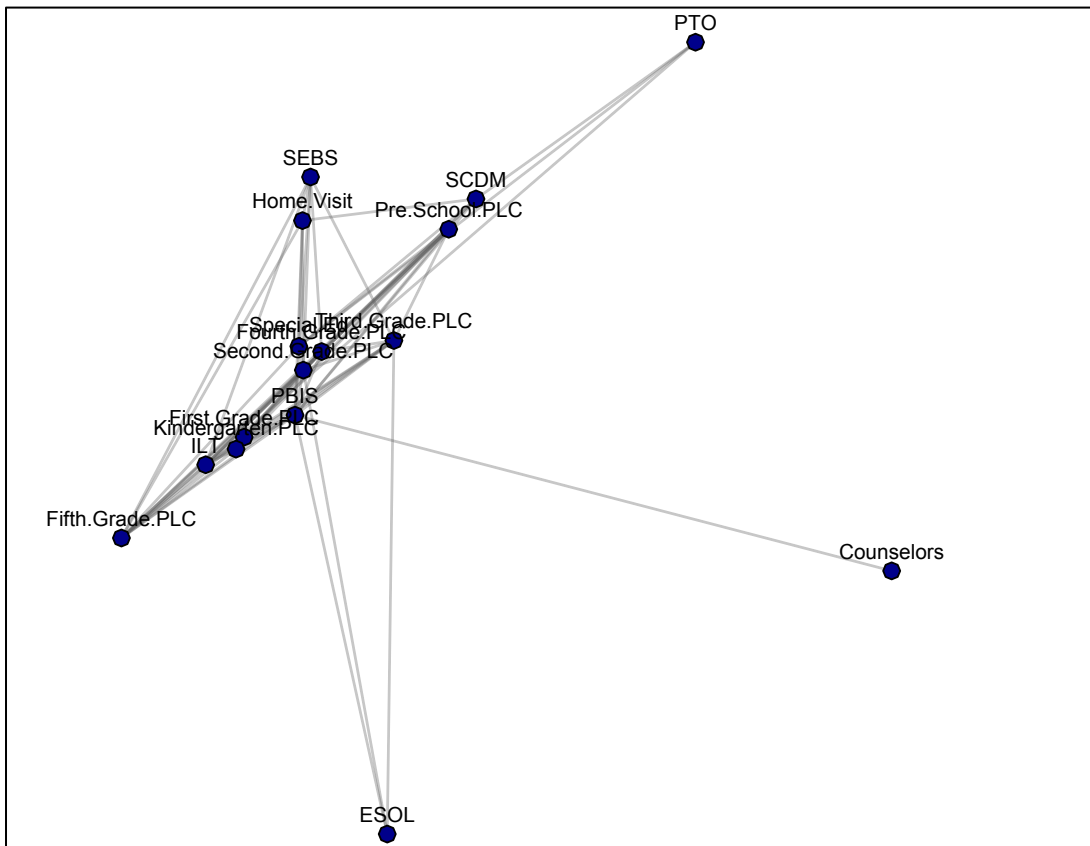


. The TCN of School 5 is a sparse network, with fewer nodes (n=6) and long edges connecting them. The ILT and OLT serve as the stars of the network, as they have direct connections to all but one team. The ILT, OLT, and PBIS leadership teams have frequent overlap in members, based on their node placements in relation to one another.

The PBIS leadership team is the bridge to the Learning Center team (the only classroom-teacher based team), and allows it access to the main network. The edge connecting the SCDM to the main network is long, indicating fewer frequent overlaps in memberships. No isolates are present in this network.

School 6

Figure 6. School 6 Team Communication Network Sociogram

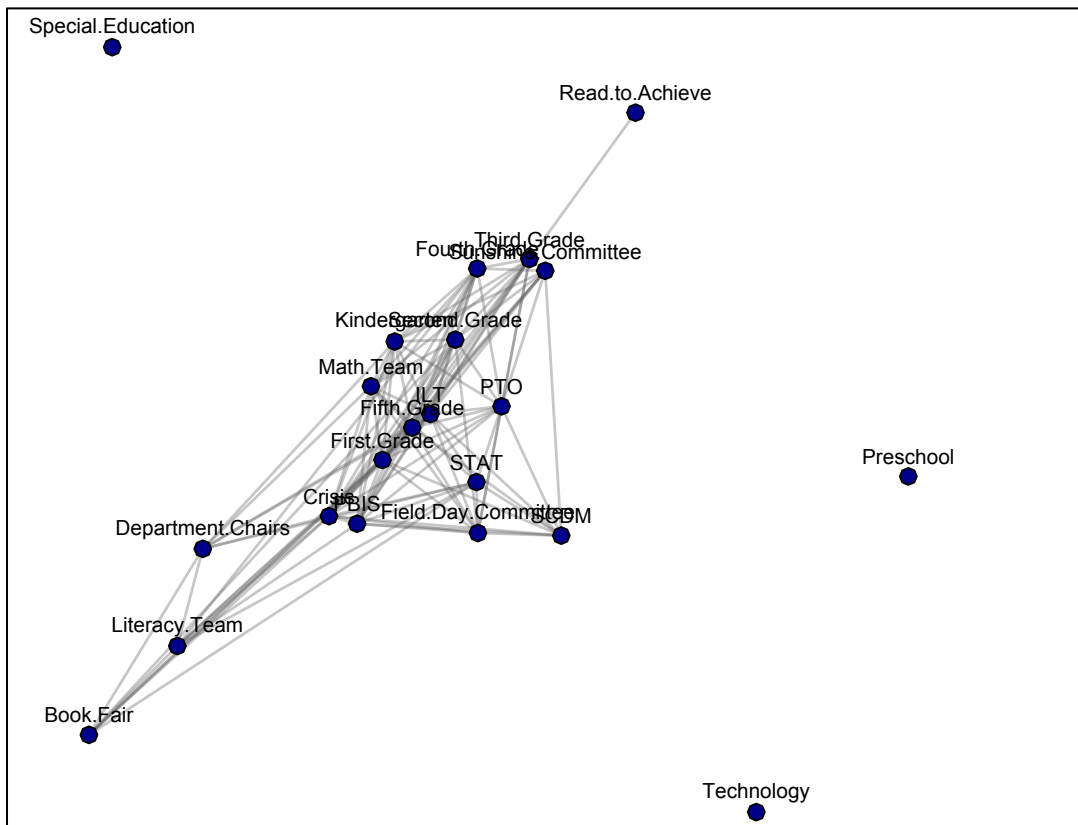


Visual analysis of the TCN of School 6 suggests a dense network with frequent ties between teams. The network appears to be controlled by grade level, the PBIS leadership, and Special Education teams. The SCDM, PBIS leadership, ILT, and Home Visit teams serve as bridges. The Fifth Grade and Social Emotional Behavioral Support (SEBS) teams are bottlenecks. The counselors, PTO, and ESOL are also bottlenecks, and

are placed on the far periphery of the network. No teams are isolated from the rest of the TCN.

School 7

Figure 7. School 7 Team Communication Network Sociogram

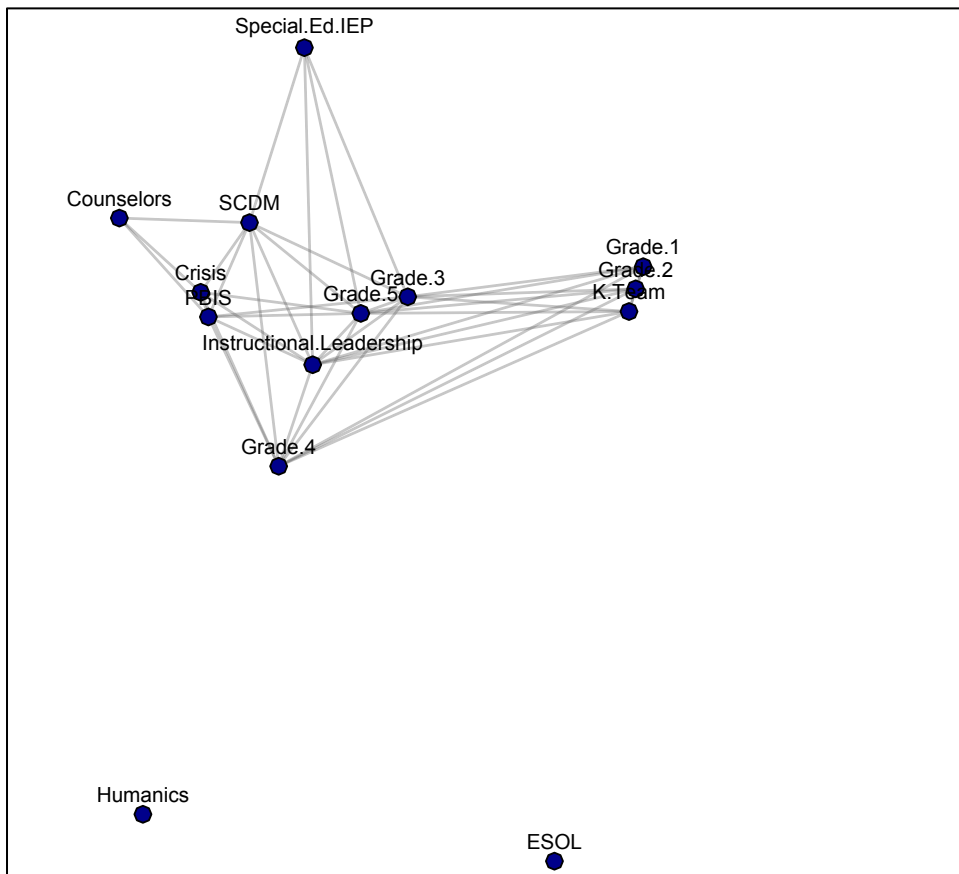


One main network is present in the TCN of School 7 with 3 isolate teams (Special Education, Technology, Preschool). The main network is dense and connected due to many lines between nodes. The PBIS leadership, Crisis, ILT, First Grade, and Fifth Grade teams are centralized and serve as stars. The SCDM, STAT, Literacy, Book Fair, Department Chairs, Kindergarten, Sunshine, and PTO teams are bottlenecks at the periphery of the network. The position of the Third Grade team indicates it serves as a bridge from the main network to the Read to Achieve Team. The Second Grade, Math, and Field Day teams are also bridges within the main network. The length of lines within

the network appears to be of similar length and the nodes are in close to equal proximity, indicating equal and frequent overlap in membership amongst teams.

School 8

Figure 8. School 8 Team Communication Network Sociogram



Visual analysis of School 8's TCN reveals a loosely dense network with fewer connections between teams. There are two main stars: the Grade 5 and Instructional Leadership Teams. Additional grade level teams are on the periphery of the network, serve as bottlenecks, and are a clique. The Crisis, PBIS leadership, SCDM, and Counselors serve as a clique. However, the Crisis, PBIS leadership, and SCDM also serve as bridges from one clique to the other. The Special Education/IEP Team is also a bottleneck and appears farther away from teams, suggesting lesser overlaps in

membership. Two isolates, the ESOL and “Humanics” Teams, are not connected to the main network, and are therefore, isolates.

Descriptive Network Properties

Table 5 includes a descriptive count of the number of nodes (actors in the network) and edges (connections between actors) of each school. The actors are the teams in the TCN. In the TCN, a range of 15 to 22 nodes and 42 to 108 edges were present across schools.

Table 5

Team Communication Network Properties Ranked by Implementation

School (Percent Implemented)	Nodes	Edges	Density	Average Path Length	Centralization
School 5 (89)	6	10	0.666	1.524	0.433
School 8 (77)	14	42	0.462	1.409	0.359
School 2 (71)	19	59	0.333	1.706	0.07
School 6 (69)	16	61	0.508	1.517	0.409
School 3 (59)	18	51	0.346	1.725	0.404
School 7 (58)	22	108	0.468	1.398	0.376
School 4 (45)	17	71	0.544	1.515	0.304
School 1 (42)	15	46	0.438	1.495	0.483

Density

Table 5 provides a list of network measurements of density for each school’s TCN. Density represents the proportion of total possible ties with total actual ties present within the network. Across the eight schools, density ranged from 0.33 to .66 in the TCN, indicating overall moderate connectedness across teams within each school.

Average Path Length

Table 5 specifies the centralization of schools’ TCN. Centralization is a measure of how dominated a network is by one actor, thus indicating the extent to which one actor

controls power or influence over a network. It provides a proportion of actors that have connections to one centralized actor. For this property, a range of .070 to .483 is present in the TCN across schools, suggesting upwards of 48 percent of teams have similar membership (in School 1).

Centralization

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Correlational Analyses

The TCN analyses described above describe the network structures of density, average path length, and network centralization. Correlational analyses were performed to answer research question one and its sub-question: What structure and properties support or constrain diffusion of PBIS practices? And to what extent are the network properties related to the level of PBIS implementation?

Table 6 summarizes the correlations between network properties of the TCN and PBIS implementation. It was predicted that a moderate relationship would be present between the properties of the TCN and PBIS implementation. More specifically, there would be a relationship between general network properties (number of vertices and number of edges) as well as properties indicative of cohesion (density, average path length, and centralization) and percentage of implementation, as measured by the SAS.

A moderately strong, negative relationship was found between number of nodes ($r = -.569$) and edges ($r = -.529$) and level of implementation, suggesting that the presence of fewer teams and lower volume of connections within the TCN is associated with stronger implementation of PBIS. A moderate positive relationship between the density of the network and SAS scores was observed ($r = .359$), indicating a moderately connected network supports diffusion of innovation. These findings confirm theoretical arguments in favor of moderate density and capacity for information flow (Granovetter, 1973). No relationship was present in terms of the average path length between teams of the network with measures of PBIS implementation, provided by the SAS ($r = -.083$), indicating the accessibility of teams across the network does not seem to have importance in considering capacity for diffusion of innovation. A weak negative relationship was found in the centralization of a network and SAS scores ($r = .138$), suggesting the extent to which a network is controlled by one or a few actors is of no significance in diffusion of innovation.

Overall, it appears that number of teams and connections, and density within the TCN are associated with stronger PBIS implementation. Schools with fewer teams connected through weak ties support diffusion of innovation. School 5, which reported strongest implementation of PBIS, was a smaller school, relative to other schools included in this sample, with only 29 teachers and staff members.

Table 6

Pearson Correlation Matrix Among PBIS Implementation (SAS) and TCN Properties

		TCN Nodes	TCN Edges	TCN Average Degree	TCN Density	TCN Path Length	TCN Centralization
Implementation	Pearson Correlation	-.569	-.529	-.138	.359	-.083	-.138
	Sig. (2- tailed)	.141	.177	.744	.382	.845	.745

(Note: No statistically significant findings reported)

Research Question 2: To what extent do the network structural position and properties of the PBIS leadership team relate to the level of PBIS implementation?

Network Analyses

In addition to understanding overall network capacity to diffuse the innovation of PBIS, it was also important to examine the role of the PBIS Leadership Team, which is formed and charged with enabling the development and implementation of PBIS school-wide. A series of network analyses were conducted to determine the position and properties of the PBIS leadership teams within the TCN of the eight schools. Network analyses of centrality were performed to indicate position of the teams and inform conclusions regarding capacity for diffusion of innovations across each network, based on where the PBIS leadership team is positioned within the network.

Visual Analysis

Additional analyses of Figures 1 to 8 were conducted. However, in this analysis, only the PBIS leadership team’s position was examined. Common themes and patterns across schools and their resulting implications will be discussed in Chapter Five.

School 1

The PBIS leadership team is a central actor in this network, thus making it a star. It has direct ties to thirteen out of fifteen teams. Its placement near other nodes indicates its members are also members of the ITL/Keys, STAT, and Fourth Grade Teams.

School 2

Examination of the PBIS leadership team within the TCN of School 2 indicates that it is a star of the network, due to its central position. It has frequent overlap in membership with the Crisis, SOT, Special Education, and Engagement Teams. It has direct ties to one grade level team.

School 3

A visual analysis of the PBIS leadership team within the TCN of School 3 demonstrates its central position within the network; thus making it a star. It is within a dense clique of teams. Its close proximity to the Third Grade, STAT, and SCDM teams indicate many of its members are also on those teams. It has direct connections to the First, Third, and Fifth grade teams. The longer lines connecting it to the ILT, Special Ed, and Kindergarten Teams suggest minimal overlap in membership with those teams.

School 4

Two PBIS leadership teams are present within the TCN of School 4. Both PBIS leadership teams are on the periphery of the central clique of the network. They also serve as bridges to the teams on the outside of the network. PBIS Tier II leadership has three direct ties to grade level teams. PBIS Tier I leadership has direct ties to the Third Grade team, PTO, ILT, and SPED teams.

School 5

The PBIS leadership team of School 5 serves a bridge to the Learning Center Team (the only classroom-based team of the network). Although its placement is seemingly on the periphery, it appears to be one of the central actors due to its direct ties to all teams.

School 6

Examination of the PBIS leadership team's position in the TCN of School 6 demonstrates its central position within the network. It is a star of the network due to its many ties to other teams within the network and close proximity to other nodes and length of lines connecting it to other teams. The long lines connecting it to the ESOL and Counselors' Teams suggest minimal overlap in membership with these teams.

School 7

The PBIS leadership team within the TCN of School 7 is positioned on the periphery of the central clique of teams. It does not appear to be one of the main stars, but is connected to them. Its close placement to the Crisis Team indicates frequent overlaps in membership between the teams. It has direct ties to two grade level teams.

School 8

Visual analysis of the PBIS leadership team's position with the TCN of School 8 indicates its direct ties to the stars of the network (Grades 3 and 5 and Instructional Leadership Teams). It is tied closely to the Crisis Team, indicating frequent overlap. It has direct ties to the Grade 3, 4, and 5 teams. It serves as a bridge between the Counselors and Grade 4 teams.

Table 7

PBIS Leadership Team Centrality Ranked by Implementation Percentage

School (Percent Implemented)	Degree Centrality	Betweenness Centrality	Eigenvector Centrality	Closeness Centrality
School 5 (89)	6	4.33	0.496	0.857
School 8 (77)	8	2.791	0.276	0.565
School 2 (71)	10	11.264	0.408	0.621
School 6 (69)	14	22.217	0.344	0.882
School 3 (59)	12	30.305	0.371	0.773
School 7 (58)	15	3.772	0.27	0.618
School 4 (45)	13	28	0.291	0.842
School 1 (42)	13	17.033	0.408	0.824

Degree Centrality

A calculation of the degree centralities of each PBIS leadership team is included in Table 7. Degree centrality is a count of how many ties a team has to another team. PBIS leadership teams had a range of 6 connections to 15 connections within the overall TCN of each school.

Betweenness Centrality

The betweenness centralities of the PBIS leadership teams within the TCN are included in Table 7. A measure of betweenness centrality indicates how many times one actor (the PBIS Leadership Team) is situated between another actor in the transfer of information or in communication, and thus the capacity of the node to act as a bridge of information between other nodes. The PBIS leadership teams' betweenness centrality ranged from 2.79 to 30.31, meaning that the PBIS leadership team connects as many as thirty pairs of nodes within the TCN.

Eigenvector Centrality

Table 7 provides the eigenvector centrality of each PBIS leadership team within the TCN. Eigenvector centrality is a measure of an actor's position of influence based on its adjacent connections' positions of influence. Across schools, the PBIS leadership teams' eigenvector centralities ranged from .27 to .49, indicating that upwards as 49% of ties across the networks include both the PBIS Leadership Team and its direct connections.

Closeness Centrality

Table 8 provides the closeness centralities of the PBIS leadership teams across the eight schools. Closeness centrality is a measure of the extent to which an actor holds all the ties in the network. Across schools, the closeness centrality of the PBIS leadership team ranged from .565 to .882, indicating 56% to 88% of actors were directly tied to the PBIS leadership team across schools.

Correlational Analyses

Correlational analyses were performed to examine how the structure and network properties of the PBIS leadership team supported or constrained PBIS diffusion. Structural position and properties were measured by network analyses of various centralities of the PBIS leadership team within the TCN. It was hypothesized that a moderate to strong relationship would be present between PBIS leadership team centralities within the TCN and PBIS implementation.

Correlational analyses of the PBIS leadership team's properties and PBIS implementation are presented in Table 4-15. A strong, negative and statistically significant relationship ($-.784, p < .05$) was found between the degree centrality of the

PBIS leadership team and SAS scores, indicating schools with PBIS leadership teams with fewer connections to other teams may report stronger implementation of PBIS. Degree centrality is dependent upon the number of members in a team, as it is a count of connections to the PBIS leadership team, which is the form of an individual person, as the entity capable of making that tie. Therefore, the observed negative correlation may also indicate that fewer members on a PBIS leadership team is associated with stronger PBIS implementation because members are the ones capable of making the connections, so with fewer members, as many ties to other teams are less likely to occur. A moderate, negative correlation ($r = -.579$) was found for the betweenness centrality of PBIS leadership teams and SAS scores, hence the less frequent the PBIS leadership team is between two teams, the stronger the PBIS implementation. A moderate, positive relationship ($r = .376$) was observed for the eigenvector centrality and SAS scores, suggesting that a PBIS leadership team positioned adjacent to teams also with advantageous positions within the TCN is associated with stronger PBIS implementation, indicating the closer position of the PBIS leadership team to actors with advantageous positions in the network, the higher level of PBIS implementation is reported. A weak negative relationship ($r = -.138$) between the closeness centrality of the PBIS leadership team and SAS scores was observed, suggesting the access the PBIS leadership teams through minimal steps is of little significance to PBIS implementation.

Overall, data suggest that PBIS leadership teams of a moderate size and thus moderate capability to form ties to other teams (degree centrality), located in positions that do not fall between pairs of teams team to another (betweenness centrality), and with

direct connections to teams with influential or advantageous positions support diffusion of PBIS practices (eigenvector centrality).

Table 8

Pearson Correlation Matrix Among PBIS Leadership Team Network Properties and PBIS Implementation (SAS)

		PBIS Degree Centrality	PBIS Betweenness Centrality	PBIS Eigenvector Centrality	PBIS Closeness Centrality
Implementation	Pearson Correlation	-.784(*)	-.579	.376	-.138
	Sig. (2-tailed)	.021	.132	.358	.992

* $p < 0.05$ level (2-tailed)

Research Question 3: To what extent does the quality of the internal process for collaboration of the PBIS leadership team relate to the level of PBIS implementation?

Teacher Collaboration Assessment Survey (TCAS) Results

In addition to considering the network structures and properties of the TCN and PBIS Leadership team, it was also hypothesized that the quality of the PBIS leadership team process, i.e. how well they engage in a cycle of inquiry, would also influence TCN capacity to diffuse the innovation of PBIS. PBIS leadership team members self-assessed quality of their team process for collaboration, as indicated by the extent to which they followed a cycle of inquiry via the Teacher Collaboration Assessment Survey (TCAS). Seven out of eight PBIS leadership teams completed the TCAS; School 4 did not return any completed surveys (interestingly they had one of the lowest levels of PBIS implementation). Individual responses to the TCAS were then collected, and the mean score of each scale was reported. Sums of each subscale were then computed to provide

an overall team process score. School 8's PBIS leadership team had a nearly perfect process, while the team at School 1 (the school with the lowest level of implementation) reported the lowest ratings of its process, based on total scores. TCAS results are as follows in Table 9.

Table 9

PBIS Leadership Team TCAS Results

School (Percent Implemented)	Subscale				Total Score (/52)
	Dialogue (/14)	Decision Making (/14)	Action (/12)	Evaluation (/12)	
School 5 (89)	12	12.625	10.25	9.5	45.75
School 8 (77)	14	14	12.5	11.5	51
School 2 (71)	12	11.5	9.75	9	42.25
School 6 (69)	11.4	11.5	10	7	39.9
School 3 (59)	12.5	11.83	8.33	5.83	38.5
School 7 (58)	11.7	10.8	8.5	6.7	37.7
School 1 (42)	7.75	9.25	3.75	3.75	24.5

Correlational Analyses

Correlations were conducted between SAS scores and each of the four subscales (Dialogue, Decision-making, Action, Evaluation) of the TCAS and summarized in Table 10. Total scores of the TCAS were also correlated with SAS scores. As predicted, strong relationships were observed in all analyses. A strong positive relationship between Dialogue subscale scores and SAS scores was noted (.708), suggesting PBIS leadership teams who display quality patterns of discussion and communication within the team are associated with strong implementation of PBIS. Within the Decision-Making subscale of the TCAS, strong positive and statistically significant correlations (0.824, $p < .05$) were observed, indicating PBIS leadership teams who make decisions regularly are associated

with stronger implementation of PBIS. A strong positive and statistically significant correlation (.853, $p < .05$) was observed between the Action subscale and SAS scores, noting strong implementation of PBIS is associated with PBIS leadership teams who take action based on the decisions they make. Another strong, positive and statistically significant ($r = .871, p < .05$) relationship was observed in the Evaluation subscale and SAS scores, indicating stronger ratings of PBIS implementation are associated with PBIS leadership teams who regularly evaluate their practices through formative and summative means. Lastly, a total score of the TCAS provides an overall indication of the team's overall inner-process. A strong, positive and statistically significant relationship was found between total TCAS scores and SAS scores (.890, $p < .01$), indicating the extent to which teams follow a quality cycle of inquiry is associated with stronger implementation of PBIS school-wide.

Table 10

Pearson Correlation Matrix Among PBIS Leadership Internal Process Ratings (TCAS) and PBIS Implementation (SAS)

		Dialogue	Decision Making	Action	Evaluation	Total
Implementation	Pearson Correlation	.708	.824(*)	.853(*)	.871(*)	.890(**)
	Sig. (2-tailed)	.075	.023	.015	.011	.007

* $p < 0.05$ level (2-tailed)

** $p < 0.01$ level (2-tailed)

CHAPTER 5

DISCUSSION

The primary purpose of this study was to investigate the network structures and properties that support the diffusion of innovation, specifically to determine the relationship of team communication network structures and properties and implementation of PBIS. The study also assessed the extent to which the network structural position and properties of the PBIS leadership team were related to PBIS implementation, and which ones supported diffusion of innovation. Lastly, the study attempted to determine how the quality of the process for collaboration of the PBIS leadership team supported the diffusion of innovation, by examining the relationship of team process for collaboration and PBIS implementation. The study employed SNA as its methodological and analytic approach to uncover the structural dimensions of team communication networks and quality of process for collaboration within a sub-network. Several network and correlational analyses were performed to answer the study's research questions and fulfill its purposes, as outlined above.

The conceptual model behind this investigation was founded on principles of SNA, diffusion of innovation, and social capital theories, which promote the importance of social interaction and relationship building on knowledge creation and transfer. The study also followed the theory of action that the structure and properties of communication networks by way of quality teacher teaming support or constrain access to information and knowledge, which in turn, facilitate or impede the diffusion of innovation and system-wide implementation.

Summary of Findings

Research Question 1: To what extent are the network structure and properties of school team communication networks related to the level of PBIS implementation?

Diffusion of innovation is dependent upon a network structured to support interaction, flow of information, and communication (Rogers, 1995). The structure of the Team Communication Networks included in this study varied by school. However, a sense of what is necessary for diffusion became apparent upon visual, network, and correlational analyses of school personnel reports of stronger implementation outcomes versus weaker implementation. Level or degree of implementation indicates the extent to which diffusion of innovation has occurred; i.e. essential practices, procedures, and systems are observable in practice and utilized by members of the school community.

It was hypothesized that moderately dense, far-reaching networks support diffusion of innovation, and disconnected, highly centralized networks in which teams are isolated or frequently inaccessible to one another constrain diffusion of PBIS. In this study, diffusion of PBIS was found to be supported by team communication networks with moderate densities, and impeded by highly (perhaps overly) dense networks with too many teams and connections. For instance, school 5, which displayed highest level of PBIS implementation had a smaller amount of teams and connections between teams, compared to School 4, the lowest PBIS-implemented school, which displayed over-connected teams with an overabundance of teams and ties between teams.

As hypothesized, a moderate relationship was present between the structure and properties of the TCN and implementation of PBIS. Visual analysis of TCN sociograms and interpretation of TCN network properties indicated several patterns and relationships

to be present. Visual analyses revealed that schools with stronger PBIS implementation (70% or higher) had fewer numbers of teams, moderate connectivity between teams, and leadership teams appeared to be the stars of the networks (actors with several ties to other teams and who held a prominent, central position in the network). Schools with weaker PBIS implementation (below 70%) tended to have highly dense networks (i.e. Schools 3, 4, and 7), cliques on the periphery of the network, and leadership teams not necessarily in centralized positions within the network. Network property calculations confirmed that highly implemented schools have fewer nodes, edges, and average degree (i.e. teams and connections between teams, and average connections between teams) and moderate reports of density (.3 to .4). Schools with weaker PBIS implementation tended to report more nodes (17 to 22), edges (71-108), and average degree (7.62 to 9.81), and higher density scores (.5 to .6). Based on an observation of network sociograms and properties, there appeared to be distinct differences between strongly implemented and weakly implemented schools in terms of number of teams within the network and level of connectedness between those teams.

Correlational analyses revealed a moderate negative correlation between the number of nodes and edges within a network and PBIS implementation, which suggests that fewer teams within a school's team communication network is associated with higher implementation of PBIS. Because the number of edges is dependent upon the number of nodes (as a connection cannot exist without two actors present), the correlation also suggests that fewer connections within a network are associated with stronger PBIS implementation. A moderate positive relationship was observed in correlations of TCN density and PBIS implementation, suggesting that a moderate relationship exists between

the level of connectivity and implementation. However, because weaker ties are theorized to be advantageous for information flow (Granovetter, 1973), a moderate correlation is actually quite ideal, as the moderateness of the network property is accounted for within the correlation. Weaker ties indicate that there are fewer connections between teams, as opposed to frequent, direct ties from one team to another. In other words, a perfect positive 1.0 correlation would indicate completely dense networks and full implementation. However, because one would want a report of moderate density to support efficient and effective diffusion of innovation, a moderate correlation including density would be ideal.

It was predicted that a moderately connected and far-reaching network would support diffusion of innovation. Findings suggest that a network with relatively few teams and moderate level of connectedness supports diffusion of innovation, and dense networks constrain diffusion of innovation, supporting the hypothesis.

Research Question 2: To what extent do the network structural position and properties of the PBIS leadership team relate to the level of PBIS implementation?

As expected, a relationship was present between both the position and properties of the PBIS leadership team and PBIS implementation. Position refers to the placement of the team within the TCN and properties as measures of their central influence or accessibility in the network. Visual analyses indicated one major pattern across schools. PBIS leadership teams in schools with higher PBIS implementation did not have direct ties to each team, but did to other stars of the network, as reflected by their measures of eigenvector centrality, which tended to be other leadership teams within the school. PBIS

leadership teams of weakly implemented schools had connections to nearly every other team within the network.

Social network analyses of centrality indicated PBIS leadership teams had lower degree centralities in schools with strong implementation, compared to those with lower reports of PBIS implementation. They also had lower betweenness centralities and stronger eigenvector centralities.

Correlational analyses revealed a strong and statistically significant negative relationship between degree centrality and PBIS implementation, indicating that the fewer ties a PBIS leadership team has to other teams, higher ratings of implementation are also present. Degree centrality can be a proxy of sorts to how many members the team has. Since a connection from team to team is in the form of one or more individuals, degree centrality is related to the size of the team itself, suggesting that schools in which PBIS leadership teams have fewer members report higher implementation of PBIS. Degree centrality and betweenness centrality were seen to have moderate, negative relationships with PBIS implementation, suggesting that PBIS leadership teams with fewer members is a support to diffusion of innovation, while larger teams impede it. When the PBIS leadership team stands between two teams too frequently, it impedes on diffusion of innovation, while if it is not, diffusion of innovation is supported.

It was predicted that PBIS leadership teams in highly central and influential positions within the network support diffusion of PBIS. The relationship between PBIS leadership teams' eigenvector centrality and PBIS implementation was found to be moderately positive, indicating higher PBIS leadership team eigenvector centrality is correlated with stronger PBIS implementation. Eigenvector centrality is a measure of

both a team's centrality in the network, but takes into account the centrality of its direct ties. Theoretically, a team could have relatively low centrality on its own, but be connected to a team that has higher centrality, producing higher eigenvector centrality. Correlations present in this study indicate that when a PBIS leadership team has direct ties to other teams with strong centralities, and thus are in influential positions, PBIS implementation in that school is also higher. Findings reveal that PBIS leadership teams with strong eigenvector are associated with their schools reporting higher levels of PBIS implementation, suggesting a PBIS team in a central position that is close to another central player supports diffusion of innovation.

Research Question 3: To what extent does the quality of the internal process for collaboration of the PBIS leadership team relate to the level of PBIS implementation?

Given that the quality of the process for collaboration within individual teams is of utmost importance to educational outcomes (McIntosh et al., 2013; Kincaid, Blase, & Wallace, 2007; Woodland & Hutton, 2012; Gajda & Koliba, 2008), it was predicted that a positive relationship would be present between the quality of process of the PBIS leadership team and PBIS implementation. As expected, a statistically significant strong relationship was present between PBIS leadership team process and PBIS implementation. A strong positive correlation was present between PBIS leadership team's dialogue and PBIS implementation, suggesting that the extent to which the PBIS leadership team engages in meaningful dialogue is associated with the extent to which PBIS is implemented within the school. Strong, statistically significant relationships were also found in decision-making, action, and evaluation correlations with PBIS

implementation. Of the four subscales, evaluation had the strongest correlation with implementation. The relationship between the total score of team process, which provides a picture of overall quality of process, and PBIS implementation was also found to be strong and statistically significant at the .01 level. These findings strongly support the notion that well-functioning teams are associated with positive educational outcomes, such as implementation of PBIS as reported by previous research, such as McIntosh and colleagues' recent study (2013) that found the functioning of the PBIS team was the strongest predictor of sustained PBIS implementation. The hypothesis that teams that follow a high quality internal process for collaboration support diffusion of innovation, while teams that have low quality internal process constrain diffusion of innovation, was supported.

Conclusions and Implications for Policy and Practice

One aim of this study was to determine the relationship of team communication network properties and PBIS implementation at the whole network level. It also sought to uncover a relationship between network properties of the PBIS leadership team and PBIS implementation, and also the process of the PBIS leadership team and PBIS implementation. Across all three aims, relationships were present, resulting in four major conclusions, which have strong implications for educational practice, policy, and research. Overall, findings of this study indicate certain network structures and properties to be associated with diffusion of innovation. These findings are congruent with SNA theoretical and empirical literature that states that network structure is able to facilitate information exchange, knowledge sharing, and serve as venues of social capital, and that social arrangements and organizational structures to support collaboration and

communication greatly influence behavior. (Leana & Pil, 2006; Nahapiet & Ghoshal, 1995; Zito, 2011; Prell, 2011; Coburn, 2010, Penuel, Sun, Frank, & Gallagher, 2012).

The current findings also support literature suggesting that the performance of schools is related to the extent to which schools staff work with one another, as high-performing schools are often characterized by networks of linked teachers, while lower performing schools are comprised of disconnected cliques and isolates (Kochan & Teddlie, 2005).

Less is More - Fewer Teams, Better Implementation

Results of this investigation suggested that the number of nodes and edges within a network were negatively associated with PBIS implementation. In this case, the more teams present within a school, the lower the implementation would be, leading one to the conclusion that the size of the network and the number of teams within a school may be related to how well practices are diffused and work is completed. Generally speaking, schools with many teams may experience poor progress in widespread change and consequently decreases in student achievement. There are multiple pathways of diffusion and fewer focused directions for implementation to take place. Transfer of knowledge may also be inefficient, or certain information may get misinterpreted, due to many different teams having access and responsibility for spreading it. On the other hand, these findings suggest that schools with fewer teams are more likely to support the diffusion of innovation, aimed to promote positive student achievement.

Further, findings suggest that many teams within a school may inhibit the diffusion of innovation. Because teams are designed to be focused on achieving the organizational goals of the school, teams are likely tasked with leading school-wide initiatives. In this case then, schools with fewer initiatives will likely have stronger

implementation/diffusion of those efforts. Competing initiatives may take away the attention, effort, and resources necessary for wide-spread implementation to occur. School leaders and policy makers are then urged to encourage schools to have a focus and direction to the initiatives they choose to implement, and do so few at a time. With many teams responsible for many initiatives in place, schools are less efficient and their teachers and staff will not be able to effectively diffuse their practices as intended or system-wide.

It is important to recognize that findings are specific to the implementation of PBIS, so number of teams may be a factor when considering PBIS implementation. Findings suggest that schools with fewer teams are facilitators of high levels of PBIS implementation. It is possible that other school-wide initiatives, apart from PBIS, actually rely on a large number of teams within a school, as they require a more integrated effort across many different stakeholders within the school community. From a policy standpoint, findings support PBIS policy makers emphasis on determining the existing initiatives in place, integrating them with PBIS, or implementing PBIS at a time when teachers and staff have the time, effort, and attention to do so. PBIS implementation guides include activities in which PBIS leadership teams are to audit the different teams within their schools and consider how to eliminate or reduce redundancies (Sugai et al., 2010). Practitioners are urged to complete these activities, as they are beneficial to the successful implementation of PBIS. Further, findings of this study support recommendations from PBIS implementation scholars, which state that for PBIS to be successful, it should be among the top three initiatives listed in the school or district improvement plan (Simonsen, Sugai, & Negron, 2008), suggesting that when PBIS is

within a small number of initiatives within a school, it is more successful. Again, leaders who wish to implement PBIS within their schools or districts must follow these guidelines to ensure that PBIS is, in fact, a top priority and can be implemented well.

Further, moderate density was related to stronger PBIS implementation. As density is the proportion of how many ties would be present to what is actually present, it is dependent upon the number of nodes within a network. In other words, a moderately dense network could reflect fewer teams and consequently fewer ties between teams or many teams with few connections. In either sense, weak ties between actors within the network produce moderate density, which avoids overlaps and redundancies in communication, which leads to more efficient information flow across communication channels within the network, and then diffusion of the innovation. Conclusions regarding network density and diffusion of innovation are consistent with Granovetter's theory of the "strength of weak ties", which posits less contact with another is more advantageous for productivity (1973). Current findings of density also support Woodland, Barry, & Crotts Roohr (2014)'s conclusion that reconfiguring a network to reduce redundancies and support efficiency supports diffusion of instructional innovation. In practice, this implies that all teachers and staff do not necessarily have to be directly connected to one another, but rather have access to others via their connections. In other words, for information flow efficiently, it can get passed from one teacher to another by way of a mutual connection, not a direct tie. Schools with teachers connected to one another with weak ties are more likely to produce substantive changes in instructional practice, compared to those with dense, over-connected, redundant networks of teachers and staff. Reform efforts are also likely to occur with more success when the network is structured

in a moderately dense way and produce instructional changes aimed to improve achievement. Policy makers should aim to encourage educators to consider the capacity of their networks, and promote systems in which redundancies in communication and interaction are minimal to ensure best implementation of school-wide practices.

Teams are the building blocks for getting any work done in a school (Barnard, 1950; DuFour & Eaker, 1998; Senge et al., 2000; Gajda & Koliba, 2008), so therefore, each one would be tasked with specific decisions to make and practices to enact and evaluate. It is quite plausible that when there are too many teams within a school, there are too many demands or competing initiatives in place. School staff and school leaders may feel that they do not have the capacity to focus on each topic, or to devote their time and effort to all that is going on within the school. As a result, too much information is being transmitted at once or the depth of information is limited, due to the competition between demands. The network then constrains diffusion, as there are redundancies and inefficiencies in the structure. Lack of diffusion restricts implementation, and demonstrated by only parts of the initiative installed and/or done so with poor quality. Leaders then should consider what their priorities are for their school and chose carefully the ones they are most capable of supporting. Schools with few initiatives are likely to support stronger implementation of those few, compared to moderate implementation of many. Stronger implementation and focus on activities will also support continued use and sustainability of the initiative.

Results of this study suggest that school leaders must be thoughtful about what teams are in place based on the priorities of the school and purposefully design their team network. Stages of implementation models (Fixen et al., 2005; 2011) suggest that the first

step in implementation requires an evaluation of the school's capacity to support the initiative, and if it fits into the existing structure. The aims of this stage of implementation lends itself quite well to determining whether or not the current team network can accommodate an additional team and related set of priorities. Policy makers then are encouraged to promote thoughtful and evidence-based decision making processes for leaders to follow regarding the focus of teams and integration of new initiatives into existing school systems. Practices may include aligning school initiatives with school goals and improvement plans to ensure focused attentions and priorities of all teams, taking an inventory of the current teaming structure and to make all teams are included and accessible in the central network of teams, creation or expansion of a leadership team to include new initiatives, and distributed membership across teams within the school system, just as outlined within the PBIS implementation guidelines and literature, such as completing an audit or needs assessment to determine if and how redundancies in priorities may be reduced.

Smaller Teams, Stronger Implementation

Just as school networks with fewer teams are more advantageous for PBIS implementation, PBIS leadership teams with smaller membership numbers were also associated with stronger implementation of school-wide practices and systems. Findings suggested that degree centrality of PBIS leadership teams, i.e. higher numbers of members, is negatively related to PBIS implementation. School-based PBIS leadership teams are tasked with providing guidance and training, promoting a vision, making decisions, and leading the charge for systemic practices and policies (Marzano, Waters, McNulty, 2005; Horner, 2012). Scholars and policy makers recommend having a

representative leadership team to promote investment in the cause, ensure the perspectives of all stakeholders, and utilize the varied skills of members of the school community (Broxterman & Whalen, 2013; Horner, 2012). In the current study, findings from this study suggest that leadership teams of a smaller size are associated with stronger implementation. There are many possible factors related to how the size may relate to implementation. Perhaps within an overcrowded team, accountability for action taking and follow through are diminished. Team members may assume someone else will take responsibility. Decision-making is more difficult as too many opinions are to be considered. Teams meetings may be difficult to schedule, as they would be trying to accommodate multiple people's schedules, leading to missed meetings and opportunities to make progress towards implementation. Perhaps the likelihood of team members to miss meetings is more likely, just by sheer numbers and natural probability, leading to decreased attendance and access to opportunities for information pertinent for implementation, collective decision-making, and enactment of essential practices.

Regarding diffusion, high numbers of team members may also inhibit efficiency and cause redundancies. With too many people taking responsibility for sharing information, the process is repetitive and time for diffusion is increased. Many members also may come with many opinions, interpretation of information, and perceptions towards the cause. The information shared may be inaccurate or misconstrued, inhibiting diffusion of the intended innovations. Schools with teams with fewer members, instead, may report better outcomes in implementation due to increased accountability, attendance, decision-making processes, and focused diffusion practices and information-sharing.

Literature suggests that all staff members within a school should have membership to at least one team within the school for the school to produce substantive outcomes in professional learning and student outcomes (Gajda & Koliba, 2008; Woodland & Hutton, 2012; Woodland & Mazur, in press). However, school leaders and policy makers must be careful when applying this evidence-based suggestion to practice. Once again, they must be thoughtful and considerate of the configuration of teams and capacities of school staff members. Equal representation on a team does not necessarily entail representation of every subgroup within the school's system. When thinking from a SNA perspective, the team may include a representative sample of staff members with advantageous positions to diffuse information to their colleagues. For example, team may include a member with direct ties to the principal or identified leader within the school. The size of the team also lends itself for practitioners to consider dividing existing groups. For example, a leadership team could be divided into sub-groups with specific short-term goals. These working groups have a specific purpose and are of a smaller size and can therefore focus on specific activities for implementation or diffusion of instructional practice. The overall team may still stay in place, but would be split up into working groups to ensure efficiency and progress towards long-lasting change. School staff members must have access to their colleagues to create a culture of collaboration and communication conducive to diffusion of instructional innovation and support through teaming. However, creating teams and processes for these teams require much time and effort to ensure best outcomes.

Consider Direct Ties

This study attempted to emphasize the importance and effects of social ties. The next major conclusion of this study is focused on the direct ties an individual actor has; that is, who or what that actor is connected to through just one step. Eigenvector centrality is a type of centrality that takes into account the influence and power (or potential for influence and power) of oneself, but also of an individual's direct ties (Prell, 2011; Borgatti, Everett, & Johnson, 2013). Results of this study demonstrated the positive relationship between the eigenvector centrality of the PBIS leadership team and PBIS implementation, which leads to the conclusion that the teams to which leadership teams are connected are very important to supporting productive outcomes in schools. Teams who are connected to influential or central players within the network are then influential and central by association. They are in highly advantageous positions to receive and send information, diffuse innovation, and be a part of the happenings of the network. These findings support the foundational research of diffusion of innovation in farming, which identified the direct ties (farmers' neighbors) to be most influential in transmission of new ideas and practices; individuals who implemented new practices were closer to the ones who had earlier access and had adopted them previously (Ryan & Gross, 1943).

Upon visual analysis of sociograms, it is clear that the PBIS leadership teams of highly implemented schools were close to other leadership teams such as the Instructional Leadership Team, for example within the network. Proximity to other teams demonstrated frequent overlaps in membership and opportunities to transmit information efficiently to teams capable of sending and receiving information quickly and effectively. In this sense, structure of the network to enable diffusion depends on the position not

only of the team in charge of the innovation, but the existing teams in place as well. Effective schools will have leadership teams connected to other leadership teams, while lower performing schools will have disjointed networks and lack of ties between teams responsible for carrying out the work of the school. Practitioners again must be mindful of representation and ensure that the leadership teams have access to other powerful teams within the network. For example, if principals appear to be a part of teams across the network, it may be helpful to have principal or administrator representation on teams, or direct ties to those key people.

Team Internal Process for Collaboration Matters

The most significant finding from this study was the relationship between the quality of process of the PBIS team and implementation of PBIS. Previous literature has suggested that the team quality is directly related to sustained changes to instructional practice and implementation of school-wide systems (McIntosh et al., 2013; Kincaid, Blase, & Wallace, 2007, Garet, Porter, Desimone, Birman, & Yoon, 2010; Goddard, Goddard, and Tschannen-Moran, 2007) and that leadership play integral roles in networks (Spillane & Min Kim, 2012; Doolittle, 2006; Bambara, Nonnemacher, and Kern, 2009; Kincaid, Child, Blase, and Wallace, 2007). Current findings support previous notions; all four elements of an effective team process – dialogue, decision-making, action-taking, and evaluation – were found to be strongly and positively correlated with measures of PBIS implementation, and all but ‘dialogue’ correlated with statistical significance. Evaluation, which correlated most strongly, supports McIntosh and colleagues’ (2013) findings that the factor most related to sustainability of PBIS was the functioning of the PBIS leadership team, especially its use of data. The premise of the

Evaluation subscale is the use of data in teams. These results suggest that the ways in which the members of a team work together to solve problems of practice related to student achievement and school functioning are directly related to educational outcomes for teachers and students. Implications are far-reaching beyond PBIS and support numerous scholarly and empirical studies endorsing the importance of collaboration amongst colleagues in the school setting and the use of data to make decisions (Darling-Hammond, Aness, & Ort, 2002; Gajda & Koliba, 2007; Goodlad, Mantle-Bromley, & Goodlad, 2004; Hiebert, 1999; US Dept. of Education, 2001; Wasley et al., 2000; Zito, 2011; City, Elmore, Fiarman, & Teitel, 2009; Stevens & Kahne, 2006; Dufour & Eaker, 1998, Dufour, Dufour, & Eaker, 2005; Pounder, 1998).

Because the quality of the team's internal process is so important to the diffusion of innovations (Gajda & Koliba, 2008; Woodland & Hutton, 2012; Woodland, Barry, & Crotts Roohr, 2014), policy makers and school leaders are encouraged to spend time and resources on training educators on effective team meeting procedures, strategies for collective dialogue and decision-making, conflict resolution, and the analysis of data in meetings. Cycles of inquiry should become a part of the school culture and drive each interaction educators have with one another. School staff members must be trained on how to collaborate with one another effectively and understand the vitality of the opportunity to interact with their colleagues. Leaders must consistently assess the quality of their schools' teams to ensure effective adherence to the cycle of inquiry, and provide intense support and problem solving for those who are not. An ineffective team is likely to be unproductive and ineffectual, thus inhibiting their own learning and diffusion of innovations. In regards to implementation of large scale efforts, such as PBIS or RTI, the

focus of consultants, district leaders, coaches, and administrators should first start with the leadership team. The extent to which the leadership team engages in effective collaborative processes is a strong predictor of a school-wide reform effort's continued success or failure in the future. Policies should also reflect a strong importance of building an effective team and providing the necessary resources to do so, including creating and providing agendas and protocols for dialogue and decision making, and ongoing use of formative and summative data to evaluate practices. Members of leadership teams should also put in significant effort in making sure they work well together and refine their practices as necessary.

Implications for the Implementation and Sustainability of PBIS

An additional purpose of this study was to introduce SNA to the study of PBIS. Findings of this study support the notion that SNA provides a unique and additional methodology for assessing the capacity of PBIS to be implemented and sustained within a school. As noted in previous sections, evaluation of PBIS typically has included observational, self-assessment, checklist-type measures aimed to indicate the presence (or non-presence) of its practices and systems (i.e. observable expectations, establishment of a leadership team, and a documented system of acknowledgement and consequences). These measures are important as they provide a picture of what elements of PBIS are in place and effective at a given time. However, they do not take into account the effects of the people and social system that are responsible for enacting them. The social system, or the network, is an essential part to consider in implementation (Fixen et al., 2005; 2011) yet few approaches are available to objectively measure and observe that system in action. As practitioners and policy makers consider the capacity of systems to support

PBIS, it makes great sense to study the social networks first. As such, school leaders are encouraged to take inventory of their teams, carefully assign members to the PBIS leadership team, and set their system to support diffusion of PBIS effectively. They should also have PBIS as a top priority in their schools, as a part of a few focused initiatives, not one of many. As schools with many teams (and many initiatives) report lower implementation, capacity is dependent upon a system that only has a few reform efforts in place.

SNA serves as an indicator of success and also an explanation for current status of PBIS, which allows leaders and policy makers to make adjustments to the network as necessary. Measures of centrality indicated that PBIS leadership teams should be positioned near other leadership teams within the network, and avoid being in between the path of two teams. In this sense, the PBIS leadership team must play a central role in the network and maintain its attention to its own practices to ensure implementation of PBIS. PBIS leadership teams closely tied to other leadership teams (such as an Instructional Leadership Team or Administrative Team), will facilitate consistency between initiatives and provide access to resources, capital, and knowledge from key players within the school. PBIS practices will then align with current initiatives and have the capacity to diffuse in a well-developed, focused way.

The also study supported previous literature that the quality of the PBIS leadership team is a predictor of implementation and sustainability, implying that in practice, the PBIS leadership team is of top priority to leaders. Schools with PBIS leadership teams who follow a high quality internal process for collaboration will report higher levels of PBIS implementation. These teams will dialogue about PBIS practices,

make timely and relevant decisions regarding those practices, act upon them effectively, and consistently evaluate their progress towards implementation school-wide. If implementation is faltering, practitioners are urged to assess the quality of the PBIS leadership team to determine if their internal process for collaboration is conducive to diffusion of innovation.

PBIS is a large-scale reform effort aimed at improving student behavior through a systematic coordination of practices, policies, and systems. In order to be most effective, it appears that the school must maintain consistent attention towards PBIS and focus its resources, time, and personnel towards it. A major implication of all SNA findings relate to the idea that PBIS is best supported when its network allows it be a focused and important priority to the school's functioning.

Limitations

Design

Although the process of SNA is quite rigorous and the study produced informative results, the correlational, non-experimental design to which it was applied serves as a limitation to this study. Correlational analyses limit the ability to make any causal statements between the variables studied (Heppner, Kivlighan, & Wampold, 1999). For example, it is possible that it is not the network that theoretically supported implementation of PBIS, but PBIS as a school-wide initiative, done well, actually made the schools' staff more communicative, leading to better diffusion across the network. Also, there are many other factors that could influence the extent to which PBIS was implemented in these schools that extend beyond the structure of the network, the positioning of the PBIS team, or the process of the PBIS team. A correlational research

design would not control for these factors, so we cannot say that the network is the only reason for implementation.

Measurement

Several issues with measurement within this study also serve as limitations. Three out of four measures were self-report: the Staff Member Survey, Self Assessment Survey, and Teacher Collaboration Assessment Survey, which rely on the perceptions of team members and school staff. Self-reports are often troublesome because they respond in a way that reflects a response bias rather than the construct being measured (Heppner, Kivlighan, & Wampold, 1999). With the SAS and TCAS especially, they were not objective measurements, and relied only what staff members perceived to be in place, as no direct observational evaluation tools were used in assessing PBIS and team process, respectively.

Limitations are also present in terms of the tools used to collect network data. The Team Inventory and Staff Member Survey, while based on researched and supported theories of data collection for identifying teams within a school (Gajda & Koliba, 2008; Woodland & Hutton, 2012; Woodland, Barry, & Crofts, 2014), are not researched tools, so they do not have any psychometric properties or empirical evidence to suggest they are reliable or valid.

Another limitation of measurement is the response rate of staff members on the Staff Member Survey and Self Assessment Survey. Both measures had relatively low and inconsistent response rates across schools, meaning that all information may have not been accounted for. Regarding the SAS, implementation of PBIS practices may have been higher or lower than what was reported by staff members.

Assumptions of Communication

This study defined a team as the mechanism for school staff to communicate with one another. However, as noted in the literature, individuals are capable of having numerous relationships, including friendship, advice-seeking, family, or close proximity in work spaces (Deal, Purinton, & Waetjen, 2009; Prell, 2011; Borgatti, Everett, & Johnson, 2013). While literature suggests that the work of any organization is accomplished through teams (Barnard, 1950; DuFour & Eaker, 1998; Senge et al., 2000; Gajda & Koliba, 2008), work completion and communication can also exist outside the team. A limitation to this study is that it assumes that the primary avenue for interaction and communication is through co-membership on formal teams. However, there could be many other informal groups and networks that facilitate or inhibit diffusion of innovation within the school.

Another limitation is the assumption that school staff members actually communicate within and across teams. Structuring a network to include teams as the opportunities for communication about school goals increases the likelihood that they will interact and communicate about practice (Rogers, 2003; Prell, 2011; Moolenaar & Daly, 2012; Daly et al., 2010), but does not guarantee it, as they may actually not take advantage of what has been put into place. Schools with a well-structured network, in theory, should communicate, which is what this study aimed to explore: the capacity for the network to support any communication. However, it did not study actual patterns of nature, direction, or frequency of communication. Communication was also assumed to be positive, productive, and related to school goals. This study did not use methods to determine the nature of the communication itself, which could have been negative,

tangential, or unrelated to anything relevant to the school. In this case, implementation could have faltered due to the nature of the communication, even if the networks were structured to support diffusion. It is important to consider and investigate the content and the way in which school staff members are actually talking with one another. Further, a major point of emphasis in this study was to investigate capacity for diffusion through communication, not the actual communication patterns themselves. The investigator did not observe or map actual interactions between staff members and teams, but only inferred potential for communication and diffusion based on the structures in place.

School Characteristics

Another limitation of the study is the time of initial training and implementation of PBIS across the schools. The District did not introduce PBIS to the eight schools at the same time, and they all received initial training at different times. Schools that had implemented sooner would have therefore received more coaching and technical assistance, and had the time to progress in their implementation, compared to those who implemented later. Given that PBIS takes three to five years to implement (Adelman & Taylor, 1997; Bradshaw & Pas, 2011; Fixsen et al., 2005), those schools farther along in that timeline could be further implemented purely based on time. Therefore, stronger implementation of PBIS may have been a result of more time and support, not just the team communication network or process of the PBIS leadership team.

The District included in this study had many different student needs to meet and corresponding educational programs in place. Across the eight schools included in this study were various educational programs, including intensive social-emotional-behavioral support programs for students with emotional impairments and social

maladjustment (School 5). Considering that these programs already have a focus on promoting positive behavior, the differences in orientation or programmatic focus of the schools serves as a limitation to this study. Schools whose main focus is to intervene with behavior likely have a background knowledge and appreciation of practices related to PBIS. Therefore, it is possible the practices and policies of the school even outside the realm of PBIS are similar to those of PBIS, thus impacting the implementation. The focus of the school could have supported diffusion, not the configuration of the communication network.

Directions for Future Research

These findings build upon the investigations initiated by Woodland, Whitcomb, & Barry (under review) who found that PBIS teams must be representative of the school community, and that representation could be observed through SNA. This study examined the relationship of collaborative practices within teams and the structured team communication networks and implementation of school-wide positive behavior support systems by correlating network and collaboration measures with measures of PBIS implementation. While important, significant findings were noted, the study was limited due to its correlational design. It is recommended that future research in this area follow an experimental design to control for other factors that could have contributed to the structure of the network, implementation of PBIS, and or the collaborative process within the teams. Measurement may also include more direct observational tools of implementation and psychometrically supported questionnaires.

Beyond experimental adjustments to the current study, there are many directions research in this area could take. Firstly, given the implications of the quality of teaming,

an overall measure of team quality would provide useful information regarding the whole network's capacity to support school-wide change. The TCAS or like instruments could be given to all teams within the school, and researchers should report on time spent in teams, examine their focus, and also representation within teams, in addition to connectivity measured by social network analyses.

Next, replication of this study in other schools and districts, perhaps with a larger sample size could help in working towards determining the structures that are best for diffusion of innovation. Because this study is preliminary and first of its kind, previous research has not made the explicit link between network properties and implementation. Sociograms which demonstrate ideal conditions for diffusion should be created, and network properties such as density, centralization, count of nodes and edges, and centrality will need to be calculated to make conclusions regarding what the optimal network structure is for successful school functioning.

This study investigated a network's capacity to support diffusion of innovation and implementation. Capacity is an essential piece to planning initial installation and implementation of school-wide innovation. However, future research may also include examination of actual communication patterns within and across all teams. As noted within the limitations, teams provide an excellent venue to communicate within and across the school network. However, it will be important to also know the reality of that communication. Surveys and observations should include prompts for school staff members to list who they actually talk to and how often about particular practices to determine how communication patterns constrain or support diffusion.

An investigation of other school-wide practices and initiatives is also recommended for future research. Schools will be well informed if its stakeholders and researchers study how certain curricula, programs, or policies will be best supported in their schools. Researchers are urged to study academically-based programming, additional social-emotional-behavioral practices, and general school operational decisions from the SNA and diffusion of innovation perspective. As evidenced by the current study, taking a relational way of thinking to leadership and professional development is a high leverage, yet underutilized approach, to determine school capacity for sustainability and implementation.

Lastly, this study investigated implementation and had implications for the job-embedded professional learning of school staff. However, because the intention of school is to ultimately to support students, future research on the effects of network structure and collaborative process on student learning is essential. Future research must include outcome data, in the form of standardized test scores, state-wide assessments, social-emotional-behavioral outcome data, graduation and dropout rates, and special education rates, for example. A relationship is likely to be present, and will then have even more profound implications for how to educate students effectively.

Conclusion

This study used SNA to investigate the relationship of team communication networks and implementation of positive behavior support systems. Significant relationships were found between the collaboration process quality in PBIS leadership teams and PBIS implementation. Moderate to strong relationships were demonstrated in network property measures, indicating fewer teams and thus moderate density of a

network is ideal for diffusion of innovation and implementation of school-wide social-emotional-behavior practices and systems. Results suggest that school leaders and policy makers should be very thoughtful during the planning stages of school-wide implementation to ensure efficient and quality social relationship building and collaborative practices within and across the team communication network of schools. More specifically, best diffusion and implementation of school-wide systems, practices, and routines are best supported in schools with fewer teams and loosely connected teams and staff members, and lead by well-functioning leadership teams of a smaller size and with ties to central teams, who follow a cycle of dialogue, decision-making, action-taking, and evaluation.

This study builds on existing literature describing the theory and application of social capital, diffusion of innovation, and SNA on individual and organizational behavior. To date, very few studies have been conducted from the SNA perspective in educational settings especially, and few have been conducted to explicitly determine the existence of a relationship between network structure and innovation. Furthermore, this is the first study to use SNA in studying the implementation of school-wide supports for positive behavior. Therefore, this study adds a tremendous and valuable look into the power of school staff working together to support high quality and equitable educational outcomes. Additional research is needed to further investigate the influence and effects of school networks. So far, it is clear that relationships matter to educational practice, and that studying those relationships offers a high leverage approach to conceptualizing school improvement and best practice in supporting student outcomes.

APPENDIX A

Recruitment Email Templates

Dear [name of administrator and/or PBIS coach],

We have a school psychology intern, Shannon Barry, working in the district this year who is studying PBIS as her dissertation study at UMass Amherst. I am writing to share with you an overview of her study (see below) and ask for your participation. It will consist of a short survey to fill out by you and your staff and a brief self-report assessment of PBIS leadership team meetings. Results of this study will be shared when it is complete and provide helpful insights into the quality of collaboration within your school and its relationship to implementation of PBIS.

Shannon is willing to meet with you to discuss the study further and/or fill out any materials, if you so desire.

Thank you for your support on this. Any questions, please let me or Shannon know.

Best,

[Behavior specialist name]

Dear [name of administrator],

My name is Shannon Barry and I am a School Psychology Intern in the district and doctoral candidate in School Psychology at UMass Amherst. I am writing to request your full participation in my dissertation research study entitled “Using Social Network Analysis to Investigate the Relationship between Teacher Networks and Implementation of Behavior Support Systems”. Your school has been specially selected due to its participation in Positive Behavioral Interventions and Supports (PBIS). The project has also been supported by the district PBIS coordinators and coaches.

About the Dissertation Study

Rationale: PBIS is best sustained and most effective when teams function at a high quality (McIntosh et al., 2013). These teams then support a connected, collaborative *network* of administrators, teachers, and school staff. The network then supports strong PBIS implementation and consequently, positive social-emotional-behavioral student outcomes.

Purpose: To closely examine the relationship between the implementation of PBIS and the nature and quality of educator networks, at the school-wide level and within the classroom.

Collection of Data

Phase One: I will first ask that you fill out an inventory of the teams and groups that exist within your school. Upon receipt of your completed survey, I will then provide hard copies of a short survey to be distributed to your staff, in which they will be prompted to identify the teams of which they are a member. Both methods of data collection are brief and should take at most 5 minutes to complete. Teacher surveys will be in multiple choice/check-box format, allowing for simple and efficient completion. Staff who complete the survey will be entered into a raffle to win a \$25 gift card.

Phase Two: Members of the PBIS leadership team will be asked to complete a short assessment rubric about the process of their team. It will take about 5 minutes to complete. This phase will occur in June.

Confidentiality

All information gathered as part of this study will be kept strictly confidential. Each staff person's name will be replaced by a pseudonym and no identifying personal information will be provided. All data will be analyzed on the aggregate to protect the identity of school staff.

Participation

To have meaningful data, it is essential that every team and staff member is identified, and 100% of your staff complete the survey. Staff should be assured that they are simply reporting whom they work with in groups, not their personal relationships, or anything related to their job performance. Such information is not relevant to the purposes of this project. Consent forms will be distributed to teachers selected to be observed, outlining the study and the benefits/minimal risks associated with their participation.

Dissemination of Results

Upon completion of this study, you will be offered and provided a report summarizing major findings. Such information will be highly informative to the overall functioning of your school's quality of collaboration, teaming, and PBIS implementation.

If you have any questions or would like to meet regarding this dissertation project, please do not hesitate to contact me at skbarry@educ.umass.edu or 508-254-1393.

Best,

Shannon K. Barry, M.Ed.
Doctoral Candidate, School Psychology
University of Massachusetts Amherst
skbarry@educ.umass.edu

APPENDIX B

PBIS Self-Assessment Survey
 (Lewis & Sugai, 1999; Sugai, Horner, & Todd, 2009).

SCHOOL WIDE SYSTEMS

Current Status			Feature	Priority for Improvement		
In Place	Partial in Place	Not in Place		High	Med	Low
			School-wide is defined as involving all students, all staff, & all settings.			
			1. A small number (e.g. 3-5) of positively & clearly stated student expectations or rules are defined.			
			2. Expected student behaviors are taught directly.			
			3. Expected student behaviors are rewarded regularly.			
			4. Problem behaviors (failure to meet expected student behaviors) are defined clearly.			
			5. Consequences for problem behaviors are defined clearly.			
			6. Distinctions between office v. classroom managed problem behaviors are clear.			
			7. Options exist to allow classroom instruction to continue when problem behavior occurs.			
			8. Procedures are in place to address emergency/dangerous situations.			
			9. A team exists for behavior support planning & problem solving.			
			10. School administrator is an active participant on the behavior support team.			

Current Status			Feature	Priority for Improvement		
In Place	Partial in Place	Not in Place		High	Med	Low
			School-wide is defined as involving all students, all staff, & all settings.			
			11. Data on problem behavior patterns are collected and summarized within an on-going system.			
			12. Patterns of student problem behavior are reported to teams and faculty for active decision-making on a regular basis (e.g. monthly).			
			13. School has formal strategies for informing families about expected student behaviors at school.			
			14. Booster training activities for students are developed, modified, & conducted based on school data.			
			15. School-wide behavior support team has a budget for (a) teaching students, (b) on-going rewards, and (c) annual staff planning.			
			16. All staff are involved directly and/or indirectly in school-wide interventions.			
			17. The school team has access to on-going training and support from district personnel.			
			18. The school is required by the district to report on the social climate, discipline level or student behavior at least annually.			

APPENDIX C

Team Inventory

Using Social Network Analysis to Investigate the Relationship between Teacher Networks and Implementation of Behavior Support Systems: A Dissertation Study by Shannon Barry

Please fill in the chart on the page below with the following information. An example has been provided.

Please attach this document and email back to skbarry@educ.umass.edu or print and send via inter-school mail to Shannon Barry (Psychology Intern) at Middle School. Or I can pick it up in person, if desired. Thank you!

Team Name – Name all teams, groups, and committees of staff members within the school that have been created to meet.

Team Members & Titles –List the full names of all members of each team and their positions (e.g. John Jones, Counselor; Sally Smith, 4th grade teacher)

Time Frequency and Duration – List how often they meet and how long their meetings typically are. (e.g. Every Tuesday for two hours; monthly for one hour)

Team Focus/Purpose – Identify the purpose of the team. What is its focus? What was it created to discuss? (e.g. Mental Health Team – student mental health concerns, Tier 2 and Tier 3 intervention, data; 8th grade team – student data analysis, instruction strategies, curriculum alignment.) Be specific as possible.

Example Name of School: Hills Elementary School

Team Name	Team Members and Titles	Meeting Time, Frequency and Duration	Team Focus/Purpose
<i>PBIS leadership team</i>	<i>Cathy Rossi – principal Will MacMillan – 4th grade teacher Shane Allen – 1st grade teacher Beth Potter - guidance counselor/internal coach Abigail Ferry – behavior specialist/district coach Sharon Fitzpatrick –</i>	<i>Every other Monday 3:30-4:30 (twice/month)</i>	<i>PBIS leadership committee. Discuss events for school-wide rewards, analyze SWIS data, develop interventions, monitor implementation</i>

	<i>music teacher Maria Santiago – 2nd grade teacher</i>		<i>progress</i>
<i>Fourth Grade Team</i>	<i>Will MacMillan, Steve Jones, Sarah Smith, Rebecca Ronaldson, Donna Ortiz (all teachers)</i>	<i>Every Tuesday 1:20-2:00</i>	<i>Plan lessons, analyze student data, design assessments</i>

Name of School:

Team Name	Team Members and Titles	Meeting Time, Frequency and Duration	Team Focus/Purpose

APPENDIX D

Staff Member Survey

Dear School staff member,

With the support of your school's leadership and PBIS leadership teams, School is participating in a dissertation research project entitled *Using Social Network Analysis to Investigate the Relationship between Teacher Networks and Implementation of Positive Behavior Support Systems*. The primary purpose of this research is to closely examine the relationship between the implementation of PBIS and the structure and quality of teaming.

The following survey will help to create an inventory of teams at your school and be used to explore the relationship between team connectedness and PBIS implementation.

Your participation is greatly appreciated. Please be assured that you are simply reporting the people with whom you work with in teams, not personal relationships, or anything related to job performance or accountability. Such information is not at all relevant to the purposes of this project.

If you would like additional information about this project, please do not hesitate to email me at. All results will be accessible to all staff upon completion of the study.

Please fill out and return to your principal.

THANK YOU!

Shannon K. Barry. M.Ed.
Doctoral Candidate, School Psychology
University of Massachusetts Amherst

[Name of Elementary School]

1. **What is your name?** *Names are asked solely to create an inventory of teams. All names will be changed to pseudonyms upon analysis and report of data. All data is stored securely and kept confidential.*

2. **What is your primary position at School?**

3. **Please identify ALL teams of which you are a member. Add any that are not listed.**

PBIS Tier I Team

PBIS Tier II Team

SCDM Team

OLT Team

PTO

ILT Team

Kindergarten Team

First Grade Team

Second Grade Team

Third Grade Team

Fourth Grade Team

Fifth Grade Team

Other(s)
(please specify):

4. **Would you like to be entered into a raffle to win a \$25 gift card?**

Yes

No

Please fill out and return to your principal by [date].

APPENDIX E

Teacher Collaboration Assessment Survey (TCAS; Woodland & Hutton, 2012; Gajda & Koliba, 2008)

Teacher Collaboration Assessment Survey (TCAS)

Name of Team/Group: _____

Team Members: _____

Date: _____

Group/Person Completing the Assessment: _____

DIRECTIONS:

1. Choose a process for administering/completing the TCAS (see below).
2. Review the criteria for *Dialogue*, *Decision-Making*, *Action* and *Evaluation* on the following pages.
3. Circle one response per row that most accurately reflects the current quality/attributes of team functioning.
4. Total the scores for each section and summarize results on page 1.
5. Use findings for developmental and/or formative assessment purposes and for resource allocation.

Process Used for Administering the TCAS: (check all that apply):

<input type="checkbox"/> recollection and reflection by a team member <input type="checkbox"/> observation of team meeting(s) (via video) <input type="checkbox"/> observation of team meeting(s) (in person) <input type="checkbox"/> review of meeting agendas/plans	<input type="checkbox"/> review of meeting running record/minutes <input type="checkbox"/> administrator consultation with team member(s) <input type="checkbox"/> other _____
---	--

Team - Collaboration Assessment Scores	
I. Dialogue	/14
II. Decision-making	/14
III. Action	/12
IV. Evaluation	/12
Total	/52

Areas of Strength:

Areas for Improvement:

Resources Needed:

DIALOGUE			
Circle one box per row			
	2	1	0
a	An agenda for team dialogue is pre-planned and accessible to all in advance of every team meeting.	A written agenda for group dialogue is provided for most team meetings.	There is no pre-planned agenda for group dialogue/team meetings.
b	The team meets regularly and all meetings are attended by all members.	The team meets with some regularity and most meetings are attended by all members.	The team meets sporadically, or full attendance at team meetings is rare.
c	Team meetings are facilitated and employ the use of protocols to structure and guide dialogue.	Occasionally, team meetings are purposefully facilitated, and/or guided by protocols.	Team dialogue/meetings are generally improvisational, unstructured, and not purposefully facilitated.
d	Team dialogue is consistently focused on the examination of instructional practice and student performance.	Team dialogue occasionally centers on quality of instructional practice and student performance.	Team dialogue rarely focuses on the quality of instructional practice and student performance.
e	Inter-professional disagreements about issues of practice are typical - these disagreements are expected, openly examined and thoughtfully discussed.	Inter-professional disagreements about important issues are not typical, often go unexamined, or remain addressed.	The group avoids conflict, tends to confirm present practices, or inter-professional disagreements are said not to exist.
f	Team members participate equally in group dialogue; there are no hibernators or dominators.	Most team members contribute to the dialogue, but there are some hibernators and dominators.	Team members contribute unequally to the dialogue; there are regular dominators and hibernators.
g	An accurate record of team dialogue, decisions, and subsequent actions is recorded and accessible to all members.	A record of team dialogue, decisions, and intended actions exists.	No accurate or accessible record of team dialogue, decisions, and subsequent actions exists.
		Dialogue Total	/14
DECISION MAKING			
Circle one box per row			
	2	1	0
a	Team members regularly identify and determine specific actions that they will take to improve instructional practice and student learning.	Team members occasionally identify and determine actions that they will take to improve instructional practice and student learning.	Team members do not identify or determine specific actions that they will take to improve instructional practice and student learning.
b	The team uses a specific process for every decision it makes (e.g. consensus, majority, or some other decision-making structure).	The team occasionally uses a process for making decisions (e.g. by consensus, majority, or some other decision-making structure).	The team does not use specific processes for making decisions.
c	Decisions made by the team are clearly and directly related to the improvement of instructional practice and student learning.	Decisions made by the team are occasionally related to the improvement of instructional practice and student learning.	Teams decisions are not related to the improvement of instructional practice and student learning.
d	The team regularly makes decisions about what specific instructional practices it will initiate, maintain, change and discontinue.	The team occasionally makes decisions about what specific instructional practices it will initiate, maintain, change or discontinue.	The team does not make decisions about instructional practices to initiate, maintain, change and/or discontinue.
e	All team decisions are informed by full group dialogue.	Most team decisions are informed by some level of group dialogue.	Team decisions are not informed by group dialogue.
f	All team decision-making is transparent; each member knows what the decisions are/were and how and why they were made.	Decision-making is somewhat transparent; members are aware of team decisions and how they were made.	Group decision-making is not transparent; members are not aware of how group decisions were made.
g	The team regularly determines what specific instructional practice and student learning information it intends to obtain and analyze.	The team occasionally decides what specific instructional practice and student learning information it needs to obtain and analyze.	The team does not determine instructional practice and student learning information it needs to obtain and analyze.
		Decision-Making Total	/14

ACTION - Circle one box per row			
Circle one box per row			
	2	1	0
a	Team members know the specific individual actions that they should take as a result of group dialogue and decision-making.	Most team members know the specific individual actions that they should take as a result of group dialogue and decision-making.	Team members are unaware of specific actions that they should take as a result of group dialogue and decision-making.
b	Intended actions to be taken by team members are high leverage (i.e. team members believe their actions will directly improve instructional practice).	Intended actions are somewhat high leverage (i.e. team members believe their actions could contribute to the improvement of instructional practice).	Intended actions are not high leverage (i.e. team members don't know how or if their actions will improve instructional practice).
c	Team members actions are specific and measurable/observable.	Team members actions are specific or measurable/observable.	Team members actions are not specific, nor measurable/observable.
d	Team member actions are coordinated and interdependent.	Team member actions are coordinated or interdependent.	Individual team member actions are independent and coordinated with one another.
e	Action-taking is equitable among members (i.e. every member acts to improve individual instructional practice and group performance as a result of team decision-making.)	Action-taking is somewhat equitable (i.e., most members regularly take steps to improve individual instructional practice and group performance.)	Action-taking is not equitable (i.e., some members take most of the action, some take very little or none.)
f	The group has clear, continuous, and accessible documentation of the instructional practices that they have stopped, started and/or changed over time.	The group has some documentation of the instructional practices they have stopped, started and/or changed over time.	Little, if any, documentation exists of the practices that the group has stopped, started and/or changed over time.
Action Total		/14	
EVALUATION			
Circle one box per row			
	2	1	0
a	The team accurately understands what evidence is available to them regarding quality of instructional practice and student learning.	The team is aware of some evidence that is available to them regarding quality of instructional practice and/or student learning.	The team does not understand what evidence is available to them regarding quality of instructional practice and/or student learning.
b	The team regularly analyzes the quality of their students' actual work (i.e. work completed by their students in response to their instruction).	The team infrequently examines the quality of their students' actual work (i.e. work completed by their students in response to their instruction).	The team does not examine the quality of their students' actual work (i.e. work completed by their students in response to their instruction).
c	The team regularly analyzes the quality of their classroom-based instructional practice.	On occasion the team will analyze the quality of their classroom-based instructional practice.	The team does not analyze the quality of their classroom-based instructional practice.
d	Team members regularly observe each other's classroom instructional practices, either in person or indirectly via technological means.	Team members occasionally observe each other's classroom instructional practices, either in person or indirectly via technological means.	Team members do not observe each other's classroom instructional practices, either in person or indirectly via technological means.
e	The team consistently generates targeted, specific, and timely feedback for team members about how to improve instructional practice and student learning.	The team occasionally generates some ideas for how team members might improve quality of instructional practice and student learning.	The team does not generate targeted, specific, and timely feedback about quality of instructional practice and student learning.
f	The group has clear, continuous, and accessible documentation and substantiation of how their instructional practice affects their student's learning.	The group has some documentation of how their instructional practice affects their student's learning.	The team does not document or substantiate the effects of their actions on student learning.
Evaluation Total		/14	

APPENDIX F

Social Network Analysis Concepts

Network Concept	Definition
Actor/Nodes/Vertices	Discrete persons, teams, departments, programs, or anything capable of forming relationships with another entity (Daly, 2010; Deal et al., 2009)
Lines/Paths/Ties	Indicate connections between people in the network (de Nooy, Mrvar, & Batagelj, 2005)
Stars	Nodes with the greatest of connections and tend to appear in the center of the sociogram (Deal et al., 2009)
Bridges	Nodes that connect other nodes and function as gateways of information flow (Deal et al., 2009)
Bottlenecks	Similar to bridges, but control the flow of information through the network (Deal et al., 2009)
Isolates	A node with very few or no ties with other nodes (Deal et al., 2009).
Clique	A sub-set of a network in which the actors are more closely and intensely tied to one another than they are to other members of the network.

REFERENCES

- Adelman, H. S., & Taylor, L. (2003). On sustainability of project innovations as systemic change. *Journal of Educational and Psychological Consultation, 14*, 1-26.
- Adelman, H. S., & Taylor, L. (2011). Expanding school improvement policy to better address barriers to learning and integrate public health concerns. *Policy Futures in Education, 9*, 431-436.
- Algozzine, B. & Algozzine, K. (2009). Facilitating academic achievement through School-wide Positive Behavior Support. In W. Sailot, G. Dunlap, G. Sugai, & R. Horner (Eds.) *Handbook of Positive Behavior Support* (pp. 521-550). New York, NY: Springer.
- Algozzine, B., Putnam, B., & Horner, R. (2010). *What comes first-the achievement or the behavior (problem)?* Charlotte, NC: University of North Carolina Behavior and Reading Improvement Center.
- Algozzine, B., Barrett, S., Eber, L., George, H., Horner, R., Lewis, T., Putnam, B., Swain-Bradway, J., McIntosh, K., & Sugai, G (2014). School-wide PBIS Tiered Fidelity Inventory. *OSEP Technical Assistance Center on Positive Behavioral Interventions and Supports*. Retrieved from <http://www.pbis.org>.
- Algozzine, R., Horner, R., Sugai, G., Barrett, S., Rossetto Dickey, C., Eber, L.,...Tobin, T. (2009). *Evaluation Blueprint for School-wide Positive Behavior Supports*. Eugene, OR: OSEP Technical Assistance Center on Positive Behavioral Interventions and Supports. Retrieved from www.pbis.org.
- Angold, A & Costello, E.J. (2000). The Child and Adolescent Psychiatric Assessment (CAPA). *Journal of the American Academy of Child & Adolescent Psychiatry, 39*, 39-48.
- Bambara, L. M., Nonnemacher, S., & Kern, L. (2009). Sustaining school-based individualized positive behavior support: Perceived barriers and enablers. *Journal of Positive Behavior Interventions, 11*, 161-176.
- Bear, G. (2010). *School discipline and self-discipline: A practical guide to promoting prosocial student behavior*. New York, NY: Guilford Press.
- Borgatti, S.P., Everett, M.G., & Freeman, L.C. (2002). *Ucinet for Windows: Software for social network analysis*. Harvard, MA: Analytic Technologies.
- Borgatti, S.B., Everett, M.G. & Johnson, J.C. (2013) *Analyzing social networks*. Los Angeles, CA: Sage Publications.

- Bourdieu, P. (1986). The forms of social capital. In J.G. Richardson (Ed.), *Handbook of theory and research for the sociology of education* (pp. 241-258). New York, NY: Greenwood.
- Bradshaw, C., Mitchell, M., & Leaf, P. (2010). Examining the effects of school-wide positive behavioral interventions and supports on student outcomes: Results from a randomized controlled effectiveness trial in elementary schools. *Journal of Positive Behavior Interventions, 12*, 133-148.
- Bradshaw, C.P., Debnam, K.J., Koth, C., & Leaf, P.J. (2009). Preliminary validation of the Implementation Phases Inventory for assessing fidelity of school-wide Positive Behavior Supports. *Journal of Positive Behavior Interventions, 11*, 145-160.
- Bradshaw, C., Koth, C., Bevans, K., Ialongo, N., & Leaf, P. (2008). The impact of school-wide positive behavioral interventions and supports (PBIS) on the organizational health of elementary schools. *School Psychology Quarterly, 23*, 462-473.
- Bradshaw, C., Koth, C., Thornton, L., & Leaf, P. (2009). Altering school climate through school-wide positive behavioral interventions and supports: Findings from a group-randomized effectiveness trial. *Prevention Science, 10*, 100-115.
- Breen, M. J., & Altepeter, T. S. (1990). Situational variability in boys and girls identified as ADHD. *Journal of Clinical Psychology, 46*(4), 486-490.
- Broxterman, K. & Whalen, A.J. (2013). *RTI team building: Effective collaboration and data-based decision making*. New York, NY: Guilford Press.
- Cains, R.A., & Brown, C.R. (1996). Newly qualified teachers: a comparative analysis of the perceptions held by B.Ed. and PGCE-trained primary teachers of their training routes. *Educational Psychology, 16*, 257-270.
- Caprara, G. V., Barbaranelli, C., Pastorelli, C., Bandura, A., & Zimbardo, P. G. (2000). Prosocial foundations of children's academic achievement. *Psychological Science, 11*, 302-306.
- Center for Social and Emotional Education. (2010). School climate research summary. *School Climate Brief, 1*(1), 1-16.
- Chami, G., Ahnert, S., Voors, M., & Kontoleon, A. (2014). Social network analysis predicts health behaviours and self-reported health in African villages. *PLOS One, 9*(7), 1-9.

- City, E. A., Elmore, R. F., Fiarman, S. E., & Teitel, L. (2009). *Instructional rounds in education: A network approach to improving teaching and learning*. Cambridge, MA: Harvard Education Press.
- Clifton, A., Turkheimer, E., & Oltmanns, T.F. (2009). Personality disorder in social networks: Network position as a marker of interpersonal dysfunction. *Social Networks, 31*, 26-32.
- Coburn, C. & Russell, J. (2008). District policy and teachers' social networks. *Educational Evaluation and Policy Analysis, 30*(3), 203-235.
- Coburn, C., Choi, L., & Mata, W. (2010). I would go to her because her mind is math. In Daly, A. (Ed.), *Social Network Theory and Educational Change* (pp. 33-50). Cambridge, MA: Harvard Education Press.
- Coburn, C. E., Russell, J. L., Kaufman, J., & Strein, M. K. (2012). Supporting sustainability: Teachers' advice networks and ambitious instructional reform. *American Journal of Education, 119*(1), 137-182.
- Coffey, J.H. & Horner, R.H. (2012). The sustainability of school-wide positive behavior intervention and supports. *Exceptional Children, 78*, 407-422.
- Cohen, R., Kincaid, D., & Childs, K. (2007). Measuring school-wide positive behavior support implementation: Development and validation of the Benchmarks of Quality (BoQ). *Journal of Positive Behavior Interventions, 9*, 203-213.
- Colvin, G. (2010). *7 steps for developing a proactive school-wide discipline plan*. Thousand Oaks, CA: Corwin Press.
- Colvin, G., Kame'enui, E. J., & Sugai, G. (1993). School-wide and classroom management: Reconceptualizing the integration and management of students with behavior problems in general education. *Education and Treatment of Children, 16*, 361-381.
- Colvin, K., Crofts, K., Li, X., & Randall, J. (2011, October). *Rating scale utility for teacher collaboration survey: Collaboration, your instructional practice and student achievement scale*. Paper presented at the annual meeting of the Northeastern Educational Research Association, Rocky Hill, CT.
- Cook, R., Foster, C., & Randall, J. (2011, October). *Applying the Rasch model to pilot testing an instrument measuring quality of collaboration among K-12 teachers*. Paper presented at the annual meeting of the Northeastern Educational Research Association, Rocky Hill, CT.

- Costello, E.J., Mustillo, S., Erkanli A., Keeler, G., & Angold, A. (2003). Prevalence and development of psychiatric disorders in childhood and adolescence. *Archives of General Psychiatry*, 60(8), 837-844.
- Croft, A., Coggshall, J. G., Dolan, M., Powers, E., Killion, J. (2010). *Job-Embedded professional development: What it is, who is responsible, and how to get it done well*. Washington, DC: National Comprehensive Center for Teacher Quality.
- Cross, R., Borgatti, S.P., & Parker, A. (2001). Beyond answers: Dimensions of the advice network. *Social Networks*, 23(3), 215-235.
- Cross, J. E., Dickman, E., Newman-Gonchar, R., & Fagan, J. M. (2009). Using mixed-method design and network analysis to measure development of interagency collaboration. *American Journal of Evaluation*, 30(3), 310-329.
- Daly, A. (Ed.). (2010). *Social network theory and educational change*. Cambridge, MA: Harvard Education Press.
- Daly, A., Moolenaar, N. M., Bolivar, J. M., & Burke, P. (2010). Relationships in reform: The role of teachers' social networks. *Journal of Educational Administration*, 48(3), 359-391.
- Darling-Hammond, L. (2009). *The flat world and education: How America's commitment to equity will determine our future*. New York, NY: Teachers College Press.
- Darling-Hammond, L., & McLaughlin, M.W. (1995). Policies that support professional development in an era of reform. *Phi Delta Kappan*, 76(8), 597-604.
- Darling-Hammond, L., Aness, J., & Ort, S. (2002). Reinventing high school: Outcomes of the coalition campus schools project. *American Educational Research Journal*, 39(3), 639-673.
- de Nooy, W., Mrvar, A., & Batagelj, V. (2005). *Exploratory social network analysis with Pajek*. New York, NY: Cambridge University Press.
- Deal, T. E., Purinton, T. & Waetjen, D. C. (2009). *Making sense of social networks in schools*. Thousand Oaks, CA: Corwin Press.
- Dearing, J. W. (2004). Improving the state of health programming by using diffusion theory. *Journal of Health Communication*, 9, 21-36.
- Degenne, A., & Forsé, M. (1999). *Introducing social networks*. London, England, UK: Sage.
- Doolittle, J. H. (2006). *Sustainability of positive behavior supports in schools*. Unpublished doctoral dissertation. Eugene, OR: University of Oregon.

- Dufour, R. (2011). Work together: But only if you want to. *Phi Delta Kappan*, 92(5), 57-61.
- Dufour, R. & Eaker, R. (1998). *Professional learning communities that work: Best practices for enhancing student achievement*. Alexandria, VA: Solution Tree.
- DuFour, R., Eaker, R., & DuFour, R. (Eds.) (2005). *On common ground: The power of professional learning communities*. Bloomington, IN: Solution Tree.
- Durkheim, E. (1893/1964). *The division of labor in society*. New York, NY: Free Press.
- Durlak, J., Weissberg, R., Dymnicki, A., Taylor, R., & Schellinger, K. (2011). The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions. *Child Development*, 82(1), 405-432.
- Dusenbury, L., & Hansen, W. B. (2004). Pursuing the course from research to practice. *Prevention Science*, 5, 55-59.
- Earl, L. & Katz, S. (2006). *Leading schools in a data-rich world: Harnessing data for school improvement*. Thousand Oaks, CA: Corwin Press.
- England, I. & Stewart, D. (2007). Executive management and IT innovation in health: Identifying the barriers to adoption. *Health Informatics Journal*, 13(2), 75-87
- Elam, S.M., Rose, L.C., & Gallup, A.M. (1994). The 26 annual Phi Delta Kappa/Gallup Poll of the public's attitudes toward the public schools. *Phi Delta Kappan*, 75, 41-56
- Fairbanks, S., Sugai, G., Guardino, D., & Lathrop, M. (2007). Response to Intervention: Examining classroom behavior support in second grade. *Exceptional Children*, 73, 288-310.
- Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39, 175-191.
- Finnigan, K.S., and Daly, A. (2012). Mind the gap: Organizational learning and improvement in an underperforming urban system. *American Journal of Education*, 119(1), 41-71.
- Fixsen, D. L., Blase, K. A., & Van Dyke, M. K. (2011). Mobilizing communities for implementing evidence-based youth violence prevention programming: A commentary. *American Journal of Community Psychology*, 48, 133-137.
- Fixsen, D. L., Blase, K. A., Horner, R. H., & Sugai, G. (2009). *Scaling up evidence-based practices in education. State implementation and scaling-up of evidence-based practices*. Chapel Hill, NC: University of North Carolina at Chapel Hill, FGP

Child Development Institute.

- Fixsen, D. L., Blase, K. A., Horner, R. H., & Sugai, G. (2010). An overview of the state implementation and scaling up of evidence-based practice centers (SISEP). *Scaling Up Brief, 4*.
- Fixsen, D. L., Blase, K., Duda, M., Naoom, S., & Van Dyke, M. (2010). Implementation of evidence based treatments for children and adolescents: Research findings and their implications for the future. In J. Weisz & A. Kazdin (Eds.), *Implementation and dissemination: Extending treatments to new populations and new settings* (2nd Ed., pp. 435-450). New York, NY: Guilford Press.
- Fixsen, D. L., Naoom, S. F., Blase, K. A., Friedman, R. M., & Wallace, F. (2005). Implementation research: A synthesis of the literature. *The National Implementation Research Network Publication, 231*(11), 247-266.
- Ford, D. L., & Lerner, R. M. (1992). *Developmental systems theory: An integrative approach*. Newbury Park, CA: Sage.
- Freeman, L. (2004). *The development of social network analysis: A study in the sociology of science*. Vancouver, British Columbia, Canada: Empirical Press.
- Fuchs, L.S. & Fuchs, D. (1986). Effects of systematic formative evaluation: A meta-analysis. *Exceptional Children, 53*,199-208.
- Gajda, R. & Koliba, C. (2007). Evaluating the imperative of inter-personal collaboration: school improvement perspective. *American Journal of Evaluation, 28*(1), 26-44.
- Gajda, R. & Koliba, C (2008). Evaluating and improving the quality of teacher collaboration: A field-Tested framework for school leaders. *NASSP Bulletin, 92*(2), 133-154.
- Garet, M.S., Porter, A.C., Desimone, L., Birman, B.F, & Yoon, Y.S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38*(4), 915–45.
- Gates Foundation. (2012). *Primary sources: 2012 America's teachers on the teaching profession*. Accessed January 17, 2013 from http://www.scholastic.com/primarysources/pdfs/Gates2012_full.pdf
- Gay, L. R., Mills, G., & Airasian, P. (2005). *Educational research: Competencies for analysis and applications* (8th ed.). Boston, MA: Pearson-Prentice Hall.
- Goddard, Y. L., Goddard, R. D., & Tschannen-Moran, M. (2007). A theoretical and empirical investigation of teacher collaboration for school improvement and student achievement in public elementary schools. *Teachers College Record, 109*(4), 877-896.

- Goldring, E, and Berends, M. 2009. *Leading with Data: Pathways to Improve Your School*. Thousand Oaks, CA: Corwin Press.
- Goodlad, J., Mantle-Bromley, C., & Goodlad, S. (2004). *Education for everyone: Agenda for education in a democracy*. San Francisco, CA: Jossey-Bass.
- Granvetter, F. & Wallnau, L. (2009). *Statistics for the behavioral sciences* (5th edition). Belmont, CA: Wadsworth.
- Granovetter, M. S. (1973). The strength of weak ties. *Journal of Sociology*, 78(6), 1360-1380.
- Greenberg, M.T., Weissberg, R.P., O'Brien, M.U., Zins, J.E., Fredericks, L., Resnik, H., & Elias, M.J., (2003). Enhancing school-based prevention and youth development through coordinated social, emotional, and academic learning. *American Psychologist*, 58(6/7), 466-474.
- Guskey, T. R. (2000). *Evaluating professional development*. Thousand Oaks, CA: Corwin.
- Hall, G. & Hord, S. (2011). *Implementing change: Patterns, principles, and potholes* (3rd edition). Upper Saddle River, NJ: Pearson.
- Hattie, J. (2009). *Visible learning: A synthesis of over 800 Meta-analyses relating to achievement*. New York, NY: Routledge.
- Hawe, P. & Ghali, L. (2008). Use of social network analysis to map the social relationships of staff and teachers at school. *Health Education Research*, 23(1), 62-69.
- Heppner, P., Kivlighan, D., & Wampold, B. (1999). *Research design in counseling* (2nd edition). Belmont, CA: Wadsworth.
- Hiebert, J. (1999). Relationships between research and the NCTM Standards. *Journal for Research in Mathematics Education*, 30, 3-19.
- Hirsh, S. (2009). A new definition. *Journal of Staff Development*, 30(4), 10–16.
- Hoagwood, K., & Erwin, H, (1997). Effectiveness of school-based mental health services for children: A 10-year research review. *Journal of Child and Family Studies*, 6, 435-451.
- Hord, S. M. (2004). *Learning together, leading together: changing schools through professional learning communities*. New York, NY: Teachers College Press.
- Horner, R. H. (2013). *Don't stop with a journal article: Lesson learned from*

implementing SWPBIS. Paper presented at the annual meeting of principal investigators at the Institute of Education Sciences.

- Horner, R. H., Sugai, G., & Anderson, C. M. (2010). Examining the evidence-base for school wide positive behavior support. *Focus on Exceptional Children, 42*, 1-14.
- Horner, R.H., Sugai, G., Todd, A.W., & Lewis-Palmer, T. (2005). School-wide positive behavior support. In L. Bambara & L. Kern (Eds.) *Individualized supports for students with problem behaviors: Designing positive behavior plans*. (pp. 359-390) New York: Guilford Press.
- Horner, R.H., Todd, A.W., Lewis-Palmer, T., Irvin, L.K., Sugai, G., Boland, J.B. (2004). The school-wide evaluation tool (SET) A research instrument for assessing school-wide positive behavior support. *Journal of Positive Behavior Interventions, 6*, 3-12.
- Horner, R. H., Sugai, G., Smolkowski, K., Eber, L., Nakasato, J., Todd, A., & Esperanza, J. (2009). A randomized, waitlist-controlled effectiveness trial assessing school-wide positive behavior support in elementary schools. *Journal of Positive Behavior Interventions, 11*, 133-144.
- Horner, R.H., Kincaid, D., Sugai, G., Lewis, T., Eber, L., Barrett, S...Johnson, N. (2014). Scaling up school-wide positive behavioral interventions and supports experiences of seven states with documented success. *Journal of Positive Behavior Interventions, 16*(4), 197-208.
- Irvin, L. K., Tobin, T. J., Sprague, J. R., & Vincent, C. G. (2004). Validity of office discipline referrals measures as indices of school-wide behavioral status and effects of school-wide behavioral interventions. *Journal of Positive Behavior Interventions, 6*(3), 131-147.
- Individuals With Disabilities Education Act, 20 U.S.C. § 1400 (2004).
- Joyce, B., & Showers, B. (1996). The evolution of peer coaching. *Educational Leadership, 53*(6), 12–16.
- Kincaid, D., Childs, K., Blase, K., & Wallace, F. (2007). Identifying barriers and facilitators in implementing school-wide positive behavior support. *Journal of Positive Behavior Interventions, 9*(3), 174-184.
- Kochan, S. & Teddlie, C. (2005). An evaluation of communication among high school faculty using network analysis. *New Directions for Evaluation, 107*, 41-53.
- Koppelman, J. (2004). Children with mental disorders: Making sense of their needs and systems that help them. *NHPF Issue Brief, 799*, 2-24.

- Kornienko, O. & Santos, C. (2014). The effects of friendship network popularity on depressive symptoms during early adolescence: Moderation by fear of negative evaluation and gender. *Journal of Youth and Adolescence*, 43, 541-553.
- Leana, C. (2011). The missing link in school reform. Stanford Social Innovation Review. Retrieved January 15, 2013 from: http://www.ssireview.org/articles/entry/the_missing_link_in_school_reform
- Leana, C. & Pil, F. (2006). Social capital and organizational performance: Evidence from urban public schools. *Organization Science*, 13(3), 1-14.
- Lee, M. K. & Randall, J. (2011, October). *Applying the Rasch model to evaluate the rating scale measuring the perceptions about collaboration among K-12 teachers*. Paper presented at the annual meeting of the Northeastern Educational Research Association, Rocky Hill, CT.
- LeBon, G. (1897/1995). *The crowd*. New Brunswick, NJ: Transaction Pub.
- Leithwood, K., Harris, A. & Hopkins, D. (2008). Seven strong claims about school leadership. *School Leadership and Management*, 28(1), 27-44.
- Lewis, T.J. & Sugai, G. (1999). Effective behavior support: A systems approach to proactive school-wide management. *Focus on Exceptional Children*, 31(6), 1-24.
- Lewis, T., Barrett, S., Sugai, G., & Horner, R. (2010). *Blueprint for School-wide Positive Behavioral Interventions and Support Training and Professional Development*. Eugene, OR: University of Oregon, OSEP Technical Assistance Center on Positive Behavioral Interventions and Supports. Retrieved from <http://www.pbis.org>
- Lewis, T., Jones, S., Horner, R. H., & Sugai, G. (2010). School-wide positive behavior support and students with emotional/behavioral disorders: Implications for prevention, identification and intervention. *Exceptionality*, 18, 82-93.
- Lewis, T.J., Newcomer, L.L., Trussell, R., & Richter, M. (2006). School-wide positive behavior support: Building systems to develop and maintain appropriate social behavior. In C.M. Evertson & C.S. Weinstein (Eds.), *Handbook of classroom management: Research, practice and contemporary issues* (pp. 833-854). Mahwah, NJ: Lawrence Erlbaum Associates.
- Little, J. W. (1990). The persistence of privacy: Autonomy and initiative in teachers' professional relations. *Teachers College Record*, 91(4), 509-536.
- Little, J. W. (2003). Inside teacher community: Representations of classroom practice. *Teachers College Record*, 105(6), 913-945.

- Luiselli, J. K., Putnam, R. F., Handler, M. W., & Feinberg, A. B. (2005). Whole-school positive behavior support: Effects on student discipline problems and academic performance. *Educational Psychology, 25*, 183–198.
- Lusher, D., Robins, G., & Kremer, P. (2010). The application of social network analysis to team sports. *Measurement in Physical Education and Exercise Science, 14*, 211-224.
- Martella, R., Nelson, J., & Marchand-Martella, N. (2003). *Managing disruptive behaviors in the schools*. Boston, MA: Pearson Education.
- Marzano, R., Waters, T., & McNulty, B. (2005). *School leadership that works: From research to results*. Alexandria, VA: ASCD.
- Mash, E. J. & Dozois, D.J. A. (2003). Child psychopathology: A Developmental-systems perspective. In E. Mash, E.J. & R. Barkley (Eds.) *Child Psychopathology* (2nd edition; pp. 3-74). New York, NY: Guilford Press.
- Massachusetts Department of Elementary and Secondary Education [MA DESE]. (2014) *School/district profile*. Retrieved October 29, 2014 from <http://profiles.doe.mass.edu/profiles/general.aspx?topNavId=1&orgcode=02810000&orgtypecode=5&>
- Mayer, G. R. (1995). Preventing antisocial behavior in the schools. *Journal of Applied Behavior Analysis, 28*(4), 467-478.
- McIntosh, K., Chard, D. J., Boland, J. B., & Horner, R. H. (2006). Demonstration of combined efforts in school-wide academic and behavioral systems and incidence of reading and behavior challenges in early elementary grades. *Journal of Positive Behavior Interventions, 8*, 146-154.
- McIntosh, K., Mercer, S., Frank, J., Turri, M., & Mathews, S. (2013). Factors related to sustained implementation of School-wide Positive Behavior Support. *Exceptional Children, 79*(3), 293-311.
- McIntosh, K., Flannery, K. B., Sugai, G., Braun, D. H., & Cochrane, K. L. (2008). Relationships between academics and problem behavior in the transition from middle school to high school. *Journal of Positive Behavior Interventions, 10*, 243-255.
- McIntosh, K., Horner, R. H., Chard, D. J., Boland, J. B., & Good, R. H., III. (2006). The use of reading and behavior screening measures to predict nonresponse to school-wide positive behavior support: A longitudinal analysis. *School Psychology Review, 35*, 275-291.
- Merrell, K.W., & Buchanan, R. (2006). Intervention selection in school-based practice:

- Using public health models to enhance systems capacity of schools. *School Psychology Review*, 35,167–180.
- Metzler, C., Biglan, A., Rusby, J., & Sprague, J. (2001). Evaluation of a comprehensive behavior management program to improve school-wide positive behavior support. *Education and Treatment of Children*, 24, 448-479.
- Moolenaar, N. (2012). A social network analysis perspective on teacher collaboration in schools: Theory, methodology, and applications. *American Journal of Education*, 119(1), 7-39.
- Moolenaar, N. & Daly, A. (2012). Social networks in education: Exploring the social side of the reform equation. *American Journal of Education*, 119,1-6.
- Moseley, S. F. (2004). Everett Rogers' diffusion of innovations theory: Its utility and value in public health. *Journal of Health Communication*, 9, 149–151.
- Murray, C. (2009). Diffusion of innovation theory: A bridge for the research-practice gap in counseling. *Journal of Counseling and Development*, 87, 108-116.
- Muscott, H. S., Mann, E. L., & LeBrun, M. R. (2008). Positive behavior interventions and supports in New Hampshire: Effects of large- scale implementation of School-wide Positive Behavior Support on student discipline and academic achievement. *Journal of Positive Behavior Interventions*, 10, 190–205.
- Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. Academy of Management. *The Academy of Management Review*, 23(2), 242-266.
- Nelson, J. R., Duppong Hurley, K., Synhorst, L., & Epstein, M. (2008). The Nebraska three-tiered behavioral prevention model case study. In C. Greenwood, T. Kratochwill, and M. Clements (Eds.). *School-wide prevention models: Lessons learned in elementary schools* (pp. 61–86). New York, NY: Guilford.
- Nelson, J. R., Martella, R., & Galand, B. (1998). The effects of teaching school expectations and establishing a consistent consequence on formal office disciplinary actions. *Journal of Emotional and Behavioral Disorders*, 6(3), 153–161.
- Nelson, J. R., Martella, R.C. & Marchand-Martella., N.E. (2002). Maximizing student learning: The effects of a comprehensive school-based program for preventing disruptive behaviors. *Journal of Emotional and Behavioral Disorders*, 10, 136–148.
- Newton, J. S., Algozzine, B., Algozzine, K., Horner, R. H., & Todd, A. W. (2011). Building local capacity for training and coaching data-based problem solving with

- positive behavior intervention and support teams. *Journal of Applied School Psychology*, 27, 228- 245.
- Newton, J.S., Horner, R., Algozzine, B., Todd, A. W., & Algozzine, K. M. (2009). Using a problem-solving model for data-based decision making in schools. In W. Sailor, G. Dunlap, G. Sugai, & R. Horner (Eds.). *Handbook of positive behavior support* (pp. 551-580). New York, NY: Springer
- O'Malley, J.A., & Marsden, P. (2008). The analysis of social networks. *Health Services and Outcomes Research Methodology* 8, (4), 222-269.
- Oldenburg, B.R., Sallis, J.F., French, M.L., & Owen, N. (1999). Health promotion research and the diffusion and institutionalization of interventions. *Health Education Research*, 14, 121-130.
- Ouimet, M., Landry, R., & Amara, N. (2004, June). *Network positions and radical innovation: A social network analysis of the Quebec optics and photonics cluster*. Paper presented at the DRUID Summer Conference on Industrial Dynamics, Innovation and Development.
- Papachristos, A. V. (2011, April 25). *Social network analysis: A brief overview*. Class Lecture Special Presentation. University of Massachusetts Amherst School of Education, Amherst, Massachusetts.
- Papachristos, A.V., Braga, A.A., & Hureau, D.M. (2012). Social networks and the risk of gunshot injury. *Journal of Urban Health*, 89, 992-1001.
- Pappano, L. (2007). More than “making nice”: Getting teachers to (truly) collaborate. *Harvard Education Letter*, 23(2), 1-3.
- Patton, M. (1997). *Utilization-focused evaluation: The new century text*. Thousand Oaks, CA: Sage.
- Penuel, W. R., Sun, M., Frank, K. A., & Gallagher, H. A. (2012). Using social network analysis to study how collegial interactions can augment teacher learning from external professional development. *American Journal of Education*, 119(1), 103-136.
- Penuel, W. R., Sussex, W., Korbak, C. & Hoadley, C. (2006). Investigating the potential of using social network analysis in educational evaluation. *American Journal of Evaluation*, 27, 437-451.
- Portes, A. (1998). Social capital: Its origins and applications in modern sociology. *Annual Review of Sociology*, 24, 1-24.
- Pinchot, G., & Pinchot, E. (1993). *The intelligent organization: Engaging the talent & initiative of everyone in the workplace*. San Francisco, CA: Berrett-Koehler Pub.

- Pounder, D. G. (1998). *Restructuring schools for collaboration: Promises and pitfalls*. Albany, NY: SUNY Press.
- Prell, C. (2011). *Social network analysis: History, theory, and methodology*. Thousand Oaks, CA: Sage Publishing.
- R Development Core Team. (2011). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from <http://www.R-Project.org>.
- Rogers, E. M. (2003). *Diffusion of innovations* (5th edition). New York, NY: Simon and Schuster.
- Ryan, B., & Gross, N. C. (1943). The diffusion of hybrid seed corn in two Iowa communities. *Rural Sociology*, 8, 15-24.
- Safran, S. P. (2006). Using the Effective Behavior Supports Survey to guide development of school-wide positive behavior support. *Journal of Positive Behavior Interventions*, 8, 3-9.
- Safran, S. P., & Oswald, K. (2003). Positive behavior supports: Can schools reshape disciplinary practices? *Exceptional Children*, 69(3), 361–373.
- Samet, M. (n.d.) *Network theory*. TED-Ed Originals. Retrieved November 7, 2014 at <http://ed.ted.com/lessons/what-facebook-and-the-flu-have-in-common-marc-samet>.
- Saunders, W. M., Goldenberg, C. N., & Gallimore, R. (2009). Increasing achievement by focusing grade-level teams on improving classroom learning: A prospective, quasi-experimental study of Title I schools. *American Educational Research Journal*, 46(4), 1006-1033.
- Schofield, M., Edwards, K. and Pearce, R. (1997) Effectiveness of two strategies for dissemination of sun-protective policy in New South Wales primary and secondary schools. *Australian and New Zealand Journal of Public Health*, 21, 743-750.
- Scott, J. (2000). *Social network analysis*. London, England, UK: Sage.
- Scott, J. (2013). Social processes in lobbyist agenda development: A longitudinal network analysis of interest groups and legislation. *The Policy Studies Journal*, 41(4), 609-636.
- Senge, P., N. Cambron-McCabe, T. Lucas, B. Smith, J. Dutton, and A. Kleiner. (2000). *Schools that learn: A fifth discipline fieldbook for educators, parents, and everyone who cares about education*. New York: Doubleday.

- Shinn, M.R., Stoner, G. & Walker, H.M. (Eds.), *Interventions for academic and behavior problems: Preventive and remedial approaches* (pp. 1–26). Silver Spring, MD: National Association of School Psychologists.
- Shores, R. E., Jack, S. L., Gunter, P. L., Ellis, D. N., DeBriere, T. J., & Wehby, J. H. (1993). Classroom interactions of children with behavior disorders. *Journal of Emotional and Behavioral Disorders* 1, 27–39.
- Simmel, G. (1908/1971). *On individuality and social forms*. Chicago, IL: University of Chicago.
- Simonsen, B., Sugai, G., & Negron, M. (2008). School-wide positive behavior supports: Primary systems and practices. *Teaching Exceptional Children*, 40(6), 32-40.
- Skiba, R. J., & Peterson, R. (1999). The dark side of zero-tolerance: Can punishment lead to safe schools? *Phi Delta Kappan*, 80 (5), 372-382.
- Snyder, W. M., Wenger, E., & de Sousa Briggs, X. (2003). Communities of practice in government: Leveraging knowledge for performance. *The Public Manager*, 32(4), 17-22.
- Song, S., Nerur, S., & Teng, J. (2007). An exploratory study on the roles of network structure and knowledge processing orientation in the work unit knowledge management. *Advances in Information Systems*, 38(2), 8-26.
- Spillane, J. & Min Kim, C. (2012). An exploratory analysis of formal school leaders' positioning in instructional advice and information networks in elementary schools. *American Journal of Education*, 119(1), 73-102.
- Sprague, J. & Walker, H. (2005). *Safe and healthy schools: Practical prevention strategies*. New York: Guilford Press.
- Sprague, J., Walker, H., Golly, A., White, K., Myers, D.R., & Shannon, T. (2001). Translating research into effective practice: The effects of a universal staff and student intervention on indicators of discipline and school safety. *Education and Treatment of Children*, 24, 495-511.
- Stevens, D., & Kahne, J. (2006). Professional communities and instructional improvement practices: A study of small high schools in Chicago. Unpublished report, University of Chicago Consortium on Chicago School Research.
- Stiggins, R. (2005). Assessment for learning: Building a culture of confident learners. In R. DuFour, R. Eaker, & R. DuFour (Eds.), *On common ground: The power of professional learning communities* (pp. 155-175). Bloomington, IN: National Education Service.

- Strein W., Hoagwood, K.E., & Cohn, A. (2003). School psychology: A public health perspective: I. Prevention, populations, and systems change. *Journal of School Psychology, 41*(1):23-38.
- Sugai, G., & Horner, R. H. (1999). Discipline and behavioral support: Preferred processes and practices. *Effective School Practices, 17*, 10-22.
- Sugai, G., & Horner, R.H. (2002). The evolution of discipline practices: School-wide positive behavior supports. *Child and Family Behavior Therapy, 24*, 23-50.
- Sugai, G., & Horner, R. H. (2006). A promising approach for expanding and sustaining school-wide positive behavior support. *School Psychology Review, 35*, 2, 245-259.
- Sugai, G., & Horner, R. H. (2009). Responsiveness-to-intervention and school-wide positive behavior supports: Integration of multi-tiered approaches. *Exceptionality, 17*, 223-237.
- Sugai, G., Horner, R.H., & Todd, A.W. (2009). *Self-Assessment Survey 3.0*. Eugene, OR: Educational and Community Supports. <http://www.pbis.org/evaluation-tools>
- Sugai, G., Horner, R. H., Algozzine, R., Barrett, S., Lewis, T., Anderson, C., & Simonsen, B. (2010). *School-wide positive behavior support: Implementers' blueprint and self-assessment*. Eugene, OR: University of Oregon, OSEP Technical Assistance Center on Positive Behavioral Interventions and Supports.
- Sugai, G., Horner, R. H., Fixsen, D., & Blase, K. (2010). Development system-level capacity for RtI implementation: Current efforts and future directions. In T. A. Glover & S. Vaughn (Eds.) *The promise of Response to Intervention: Evaluating current science and practice* (pp. 286-309). New York, NY: Guilford Press.
- Sugai, G., Horner, R. H., Lewis-Palmer, T., Rossetto Dickey, C. (2011). *Team Implementation Checklist, Version 3.1*. Eugene, OR: Educational & Community Supports, University of Oregon.
- Sulzer-Azaroff, B. & Mayer, G.R. (1991). *Behavior analysis for lasting change*. Fort Worth, TX: Harcourt Brace.
- Sulzer-Azaroff, B., & Mayer, G. R. (1994). *Achieving educational excellence: Behavior analysis for achieving classroom and school-wide behavior change*. San Marcos, CA: Western Image.
- Taylor, L., Nelson, P., & Adelman, H.S. (1999). Scaling-up reforms across a school district. *Reading and Writing Quarterly, 15*, 303-325.

- Taylor-Greene, S., Brown, D., Nelson, L., Longton, J., Gassman, T., Cohen, J., Swartz, J., Horner, R. H., Sugai, G., & Hall, S. (1997). School-wide behavioral support: Starting the year off right. *Journal of Behavioral Education*, 7, 99-112.
- Todd, A.W., Horner, R.H., Newton, J.S., Algozzine, R.F., Algozzine, K.M., & Frank, J.L. (2011). Effects of a Team Initiated Problem Solving on meeting practices of school-wide behavior support teams. *Journal of Applied School Psychology*, 27(1), 42-59.
- Tolan, P., & Guerra, N. (1994). *What works in reducing adolescent violence: An empirical review of the field*. Boulder, CO: Center for the Study and Prevention of Violence.
- Tonnies, F. (1955/1936). *Gemeinschaft und Gesellschaft*. East Lansing, MI: Michigan State University.
- Tuomainen, J., Palonen, T. & Hakkarainen, K. (2010). A special education teacher's networks: A Finnish case. *International Journal of Special Education*, 25(1), 46-58.
- U.S. Department of Health and Human Services. (2000). U.S. public health service, report of the Surgeon General's conference on children's MH: A national action agenda. Washington, D.C.
- Valli, L., & Buese, D. (2007). The changing roles of teachers in an era of high-stakes accountability. *American Educational Research Journal*, 44(3), 519-558.
- Walker, H. M., Horner, R. H., Sugai, G., Bullis, M., Sprague, J. R., Bricker, D., & Kaufman, M. H. (1996). Integrated approaches to preventing antisocial behavior patterns among school-age children and youth. *Journal of Emotional and Behavioral Disorders*, 4, 194-209.
- Wang, M. (1985). An analysis of program design implications for teacher and student use of time. In C.W. Fisher & D.C. Berliner, (Eds). *Perspectives on instructional time* (pp.55-70). New York, NY: Longman.
- Wang, A. & Zhang, X. (2012). A study of the correlation between online tutors' social network position and their performance. *Hybrid Learning Lecture Notes in Computer Science*, 74(11), 351-361.
- Wasley, P.A., Fine, M., Gladden, M. Holland, N.E., King, S.P., Mosak, E., & Powell, L.C. (2000). *Small schools: Great strides*. New York, NY: Bank Street College of Education.
- Wasserman, S. & Faust, K. (1994). *Social network analysis: Methods and applications*. Cambridge, UK: Cambridge University Press.

- Wiese, L. & Mueller, H. (1931/1941). *Sociology*. New York, NY: O.Piest.
- Woodland, R., Whitcomb, S., & Barry, S. (under review). Examining school leadership team influence on degree and pace of school reform: A case study of PBIS implementation using social network analysis. Unpublished manuscript.
- Woodland, R. & Hutton, M. (2012). Evaluating organizational collaborations: Suggested entry points and strategies. *American Journal of Evaluation*, 33(3), 366-383.
- Woodland, R. and Mazur, R. (in press). Teacher teaming and professional development. In G. Scarlett (Ed.) *Encyclopedia of Classroom Management: An A-Z Guide*. Thousand Oaks, CA: SAGE Publications.
- Woodland, R.H., Barry, S.K., & Crotts Roohr, K.M. (2014). Using social network analysis to promote school-wide instructional innovation: A case study. *Journal of School Leadership*, 24, 114-144.
- Woodland, R., Lee, M.K., & Randall, J. (2013). A validation study of the Teacher Collaboration Assessment Survey. *Educational Research and Evaluation*, 19(5), 442-460.
- Zins, J. E., Weissberg, R. P., Wang, M. C., & Walberg, H. J. (Eds.) (2004). *Building academic success on social and emotional learning: What does the research say?* New York, NY: Teachers College Press.
- Zito, M. (2011). *Is working together worth it?: Examining the relationship between the quality of teacher collaboration, instruction, and student achievement*. (doctoral dissertation). University of Massachusetts Amherst, Amherst, MA. Available at: <http://proquest.umi.com/pqdweb?did=2423420471&sid=1&Fmt=2&clientId=70548&RQT=309&VName=PQD>